Development and Modern Industrial Policy in Practice
Contents

List of contributors vii
Foreword by Ha-Joon Chang ix
Preface xi
List of abbreviations xiv

1 Modern industrial policy
   Jesus Felipe 1

2 Issues in modern industrial policy (I): sector selection, who, how, and sector promotion
   Jesus Felipe and Changyong Rhee 24

3 Issues in modern industrial policy (II): human capital and innovation, and monitoring and evaluation
   Jesus Felipe and Changyong Rhee 51

4 Capability building and industrial diversification
   Keun Lee 70

5 Industrial policy design and implementation challenges
   Mushtaq H. Khan 94

6 Catching up: structural transformation and diversification
   Justin Yifu Lin and Yan Wang 127

7 Economic diversification: implications for Kazakhstan
   Jesus Felipe and Cesar A. Hidalgo 160

8 Industrial diversification in the People’s Republic of China
   Justin Yifu Lin, Cheryl Xiaoning Long and Xiaobo Zhang 197

9 Do as I say, or as I do? US innovation and industrial policy since the 1980s
   Matthew R. Keller and Fred Block 219

10 The Republic of Korea’s financial support for small and medium-sized enterprises and venture businesses
    Jung-moh Chang 247
Development and modern industrial policy in practice

11 Industrial policy: the Australian experience
   William Francis Mitchell 279

12 Diversification and industrial policies in Malaysia
   Tham Siew Yean 320

13 Industrial policy in the European Union
   Kristine Farla, Francesca Guadagno and Bart Verspagen 346

Index 397
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Foreword

I am delighted to see this volume on modern industrial policy. The 13 chapters that it contains provide a cogent account of the how of industrial policy. This is done by addressing key issues in industrial policy and by discussing a wide variety of current country experiences.

Modern industrial policy tries to go beyond the old industrial policy debates around the role of government in the economy, in particular on the thorny question of whether governments should choose between sectors (that is, pick winners). Instead, today there is widespread acknowledgement that governments should and can select sectors. By now we have sufficient evidence that not all activities in the economy have the same consequences for development (for example, traditional agriculture versus modern manufacturing and services). We also know that development tends to be a slow and path-dependent process and, therefore, that the government has the natural desire and the ability to expedite it, especially if its industrial policy is based on collaboration between the private and the public sectors. The question today is how to select sectors and nurture them appropriately. In this regard, I welcome the insights that the Product Space and the Growth Identification and Facilitation Framework can provide, both extensively discussed in this volume.

The present volume is built around five key questions that all industrial policymakers ask constantly: who selects the sectors? What is the rationale for sector selection? What are the main tools used to promote sectors? How can industrial policies support innovation and human capital development? How should industrial policies be monitored and evaluated?

The conclusions of the analysis are very clear. First, development is ultimately about the transformation of the structure of the economy, both in terms of the diversification of the production and export baskets and the increase in the levels of sophistication and uniqueness of individual products. Second, progress along these two dimensions of transformation is not automatic, in the sense that if a country simply follows its (static) comparative advantage and ‘leaves it to the market,’ it will not get very far. Third, developing countries suffer from serious coordination and information failures and lack organizational capabilities. Fourth, and as a consequence of the previous three points, developing countries need to implement industrial policies that allow them, if not to leapfrog to the
most complex products along the spectrum, at least to jump into sectors that offer significant chances of development, that is, to diversify and to upgrade the economy. Fifth, developed countries used industrial policies in the past and continue to do so today, although under different names, as the volume shows in a wide variety of contexts.

For the reasons discussed in this volume, the twenty-first century is not going to be easy for most developing countries. Therefore, governments need to weigh their options carefully. They need to understand that, without a sound industrial policy, their countries’ economic development will be very slow and that many of them may be condemned to remain in limbo for a long time.

This volume will serve as a very useful guide to both industrial policy-makers and development practitioners all around the developing world.

Ha-Joon Chang
University of Cambridge
Preface

Policy advice is central to the Asian Development Bank’s (ADB) partnership with its developing member countries. Demand for policy advice increases with income per capita. The governments of countries that achieve middle-income status, and of those that are close to high-income, often approach ADB for advice on a wide range of issues. In recent years, we have engaged policymakers from many countries in discussions about how to achieve inclusive growth, how to avoid the middle income trap, how to participate actively in the global knowledge economy or how to diversify and upgrade the economic structure and modernize industrial policy programs. Governments are also keen to learn from the experiences of other countries. Providing answers to these questions in the form of policy advice, in particular as countries seek to implement policies and develop institutions that facilitate the structural transformation of their economies, requires research.

This interaction with our member countries is especially relevant today, as the development landscape of the twenty-first century will be different from that in which a number of countries thrived during the second half of the twentieth century. Obvious examples of this are the opportunities and challenges posed by the full incorporation of India and the People’s Republic of China (PRC) to the world economy, the emergence of new labor-saving technologies, the push for low-carbon growth paths in the face of climate change, the fact that developed countries will not be keen to run current account deficits and facilitate developing countries’ export-led growth or the fact that the World Trade Organization places severe restrictions on developing countries’ space to conduct industrial policies. These ongoing changes make it increasingly important for policy makers from developing countries to understand their options.

In 2011, the Government of Kazakhstan requested policy advice from the Asian Development Bank (ADB) on how to further diversify the economy and modernize its industrial policy. The government was keen to learn from the experience with diversification and industrialization policies of both developed and developing economies, including Australia, the PRC, the European Union, the Republic of Korea, Malaysia and the United States, with a focus on insights on the probable outcomes of Kazakhstan’s own efforts at diversification and industrialization.
To shed light on these issues, the ADB commissioned a series of studies on specific issues in industrial policy and country experiences, under a technical assistance project of the Economics and Research Department.\(^1\) Our work was intellectually supported by the Government of Kazakhstan. Kazakhstan is an emerging economy with a clear strategy to become a modern industrial and service economy in the coming decades. I am especially grateful to H.E. Kairat Kelimbetov (Deputy Prime Minister of the Republic of Kazakhstan), Erbolat Dossaev (Minister of Economy and Budget Planning of the Republic of Kazakhstan), Madina Abylkassymova (Vice-Minister of Economy and Budget Planning of the Republic of Kazakhstan) and the staff of the Economic Research Institute in Astana, for their interest and collaboration in this project.\(^2\)

While the project led to a detailed ‘Report to the Government of Kazakhstan,’ we decided to extend it and write a book on modern industrial policy for a wider audience, as we realized that many of the issues that appeared during our discussions on Kazakhstan are also relevant for other countries with which we have had similar discussions about development and planning.\(^3\) The result is this book.

I am deeply grateful to Changyong Rhee, ADB’s Chief Economist at the time the project was conceptualized and during its initial stages, for his enthusiasm and belief in the importance of this work. Our many discussions on the subject led to a common understanding about key development ideas that became the basis of this book. One was that developing countries will not reach high-income status without applying elements of modern industrial policy. This is reflected in our two coauthored chapters. A second agreement was that structural transformation, in particular achieving a certain level of industrialization, is fundamental for achieving high-income status. Some of these ideas were presented in the special chapter ‘Asia’s economic transformation: where to, how and how fast?’ of ADB’s Key Indicators for Asia and the Pacific 2013. I am also grateful to the colleagues and friends who agreed to collaborate in this project and to provide their views and experiences on different aspects of industrial policy. I am indebted to my assistant, Maan Magadia, who did an excellent job helping me organize the material and coordinating with all authors. Alastair McIndoe provided editorial assistance.

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\(^1\) Background studies were commissioned by the ADB in 2012 under ‘Technical Assistance 8153: Policies for Industrial and Service Diversification in Asia in the 21st Century’. The authors met in Seoul to discuss the contents of this book in September 2012.

\(^2\) These were their positions in the government at the time the project was conceived.

I hope this book becomes a reference in discussions and policy analyses. Taken together, the 13 chapters provide a coherent, comprehensive and in-depth assessment of key issues in modern industrial policy, in particular how to undertake industrial policy in the twenty-first century. They also provide country studies that discuss experiences from which other countries can learn what to and, perhaps more important, what not to do.

Finally, the views and opinions expressed in this book are those of the authors and do not necessarily reflect those of ADB, its Board of Governors or the countries they represent.

Jesus Felipe
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Asian Development Bank
Abbreviations

ADB Asian Development Bank
ASEAN Association of Southeast Asian Nations
BeST Beijing–Seoul–Tokyo consensus
CGF credit guarantee foundation
CIC China Industry Code
CIP Competitiveness and Innovation Framework Programme
DARPA Defense Advanced Research Projects Agency (US)
EIB European Investment Bank
ERA European Research Area
EU European Union
FDI foreign direct investment
GDP gross domestic product
GIF Growth Identification and Facilitation Framework
IAC Industries Assistance Commission (Australia)
ICT information and communication technology
IMF International Monetary Fund
IMP Industrial Master Plan (Malaysia)
IPR intellectual property rights
KfW Kreditanstalt für Wiederaufbau (German Development Bank)
KODIT Korea Credit Guarantee Fund
KONEX Korea New Exchange
KOSDAQ Korean Securities Dealers Automated Quotations
KOSTAT Statistics Korea
KOTEC Korea Technology Finance Corporation
M&A mergers and acquisitions
MAP Multiannual Program for Enterprises and Entrepreneurship
NBN national broadband network
NSE New Structural Economics
OECD Organisation for Economic Co-operation and Development
POSCO Pohang Steel Corporation
PRC People’s Republic of China
PSE producer support estimate
RCA revealed comparative advantage
R&D research and development
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>SBC</td>
<td>Small and Medium Business Corporation (Republic of Korea)</td>
</tr>
<tr>
<td>SBIR</td>
<td>Small Business Innovation Research (United States)</td>
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<tr>
<td>SMBA</td>
<td>Small and Medium Business Administration (Republic of Korea)</td>
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<tr>
<td>SMEs</td>
<td>small- and medium-sized enterprises</td>
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<tr>
<td>TRIPS</td>
<td>trade-related intellectual property rights</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<td>US</td>
<td>United States</td>
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<td>WTO</td>
<td>World Trade Organization</td>
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**Notes:** In this publication, 'S' refers to US dollars. The Asian Development Bank recognizes China as the People’s Republic of China; Hong Kong as Hong Kong, China; and Korea and South Korea as the Republic of Korea. The book has been edited to conform to this usage.
1. Modern industrial policy

Jesus Felipe

1.1 MODERN INDUSTRIAL POLICY AND THE RATIONALE OF THIS BOOK

The development landscape of the twenty-first century will be significantly different from that of the second half of the twentieth century, when a small group of economies (mostly in Asia) made significant progress and some achieved high-income status. The emergence of India and the People’s Republic of China (PRC), the development of many new labor-saving technologies, the fact that developed countries will not be keen on running deficits that facilitate export-led growth and that the World Trade Organization places severe restrictions on developing countries to conduct industrial policies (widely used earlier) mean that reproducing what this small group of economies did will be next to impossible in the coming decades. For these reasons, policymakers in developing countries need to understand that the key to achieving high-income status will be to induce rapid structural change by moving from traditional primary products to nontraditional industrial products, and to find niches in industrial products, consumer products with high-income elasticities of demand, and modern services.

Evidence, however, indicates that development is a path-dependent process. This means that it is easier for a country to develop new comparative advantage in some product if it already has comparative advantage in similar products. This makes development a slow process that requires stepping stones. Consequently, leapfrogging, that is, the development of comparative advantage in sophisticated and complex products (for example, advanced machinery, chemicals and pharmaceuticals) without having previously developed comparative advantage in similar products, is rejected by the empirical evidence (Mehta and Felipe 2014).¹ A frequent question in policy circles is whether it is possible to reduce or eliminate

¹ See Felipe et al. (2012) for an analysis of country and product complexity using a large data set covering 124 countries and 5107 products. See also Felipe et al. (2014a, 2014b).

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path dependence. This is because sophisticated products and services are usually associated with high wages.

The central argument of the chapters in this book is that achieving this will be possible only if countries engage in industrial policy; more precisely, ‘modern industrial policy.’ It needs to be stated at the outset that our focus is not on the theory of industrial policy and its merits or lack of them, but on the practice of modern industrial policy. This book came about after years of discussions with governments and policymakers across developing Asia, who are searching for answers to critical questions on how to achieve rapid industrialization; transform, restructure and diversify their economies; move up the value ladder; determine what industries should be nurtured and who should decide this. The aim of all these countries is to eventually achieve high-income status; and to get there, they are trying to do the right things. Not surprisingly, these countries are looking closely at the experiences of the region’s economic success stories, especially the PRC, the Republic of Korea and Singapore, for guidance and lessons. Even though it is clear that these experiences cannot be repeated because of the very different economic and political contexts, there is nevertheless huge interest among the region’s developing economies about how these countries organized themselves to make the jump that they have within a generation.2

One answer to all these questions could be along the lines of ‘governments ought to stay out of the economy and let the market decide’ and to recognize that government failures are large in developing countries (indeed they are!), but we concluded that this was not a satisfactory answer. For better or worse, all governments get involved in the economy for one reason or another. Although we believe that the market is the best mechanism to allocate resources efficiently, it is also clear that quite often this does not happen for reasons that are now well established—market

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2 For example, the Republic of Korea’s well-known collaboration between the chaebols and the state after the 1961 military coup resulted from corrupt firms being exempted from criminal prosecution and confiscation of assets on the condition that their management worked with the new government (Jomo and Tan 1999: 86–7). The merit of the Republic of Korea’s managers was that they used this situation for the benefit of the country. Singapore has no natural resources, and at the time of the breakup with Malaysia in 1965, unemployment was 14% and population was only 2 million, which was very small to support any industry on its own. The government concluded that, given these conditions, it had to be bold and devise a unique approach to industrialization and job creation, the key to economic development. However, unlike Japan and the Republic of Korea, Singapore’s bureaucrats did not focus on nurturing domestic firms run by local entrepreneurs. This meant that when the government wanted to enter a new area, it had to do it directly. This political context certainly cannot be repeated, but in these two cases, the state was not captured by particular interest groups or classes—and this is an important lesson valid today.
failures. Hence, we believe there are sound reasons for a government to facilitate the transformation of the economy and contribute to its diversification and upgrading, as neither are natural processes. Diversification can happen quite easily within a narrow range of products; that is, across products that require similar technologies and capabilities (for example, from simple textiles into slightly more sophisticated textiles or from garments into shoes). However, diversification into distant product lines—the development of new generations of industries with a greater potential for innovation and productivity, such as from garments into automobiles—requires mastering specific capabilities across many areas, as well as having well-developed supporting institutions. History teaches that this process is policy induced. Clearly, it is virtually impossible to list a set of universally valid policies on how to diversify; indeed, the only generally valid recommendation is to avoid policy incoherence. In this context, this book discusses key market failures that developing countries face and how to solve them, which is the essence of modern industrial policy.

Today, we understand that economic development is essentially about three key issues, which jointly provide the rationale for modern industrial policy. First, it is a process of accumulating productive capabilities (Box 1.1). This acknowledges that development is about more than simply increasing income, which could happen as a result of a resource bonanza. Capabilities are all inputs that go into the production process; more specifically, they refer to the ability to produce by using and developing new technologies and organizations. But since some of these inputs are tradable (for example, machinery) everyone has access to them. What truly differentiates countries is their use of non-tradable capabilities (for example, a law).

Second, the accumulation of capabilities leads to structural transformation, that is, the rise of new industries to replace traditional ones and the diversification of the productive structure and its upgrading. The idea of structural transformation encompasses the concepts of diversification and upgrading of an economy’s productive structure, and acknowledges that not all activities have the same consequences for development (Syrquin 2008). High-technology manufacturing is clearly better than traditional farming to enable countries to upgrade their productive capabilities. However, high-technology manufacturing does not develop naturally in backward economies. Unless governments promote such activities and help the private sector, the market will pull a backward economy toward the same type of activities that it was doing previously (for example, agricultural products or simple textiles), which are often based on its comparative advantage of natural resources or cheap labor.

Third, in market economies, private firms are the agents of economic
Development and modern industrial policy in practice

transformation, but their actions need to be inserted in a framework of public action. In today’s world, economic development requires a mix of market forces and public sector support. Although in a market economy the role of firms, and what moves them, is relatively straightforward (profits and returns), what moves the public sector is less clear since it is not subject to the same type of incentives that move private firms.

BOX 1.1 PRODUCTIVE CAPABILITIES: WHAT ARE THEY AND WHY DO THEY MATTER?

The products and services that a firm produces are a reflection of the set of capabilities that it possesses. Capabilities encompass all the tacit knowledge necessary to produce a good or deliver a service. Specifically, these are: (1) human abilities; (2) technology to ensure sustained growth (that is, knowledge on raw materials, machines and equipment, engineers and skilled workers, management and markets); and (3) firm-level know-how, as well as working and organizational practices held collectively by the group of individuals comprising a firm. This know-how also encompasses the communication, organization and coordination abilities that provide the capacity to form, manage and operate activities involving large numbers of people. These practices are particularly important for developing countries because they are often in short supply. The important point is that they are more relevant for competitiveness than low wages or tertiary education. Capabilities take the form of groups of citizens well organized into collective entities with high productivity, as seen in companies such as Boeing, Volkswagen and Rolex.

So what role do capabilities play? The competitiveness of a productive sector ultimately depends on the ability of firms to accumulate technological capabilities in a changing environment. In the case of high-technology industries such as aerospace, long-run competitiveness depends on the capacity of the sector’s innovation systems to provide cost-cutting and productivity-increasing innovations, and products with technological features superior to those of competitors. Although firms learn how to respond to demand (and hence how to produce), their capabilities coevolve with those of the scientific and technological frontier, as well as with the institutions that regulate access to and adoption of knowledge. The aim of any competitive industry is to continue increasing its innovative performance. This requires constantly upgrading production and innovation systems, which in turn requires new combinations of resources and new institutions. The experience of developing countries is that this is a very costly, uncertain and risky process, which can fail.

Understanding the transformation of companies such as Nokia (from a paper mill into a technological leader), or 3M (from mining a mineral deposit for grinding-wheel abrasives to manufacturing sandpaper products, the first waterproof sandpaper, Scotch masking tape, the thermo-fax copy process, Post-it notes and Scotch Brite cleaning products) or, more recently, innovative Chinese and Indian companies (e.g. Focused Photonics, Haier Group, Huawei, and Tata) requires acknowledging the central role played by the accumulation of capabilities in development.

Source: Author.
Although industrial policy is still a taboo word in many circles, the reality is that virtually all national economic programs include elements of it through different forms of government intervention. The difference across countries is that some are still engaged in old-style industrial policy while others have evolved into the practice that we refer to as modern industrial policy. Old-style industrial policy is about picking specific sectors of the economy (known as ‘vertical’ industrial policy) for political reasons—thus preserving the status quo and preventing institutional change (see Bardhan 2001; Rajan 2009)—and about promoting these sectors through different strategies. The most criticized of these has been the use of subsidies not linked to performance measures. Unfortunately, this type of industrial policy has often led to rent-seeking behavior that undermines the initial good intentions and, sooner or later, to losers that need to be bailed out, with the corresponding fiscal implications. This is not what modern industrial policy is about.

1.2 WHAT IS MODERN INDUSTRIAL POLICY?

Consistent with the view of development just explained, modern industrial policy concerns anticipating change and facilitating it by removing obstacles and correcting market failures (Syrquin 2008). In practice, modern industrial policy comprises restructuring policies that facilitate the transfer of resources to the more dynamic activities of an economy, be they agriculture, industry or services. These are both ‘horizontal’ and ‘vertical’ policies. The former refers to the provision of inputs that can be used by a broad range of firms across different sectors. Typical examples are transport infrastructure, well-educated engineers, or health and safety

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3 The Inter-American Development Bank uses the less sensitive term ‘productive development policies.’ See Velasco (2014).
4 Governments intervene in the economy in four ways: (1) as regulators setting tariffs and providing fiscal incentives and subsidies; (2) as financiers influencing credit markets and the allocation of public and financial resources to different projects; (3) as producers through, for example, state enterprises; and (4) as consumers through, for example, public procurement.
5 Although see Jomo and Tan (1999: 14–15) for a discussion of when rent-seeking activities are probably harmful and when they are not. To understand this, it is important to differentiate between rent-seeking activities and state-created rents. The danger of rent-seeking transaction costs (for example, payments to keep subsidies) lies in the possibility of the state augmenting and encouraging the existence of inefficient producers who may end up having monopoly rights. This may have serious consequences for long-term efficiency. But the mere existence of state-created rents, which are only a transfer of wealth and may not involve wastage, does not mean that resources will be spent on rent seeking. In fact, these rents could stimulate entrepreneurship.
inspection systems. Vertical policies favor a particular sector (for example, training electronic engineers). Very often, however, publicly provided inputs (for example, a road) are sector or product specific; that is, vertical. Examples of these inputs are a remote road that fosters eco-tourism—it does not help carry merchandise to a port—or a laboratory certifying the quality of meat, which is different from a laboratory certifying the quality of vegetables. Such examples show there is a small difference between horizontal and vertical policies.

Consequently, modern industrial policy also entails sector selection (training a particular type of engineer or building a particular road, for example). However, the strategies used to select sectors have a clear rationale and the tools to promote them are stage-development dependent and linked to performance measures; that is, they are allocated according to the principle of reciprocity and given in exchange for concrete performance standards. Modern industrial policy also has a clear objective: to address the typical market failures that many firms face in the discovery of new activities in which they may thrive and that may ultimately lead to an economy’s transformation.\(^6\) To solve these problems, modern industrial policy uses both horizontal and vertical tools. Finally, to succeed, modern industrial policy has to be conducted in a highly competitive environment (Aghion et al. 2012).

Firms from developing countries face a multiplicity of market failures. Two that are typical are information and coordination externalities. The first derives from the difference between the social and private values that entrepreneurs face when they try a new venture. For example, if the introduction of a product in a new market fails, the company will have to bear the full cost, but if it succeeds, it will share the discovery with other producers. Coordination externalities refer to the fact that new industries require capital that private entrepreneurs may not have. Moreover,

\(^6\) For Rodrik (2007), the essential elements of an industrial architecture are the following: political leadership must be at the top; there must be coordination and deliberation councils; and countries must have transparency and accountability mechanisms. He also lists ten design principles for industrial policy: (1) incentives should be provided only to new activities; (2) there should be clear benchmarks/criteria for success and failure; (3) there must be a built-in sunset clause; (4) public support must target activities not sectors; (5) activities that are subsidized must have clear potential for providing spillovers and demonstration effects; (6) the authority for carrying out industrial policies must be vested in agencies with demonstrated competence; (7) implementing agencies must be monitored closely by a principal with a clear stake in the outcomes and who has political authority at the highest level; (8) the agencies carrying out promotion must maintain channels of communication with the private sector; (9) optimally, mistakes that result in ‘picking losers’ will occur; and (10) promotion activities need to have the capacity to renew themselves, so that the cycle of discovery becomes ongoing.
new industries require coordinated investments in many related industries that individual entrepreneurs cannot organize by themselves. These investments generate demonstration effects and technological spillovers that raise the social return above the private return. This is the role of modern industrial policy. Solving these problems and providing adequate public services may not be easy (and not all cases will be successful), but they are a necessary condition for a healthy modern market economy and to engineer the structural transformation process that many developing countries need to accomplish.

Information and coordination failures make discovery a costly and difficult process. The discovery of new activities and the identification and removal of market failures requires strategic collaboration between private and public sectors. As a consequence, modern industrial policy is not just about picking promising sectors, but about jointly uncovering the obstacles to restructuring an economy and the types of interventions that can remove obstacles (Hausmann and Rodrik 2006; Rodrik 2007).

Another significant problem that many firms in developing countries face is a lack of organizational capabilities, and this could be more important than the market failures described above. To understand what these refer to, one simply has to visit two firms making the same product or delivering the same service in a developed country and a developing country. Significant differences in the organization of the work flow and the workshop are quickly apparent. Very often these differences are not related to different capital–labor ratios but to work practices. Sutton (2000, 2005) argues that becoming a rich country is about being able to earn higher real wages, and that some economic activities are more lucrative than others. Countries that specialize in such activities enjoy a higher level of real wages. But, unlike the traditional neoclassical model in which higher real wages are the result of an increasing capital–labor ratio, Sutton argues that the primary driver of growth is the gradual buildup of firms’ organizational capabilities. This is also reminiscent of Kremer’s (1993)
O-ring theory, whereby production is a series of tasks that can be performed at different levels of skill, where the latter refers to the probability of successfully completing a task. For the final product or service to be successfully made or delivered, every single task must be completed correctly. For example, a car is a car if and only if all systems and components work. This implies that the value of each worker’s effort depends on the quality of the efforts of all workers.

There is also another class of problems that countries face as they become richer and have solved some of the problems mentioned above. These are referred to as network failures. In a wide array of technological and industrial arenas, advances are achieved not entirely through competitive transactions, but also through mutual learning processes fostered by well-managed collaboration between specialists in complementary fields, as well as between designers, producers and end-users. These failures can be addressed through policies aimed at helping dispersed network partners acquire a degree of certainty about the trustworthiness and competence of one another.

Seen in this light, industrial policy need not be controversial. Here, industrial policy is much less about the efficacy of government intervention—in particular about the incorrect allocation of funds to the wrong sectors or the capture of subsidies by private interests—than about collaboration and the design of mechanisms to avoid these problems (for example, through transparency and accountability, sunset clauses and time-bound assistance). Consequently, both vertical and horizontal measures can be used simultaneously. Public–private collaboration is the essence of modern market economies and a key differentiating factor between economies that function well and those that do not.

1.3 A SUMMARY OF THE ARGUMENTS

The chapters in this book are divided into industrial policy issues (Chapters 2–6), economic diversification (Chapters 7–8) and country experiences (Chapters 9–13). The chapters were conceived and developed around five underlying questions on industrial policy: (1) who selects the sectors to promote? (2) What is the rationale for sector selection? (3) What are the main tools used to promote sectors? (4) How can industrial policies support innovation and human capital development? (5) How should imported. Therefore, differences across countries must be due to capabilities that are non-tradable inputs.
industrial policies be monitored and evaluated? The chapters in this book examine the latest thinking on these issues as well as country experiences on industrial policy in Australia, the PRC, the European Union (EU), the Republic of Korea, Kazakhstan, Malaysia, the Philippines and the United States (US). The developed countries in this list do indeed conduct industrial policy, albeit somewhat stealthily by using various names and euphemisms as the term itself continues to be regarded negatively in many influential circles.9 That notwithstanding, developed countries spend heavily to stimulate their economies; for example, for advancing new technologies or clusters.

This book fills a vacuum in the literature on industrial policy. Ultimately, as noted earlier, policymakers want to know what industrial policies have been most successful and how they should move forward in designing and implementing their own country-specific versions of them. Although all the authors are ‘supporters’ of industrial policy, they are so to different extents and with significant nuances. That said, all of us think in terms of modern industrial policy and, in this sense, the chapters in this book offer a balanced defense of industrial policy and complement the excellent collection of studies in Cimoli et al. (2009) and Szirmai et al. (2013).10

Our aim is not to evaluate the merits of industrial policy (in terms of the possible benefits by addressing market failures) in relation to the costs of government failure, which we acknowledge are present in developing countries. Instead, we discuss key issues in modern industrial policy and how these are being dealt with in a variety of developing and developed countries. Clearly, there is no basic formula for effective modern industrial policy that fits all country contexts, but this book does seek to draw findings and arguments from country experiences and, from these, offer do’s and don’ts to help guide policymakers on how to address market failures and avoid rent seeking.

The following is a summary of these findings and arguments:

1. Development is about the structural transformation of the economy. This idea has three key dimensions: diversify the economy, increase product/service sophistication and transfer of resources (both labor and capital) toward the more productive activities of the economy. These lead to higher wages. The key question for developing

9 See Chang (2002) for an account of industrial policy in developed countries at the time they were developing.
10 We also recommend Jomo and Tan (1999), who provide in-depth analyses of the industrial policies of Japan, the Republic of Korea and Taipei, China, as well as useful policy lessons.
countries today is the speed at which this process happens. Historical experience shows that, with a few exceptions, it has been very slow and path dependent. Structural transformation is slow and not a natural process because it is rife with market failures and because developing countries often lack organizational capabilities. The rationale for industrial policy is the desire to expedite this process through government intervention.

2. Modern governments, in coordination with the private sector, can play an important role in addressing the coordination and information externalities, as well as the lack of capabilities, inherent in attempts to diversify. This coordination is a key pillar of modern industrial policy.

3. The experiences highlighted in this book suggest that industrial policy should be stage-of-development dependent. Countries at an early stage of development produce goods that are already produced elsewhere, thus selecting sectors is less risky because well-known patterns of technological development can be emulated. Here, industrial policy is not about expanding technology frontiers to create new industries, but about the public sector playing a leading role in identifying development bottlenecks and addressing coordination failures. Finance is also an important factor. Financial institutions that specialize in intermediating risks associated with large-scale projects generally do not exist in less developed economies, and so their governments need to mobilize domestic and external financial resources. The nature of industrial policy changes as economies mature. Production technologies become more sophisticated and the promotion of new industries moves into uncharted territory. Industrial policy then has to confront high-return, high-risk trade-offs that are too much for the public sector to take on alone. Furthermore, as economies mature, the balance of expertise gradually shifts from the public to the private sector. Therefore, it is natural that decisions about developing new products or sectors—picking winners—is increasingly left to private firms.

4. Political economy is an important factor. Industrial policy is unfair by nature as some areas of society benefit more than others. This inherent unfairness becomes less widely accepted as a society becomes more democratic. Furthermore, as an economy develops, foreign competitors will not be as forgiving of government subsidy support to certain sectors. Therefore, the role of government’s conducting industrial policy tends to be more indirect in advanced economies.

5. A common misconception is that governments in advanced economies no longer pursue industrial policies. The reality is that many
advanced economies do rely on ‘indirect industrial policy’ by selecting and supporting industries through private financial markets. Here, governments broadly define favored industries and announce incentives for private financing. The role of private financial institutions is to find candidates to support. Governments then adjust the level of incentives to assume a minority or majority share of the guarantee depending on the risk. Good examples include the Multiannual Program for Enterprises and Entrepreneurship under the EU’s Lisbon Strategy; various credit guarantee programs of the European Investment Fund; and the small- and medium-sized enterprises on-lending programs of Kreditanstalt für Wiederaufbau (KfW), Germany’s national development bank. Indirect industrial policy works only in a competitive environment. In the US, the government undertakes a significant amount of industrial policy to address network failures.

6. The benefits of indirect industrial policy are numerous. Risks can be shared between the public and private sectors, and governments can leverage the private sector’s deeper knowledge in selecting potential winners. Moreover, it is an effective way of minimizing the moral hazard problem. One of the practical problems of traditional industrial policy is that governments have difficulties withdrawing assistance to firms once extended. But with indirect industrial policy, private financial institutions—not the government—interact directly with firms, and can, if necessary, withdraw their support without causing political backlash or giving the impression that the ‘government is taking away the umbrella when it rains.’

7. The selection of industrial policy tools is also stage-of-development dependent. These can be classified into one of eight categories: fiscal incentives, investment attraction programs, training policies, infrastructure support, trade measures, public procurement, financial mechanisms and industrial restructuring schemes. The key issue is not whether these tools are horizontal or vertical. Both are used, depending on the case. Rather, it is whether their use is consistent with the principles of modern industrial policy. Governments in advanced economies rely increasingly on financial tools as their economies mature, while the public sector’s role in industrial policy becomes less and less visible.

8. Risk management tools are important in modern industrial policy. Although there are potentially significant social returns from pursuing industrial policy, the fiscal cost of credit program failures are absorbed by the government and, ultimately, taxpayers. A stop-loss mechanism is necessary to ensure that ineffective or wasteful credit
programs are not continually funded year after year. The US Federal Credit Reform Act 1990 is a good example of such a mechanism. Industrial restructuring tools also need to be developed to minimize the *ex-post* impact of program failures.

9. Human capital development and innovation are essential components of industrial policies. Low- and middle-income economies need to develop high-quality basic and vocational education to gain competitiveness in existing industries or to move into new ones. Societies need workers who can be trained to assimilate technologies. As countries become richer, they should develop high-quality tertiary education, though this obviously does not mean that everybody needs a degree. Still, the reality is that societies generate relatively few jobs that require advanced degrees, which means that the private sector must also supply education, training, and research and development (R&D). Initiating R&D consortia with the private sector in targeted industries can be an effective government strategy to accelerate R&D expenditure.

10. Foreign direct investment is an important element of the industrial diversification process. However, if not properly designed, preferential treatment and R&D incentives for foreign multinational corporations can increase their profitability without resulting in technology transfer to domestic firms. Sometimes, buying technology and paying royalties may be more effective in developing the domestic technology base.

11. A strong monitoring and evaluation mechanism is essential for successful industrial policies, and there are several general rules for effective mechanisms, including establishing clear objectives, developing simple check-up systems and ensuring coordination among relevant agents. However, governments should not launch new initiatives if programs with similar policy objectives remain unfinished or unevaluated.

12. As economies mature, industrial policies become more complex. It is virtually impossible to trace all spillover effects across industries and come up with a comprehensive macroeconomic evaluation of a modern industrial policy package. Therefore, industrial policies in advanced economies are typically reviewed and monitored on a program-by-program basis rather than evaluated as an overall industrial policy package. Evaluation programs must be decentralized and have multiple layers of oversight. An appropriate legal framework is also needed to make monitoring and evaluation mechanisms effective and transparent.
1.4 OVERVIEW OF THE CHAPTERS

In Chapters 2 and 3, Jesus Felipe and Changyong Rhee tackle the five questions that underlie this book. *Who selects the sectors?* This has always been contentious among those who criticize government interventions to alter the structure of an economy. The majority view suggests that governments should not engage in sector selection, but rather act as a facilitator of industrial development. However, the facilitator role can be defined and interpreted in different ways. Felipe and Rhee argue that the agents engaged in sector selection should vary depending on the level of economic development and on their capacity. *What is the rationale for sector selection?* This is also contentious. Critics of industrial policy argue that this should be left to the market. However, the authors argue that if the rationale behind sector selection is left entirely to the market, presumably by following the country’s static comparative advantage, it would be difficult for developing countries to advance fast.11 Different countries use different approaches and recent work (for example, the Growth Identification and Facilitation Framework and the Product Space theory) provides some useful ideas on how to select sectors and coordinate public and private decisions. Felipe and Rhee believe that the use of any methodology highlights the high-return, high-risk nature of industry selection. They provide an example of what this means by contrasting the cases of the Republic of Korea and the Philippines. *What are the main tools used to promote sectors?* The tools governments use to implement industrial policy vary greatly, as these instruments are also dependent on a country’s stage of development. In general, as an economy develops, financial market instruments are used more frequently than direct fiscal subsidies. *How can innovation, technology and human capital development be fostered?* As a country becomes richer, its industrial policies tend to give increasing attention to innovation, technology and human capital. These are also areas that most often require indirect government intervention due to market failures. *What are the most appropriate monitoring and evaluation mechanisms?* All components of industrial policy must include a monitoring and evaluation mechanism to provide feedback on program outcomes. Without this it would be hard to evaluate whether policies are producing the intended economic impacts. The most appropriate mechanism is the one that allows policymakers to measure program impact so that future policies and programs are designed to produce better outcomes.

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11 However, we do not deny the importance of comparative advantage, quite the opposite. What we argue is that the historical experience of countries that have advanced shows that they did so with an important component of government action.
In Chapter 4, Keun Lee argues that latecomer countries should implement a series of capability-based industrial policies as they move up the development ladder, and he recommends specific strategies to build these capabilities at various stages of economic development. Latecomers cannot stay long in a given industry because old industries are themselves changing, often declining as new industries emerge and driven by the more profitable initiatives of forerunners. To tap into emerging industries, latecomer firms ought to first acquire design capabilities. Lee provides many examples of what the Republic of Korea and Taipei, China have done to achieve this, and argues that there was deliberate learning and extensive cooperation between the public and private sectors, with the former playing a key role. Lee identifies three essential stages to enter high-value segments: (1) assimilating foreign technologies; (2) codeveloping contracts and public–private consortiums once latecomer firms establish their own in-house research and development centers for indigenous learning; and (3) leapfrogging to the latest technologies, the most ambitious of the three stages. The author also discusses how upgrading and diversification are possible only after latecomer firms acquire design capabilities, such as from reverse engineering.

In Chapter 5, Mushtaq H. Khan analyzes the complex question of how to design effective industrial policies. This matters because not all industrial policies have the same objectives and because of country idiosyncrasies. One way or another, the achievement of objectives such as employment generation, wage growth and the financing of public goods require the development of a diversified base of competitive, modern and high-productivity industries. In this context, Khan discusses the constraints and externality-related contracting issues that affect industrial development and lead to private underinvestment, such as failures in education, technology, information discovery, and coordination. His thesis is that competitive industries often do not emerge in developing countries because firms face the most important of these contracting failures—the lack organizational and technical capabilities needed to use optimally available technologies. Developing these capabilities requires financing learning-by-doing, and the different financing modalities have to be tailored to country circumstances. Moreover, in the absence of effective financing strategies, solving other externalities and coordination problems, as well as developing grandiose master plans, will be futile. Indeed, strategies to improve, for example, education or to support firms

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12 Leapfrogging is a term widely used in the literature, but not clearly defined. Mehta and Felipe (2014) define rigorously the concept and propose how to test it. They show that leapfrogging is very difficult in practice.
making certain types of investments, assume there is a base of competitive firms that have the capabilities to benefit from such strategies. Differences between firms in developed and developing countries in organizational capabilities stem from differences in local conditions, organization of shop floors and infrastructure constraints. All these form the tacit knowledge that production teams have on how to organize production. Khan emphasizes that public support of learning efforts requires that subsidies be provided with conditions (usually time bound or based on performance) and be withdrawn if these conditions are not met. This is the key to avering rent-seeking problems. The challenge for developing countries is to create internal structures that are adequate for organizing production to meet the price-quality combinations of known products in international markets. The Republic of Korea is the best example of a developmental state that implemented these strategies effectively. Many other countries that tried to implement industrial policies failed because strategies for supporting the learning of organizational and technical capabilities could not be enforced. The absence of appropriate mechanisms to enforce a minimum satisfactory performance against a subsidy is the most common cause of failure associated with specific industrial policy strategies.

In Chapter 6, Justin Yifu Lin and Yan Wang argue that structural transformation—changes in a country’s economic structure—is the key to development. They discuss structural transformation in developing countries in the context of New Structural Economics and the Growth Identification and Facilitation Framework. New Structural Economics is a theory of dynamic comparative advantage based on the idea that: (1) an economy’s factor-endowment structure, and consequently its industrial structure, evolves with the level of development, and that infrastructure is part of this endowment and needs to evolve with a country’s economic structure; and (2) that at all levels of development, the market is the basic mechanism to allocate resources. As a consequence, New Structural Economics argues that an economy’s structural transformation—which ultimately shows up as a change in a country’s endowment structure—should be guided by its comparative advantage. In the authors’ view, this is the key difference between the New Structural Economics that they espouse and other structuralist theories. In fact, the latter may recommend fostering the production of new activities even before the right factor endowments are in place. Lin and Wang, on the other hand, argue that trying to defy comparative advantage will lead to the misallocation of resources and to failure. They focus on resource-rich countries, both labor scarce and labor abundant, and argue that the strategy of developing countries should be to transform what a country possesses into what they could do well. They use the example of Australia as a target country
for Kazakhstan, which is both resource abundant and labor scarce, and the PRC as a target country for low-income Asian countries. The authors argue that these countries should seek opportunities from the relocation of labor-intensive industries out of the PRC, which, in their view, has followed a dynamic comparative advantage strategy consistent with the key tenets of New Structural Economics.

The Growth Identification and Facilitation Framework complements the New Structural Economics by suggesting a methodology to identify strategies for catching up. It is a six-step procedure to help low- and middle-income countries identify both the countries that can offer models to study (that is, countries that are not too far ahead, at most two to three times the per capita income of the country studying them) and the possible sectors that they could target. The latter are industries with latent comparative advantage. This is the idea that a country needs to know both what its comparative advantage is, especially the sectors in which it could be competitive given its endowments, and the sectors that other countries are vacating and that match its comparative advantage. This is a country’s dynamic comparative advantage. The next five steps of the Growth Identification and Facilitation Framework are the need to assist domestic firms, to attract global investors, to scale up self-discoveries, to use industrial parks and to provide incentives.

In Chapter 7, Jesus Felipe and Cesar A. Hidalgo discuss the relevance of economic diversification in the context of Kazakhstan, a country with an economic structure not well diversified and heavily dependent on oil, and with an income per capita already close to that of the lower bound of high-income countries. The government is aware of the importance of diversifying the economic base to become a modern industrial and service economy, a key objective for the coming decades. Despite several programs to increase diversification, the reality is that Kazakhstan has not progressed much on this front, with the country exporting with revealed comparative advantage in 2010 fewer products than it did in 2000. A combination of factors explains why. In general, economies well endowed with natural resources have problems diversifying their economies. Kazakhstan, in the context of high oil prices, has had weak incentives to diversify, with the government selecting sectors and specific companies for public support instead of fostering innovation, technological upgrading and the development of new products. Moreover, the country’s framework for competition is very shaky. Under these circumstances, economic diversification becomes difficult. Felipe and Hidalgo use the Product Space methodology to document, with the help of a highly disaggregated data set, Kazakhstan’s low export diversification. They argue that Kazakhstan should diversify by developing products
that use capabilities similar to those used in the products it exports with comparative advantage. Local exporters should be able to easily identify these potential new products. The authors conclude that Kazakhstan needs to follow a multi-pronged development strategy that relies on diversifying its economic base, properly managing resource revenues, developing a stronger human capital base, improving the quality of physical infrastructure to counteract being a landlocked country and nurturing stronger institutions.

In Chapter 8, Justin Yifu Lin, Cheryl Xiaoning Long and Xiaobo Zhang study the relationship between the PRC’s level of development and its degree of diversification. This question is motivated by the belief that economic diversification follows a U-shaped pattern, according to which diversification increases with income per capita up to a point, after which diversification declines and countries start specializing. Using disaggregated data for the PRC, the authors find, somewhat surprisingly, that during 1995–2004 industrial production became increasingly specialized at both national and regional levels. They conclude that there has been an increase in sectoral concentration across the board, a result that is robust to the use of different measures of diversification and aggregation levels. The authors also find that capital intensity has increased across industry and that capital-intensive industries have hired workers at a faster pace than have labor-intensive industries. This is surprising given that the PRC is seen as having a comparative advantage in labor-intensive industries. The authors interpret this as evidence that the PRC has adopted a dynamic comparative advantage strategy to target capital-intensive industries with considerable potential for employment growth. To do so, they had to change their structure of production to accommodate more labor, in line with its low capital–labor ratio.

In Chapter 9, Matthew R. Keller and Fred Block contend that, like other developed countries, the US also undertakes a significant amount of industrial policy. The peculiarity of the US is that there has been a dominant rhetoric, especially since the early 1980s, around the idea that its innovative dynamism is the result of embracing the free market. In other words, firms operate in a framework in which they are insulated from government interference. The authors, however, argue that this view is misleading and obscures the reality that government agencies and policies have indeed played a critical role in fostering US innovation. Although it is true that the US does not have a centralized model of industrial policy (in fact it is very decentralized), the country nevertheless resembles in many respects the development network states of Israel, Ireland and Taipei, China. However, in the US the issue is that a large and very complex web of agencies involved in industrial policy, the scale
of government spending, and the variety of tools used are simply not well known to the public. Keller and Block argue that the US model of industrial policy should be understood as a collaborative network aimed at addressing network failures, which goes beyond the standard idea of market failures. The authors note that the distinction between basic and applied research has become increasingly blurred, and that networks of specialists, often working across the public–private divide, have become ever more central to innovative and industrial dynamics. In a wide array of technological and industrial arenas, advances have been achieved not through competitive transactions, but through mutual learning processes fostered by well-managed collaborations between specialists, who combine complementary skills or bodies of knowledge, as well as between designers, producers and end-users. Likewise, R&D and manufacturing are particularly prone to outsourcing or downsizing because developing innovative products or services is inherently unpredictable. The collaborative form of organization that has moved to the fore of innovation and production regimes has weaknesses of its own, the most important of which is the ability of firms to continually evaluate the trustworthiness and competence of partners necessary for effective collaborative production. For example, specialized or small firms rarely have the resources to thoroughly investigate supply chain options. Even large or well-resourced ones are typically unable to monitor all potentially relevant collaborators, technical fields or to set industry standards around which dispersed parties organize their innovative efforts. This is precisely where the US government has been effective. Since the 1980s, it has been particularly successful in correcting network failures in an increasingly fragmented and decentralized production environment. A range of programs and policies have helped dispersed network partners acquire a degree of certainty about the trustworthiness and competence of one another. In addition, linking entrepreneurs and technologists with support networks has often been important to US technological dynamism. Finally, Keller and Block argue that the US system of industrial policy has monitoring and evaluation mechanisms despite its high level of decentralization.

In Chapter 10, Jung-moh Chang examines the Republic of Korea’s experience in providing financial support to the country’s traditional and innovative small- and medium-sized enterprises (SMEs). The chapter covers the period 1997–2012, when major changes in SME financing took place. Observing the relevance of SMEs in the country’s economy, policymakers grasped the importance of nurturing them as growth entities. Innovative SMEs are now a driving force in the Republic of Korea owing to their quantitative impact on the economy and their contribution to job creation. However, access to finance is a perennial problem for
these firms owing to high transaction costs and asymmetric information. Requirements to obtain a loan are onerous, and a number of macroeconomic institutional and regulatory rigidities still bias the banking system against lending to SMEs. Yet innovative enterprises need a wide range of financing vehicles to progress through the business life cycle. As a result of these market failures, the market mechanism underfunds innovative-firm creation. For these reasons, policymakers have developed a variety of institutions and instruments to provide funding for innovative SMEs through venture capital funds or securitization. These are good examples of what we mean by modern industrial policy (that is, public–private collaboration to address market failures) and indirect industrial policy (public funds allocated through the financial sector).

In Chapter 11, William Francis Mitchell surveys Australia’s industrial policy from a historical perspective. He argues that Australia has demonstrated that a small and open economy heavily reliant on primary commodity exports, and initially without a strong and diversified industrial base, can still achieve high income per capita. The recipe has been the right mix of domestic and external policies, combined with an effective industrial policy. Mitchell argues that the state has played a central role in Australia’s industrial progress, as successive governments recognized that the state is responsible for enacting regulations that may limit market activity in the interests of economic stability, such as promoting competition via regulation. Australia’s industrial policy can be divided into two main phases. The first, set early in the twentieth century, focused on tariff protection to establish an internationally competitive manufacturing sector. However, Mitchell argues that Australia’s history with tariff protection suggests the country failed to create a diversified industrial structure, because it did not simultaneously offer incentives (rewards or penalties) for industries to innovate. The second phase started in the 1970s, when Australia’s industrial policy shifted toward promoting productivity, enhancing competitiveness and providing incentives for industry to restructure to meet emerging domestic and global challenges. Changes in the focus of industrial policy were also induced by structural changes in the economy. Services have grown very quickly in recent years and there has also been a resurgence of the mining sector. In this context, the once highly protected manufacturing sector has declined amid strong competition from Asia’s emerging economies. Australia has also shifted into more knowledge-intensive sectors. Mitchell argues that there has been an interaction between industrial policies and the postwar approach to economic and social settlement, based on a commitment to full employment. Although private and public employment growth was strong until the mid-1970s, the main reason why Australia was able to sustain full
Development and modern industrial policy in practice

employment was that it maintained a buffer of jobs. For example, process work in factories and public sector jobs were always available and provided easy employment to the least skilled workers. Mitchell believes that industry sector selection should be part of a full-employment strategy. He closes the chapter by discussing Australia’s decision to float the Australian dollar in 1983. In his view, this was crucial for insulating the economy from international fluctuations in commodity prices and still provides an important lesson today for economies with similar characteristics.

In Chapter 12, Tham Siew Yean analyzes Malaysia’s attempts to diversify its economy and the role that industrial policies have played in the country’s aim to become a high-income economy by 2020. The shift in Malaysia’s economic structure from agriculture toward manufacturing can be partially attributed to deliberate government policies, reflecting the country’s underlying development philosophy of active government support and direction, combined with free enterprise. To implement industrial targets, Malaysia has formulated three Industrial Master Plans, IMP1 (1986–95), IMP2 (1996–2005) and IMP3 (2006–20), and the Economic Transformation Plan of 2010. Malaysia’s industrial development has been largely based on attracting foreign direct investment—and, to this end, the country provides significant incentives to multinational companies. However, although this strategy has enabled some Malaysian firms to link into the global supply chain as suppliers and design houses, it has not produced any global, Malaysian owned and designed products (in the sense of a Sony or Samsung). Consequently, Malaysia’s indigenous technological capability is rather low. Tham argues that while strategies to industrialize and become a high-income economy have produced some positive results, they fall short of expectations. Because the targets of Malaysia’s economic plans are very broad, they tend to be poorly executed and lack adequate monitoring mechanisms. Furthermore, the country’s human capital base is low, technology policies overemphasize supply-side public institutions instead of addressing deficiencies in the demand for technology from private firms, and links between firms and universities are weak. Tham argues that while there has been some technology transfer into Malaysia’s economy, it has not occurred at the pace and speed necessary for the country to achieve its ambitious goal to become a knowledge- and innovation-led economy by 2020. She uses the policies implemented in the electronics and automobile sectors to illustrate these problems. In electronics, Malaysia has not been able to move up the value chain and most companies operate at the lower end. The policy of bringing cheap workers from abroad plus a lack of domestic capacity to undertake R&D prevent Malaysian firms from getting a foothold in more knowledge-intensive stages of the elec-
tronics value chain. Malaysia’s foray into the car industry is an example of old-style industrial policy (mixed with social objectives), marked by ill-targeted subsidies and all sorts of privileges to keep an uncompetitive industry afloat. Its failure was the result of not imposing conditions such as sunset clauses or performance requirements to subsidies. Overall, the future of Malaysia’s car industry looks grim.

In Chapter 13, Kristine Farla, Francesca Guadagno and Bart Verspagen review the experience of the EU in conducting industrial policy by examining its objectives, tools, and monitoring and evaluation mechanisms. They argue that the term ‘industrial policy’ is most often associated with development and developing countries, but this is not the case. The EU as well as its individual member countries extensively turn to industrial policy to deal with the effects of structural transformation. The EU has a complex set of tools to achieve goals related to how changes in the global economy affect the structural transformation of its member economies in the form of deindustrialization in some member states and industrialization in others, as well as the rise of particular sectors, mostly associated with high-technology activities. This requires member economies to adapt to changing circumstances and make provision for potential threats, such as a loss of competitiveness and market share. Related to the previous point is the need to maintain firm competitiveness. Farla et al. argue that there is a clear political economy in the EU that justifies the need for a European industrial policy, and that this has been the process of unification since 1951 with the ultimate goal of achieving a common market. For this to happen, it was important to have a level playing field in which all countries had equal opportunities to enter the national markets of other member countries. This required the removal of barriers. Another major factor in EU industrial policy is social cohesion, the idea that excessive differences in living standards are harmful. The authors argue that a large part of industrial policy in the EU takes the form of horizontal tools (across-the-board measures), although the EU also uses vertical tools (targeting specific sectors) to cope with the effects of structural transformation. Lately, the EU has shown a strong bias toward policies aimed at stimulating the development of new knowledge, innovation, education and high-technology activities. This is enshrined in the objectives of the EU’s Europe 2020 policy, which introduces the idea of ‘smart specialization’ and pushes the identification of clusters. The authors review EU industrial policy tools in trade, investment, regional development, science and technology, education and public–private partnerships. The chapter also discusses individual country tools to undertake industrial policy and highlights their differences. Monitoring and evaluating industrial policy in the EU is very complicated because of the very wide variety of tools and
Development and modern industrial policy in practice

programs. Attribution is complex because of the difficulties in correctly isolating the effects of a policy intervention. Even so, the EU makes an effort to monitor its industrial policy programs.

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2. Issues in modern industrial policy (I): sector selection, who, how, and sector promotion

Jesus Felipe and Changyong Rhee

2.1 INTRODUCTION

How should countries, particularly developing countries, design their industrial policy programs and strategies in the twenty-first century? Answering this requires an understanding of the essence of modern industrial policy. In these days of fully fledged globalization, it could be argued that industrial policies—understood as a set of restructuring policies in favor of more dynamic activities in general—have actually become obsolete. In this context, targeting policy interventions on picking sectors should be discouraged. However, a key argument of this book is that modern industrial policy is about collaboration between public and private sectors to identify significant externalities and address them in the right way. Here, economic development is not a natural process, but one subject to significant coordination and information externalities. Industrial restructuring today does not take place without significant government assistance, and firms, of course, do not need to manufacture an entire product. By operating as part of global value chains, it is possible for firms to participate in the production of a great number of products (Asian Development Bank 2013). Governments, for their part, can play an important role in facilitating this process.

The design and implementation of modern industrial policy need to pay special attention to five key issues: (1) who selects the sectors? (2) What is the rationale for sector selection? (3) What are the main tools to promote sectors? (4) How can innovation, technology and human capital development be fostered? (5) What are the most appropriate monitoring and evaluation mechanisms? This chapter deals with the first three of these issues; the next chapter tackles the remaining two.

1 This chapter is based on Felipe and Rhee (2013).
2.2 SELECTING SECTORS: WHO DOES IT?

Economic theory does not clearly state which agents should undertake sector selection. In practice, however, the experiences of many countries that have adopted industrial policies show that the agents selecting sectors is stage dependent (Table 2.1). At low levels of development, governments themselves tend to select the sectors. As a country develops, the role of the private sector increases. Low-income economies operate inside the technology frontier, thereby simplifying the selection process since existing technologies and industries are available to be adopted and benchmarked. In many low-income economies, the public sector often provides better paying and more stable jobs than the private sector. Thus, the public sector has a higher level of human capital, which is an advantage in the sector selection process. In more advanced economies, the private sector is more likely to attract the most talented individuals by offering significantly higher compensation than the public sector. As such, the nature of industrial policy evolves to the point that the private sector drives the process of expanding the technology frontier while the public sector plays a supporting role.

At an early stage of development, countries produce goods that are already being produced elsewhere. Existing production technologies can be imported and selecting sectors is less risky because patterns
of technological development are well known and can be emulated (for example, the ‘flying geese’ paradigm of development in East and Southeast Asia). Furthermore, the public sector, even without extensive business experience, can perform quite well in selecting industries to promote. Industrial policies during this early stage of development are not about expanding technology frontiers to create new industries, but about assessing international markets to identify domestic winners, identifying key development bottlenecks and coordinating capacity building in areas such as infrastructure and human capital.

Finance is an important factor in making industrial policies stage dependent. In less developed economies, it is difficult to secure financing for large-scale projects as private financial institutions and investors are hesitant to provide long-term funding. Financial markets in these economies are underdeveloped and there tend to be no financial institutions specializing in intermediating risks such as venture capital. Thus, government financing is in high demand, often in the form of credit subsidies to attract both foreign and domestic private capital.

Political economy is also a factor. In the early stages of economic development, governments design and implement industrial policies, and they want the public to know that these policies are an explicit part of their overall development plans. Amid an uncertain political environment that often accompanies the earlier stages of economic development, governments seek to gain legitimacy by gaining reputations as champions of economic progress. Foreign producers and countries are also not likely to object to government-led or subsidized industrialization of low-income countries because they do not directly compete with them. However, as an economy develops, foreign competitors will not be as forgiving of subsidies. Consequently, the role of government in industrial diversification becomes more indirect.

Industrial policy is unfair since some sectors benefit more than others. Industries and large firms often benefit from government largesse from cheap credit, infrastructure development or a favorable tariff regime at the expense of small- and medium-sized enterprises (SMEs). In low-income countries, a social consensus generally exists that prioritizes growth, employment and rising incomes over issues of economic fairness. Therefore, government involvement faces less resistance. However, in mature economies, explicit industrial policies are no longer politically feasible due to fairness issues.

As an economy matures, production technologies become more sophisticated, making it increasingly difficult to produce more complex products since there is no benchmark to follow. The risks involved in promoting new industries in uncharted territories are simply too big for the public sector.
So firms themselves must invest in and develop new technologies if they are to survive and prosper, and here the government’s role shifts to supporting research and development (R&D) and innovation. In the private sectors of advanced economies, businesses are able to attract highly educated personnel seeking greater compensation, and the balance of expertise gradually shifts from the public to the private sector. Therefore, it is natural that decisions about developing new products or sectors—picking winners—is increasingly left to the private sector in advanced economies.

The role of the government in financial markets also changes. In advanced economies, its resource-allocation role declines and its risk-sharing role becomes more important. Rather than direct bank lending, public sector financial assistance becomes more diversified and includes risk-sharing instruments, such as equity stakes, guarantees and subordinated debt.

A common misconception is that governments in advanced economies no longer pursue industrial policies. They maintain a low profile as they continue to be engaged in industrial policy because they do not want to be accused by foreign governments and producers of supporting unfair competition and violating World Trade Organization obligations. Advanced economies also tend to lack a social consensus on the primacy of growth over concerns such as job creation and income inequality. Instead, these governments must balance the interests of multiple economic constituencies such as large firms, SMEs and innovative firms that are often at odds with each other in terms of preferred industrial policies. This causes governments to downplay their level of intervention in the economy and to use indirect assistance channels, such as promoting R&D through academic and military-based research and supporting innovation and other policy objectives through government procurement contracts.

It is important to emphasize that the experiences of the following two case study countries—the Republic of Korea and the United States (US)—show that the role of the private sector is key to economic development, even during the early stages when industrial policy is generally led by the public sector. Governments can select and try to promote industries, but in the end it is the private sector that delivers the desired outcomes. So building private-sector capacities in the early stages of industrial policy is imperative for long-run sustainable growth.

2.2.1 Republic of Korea: Stage-Dependent Industrial Policy

In the early 1960s the Republic of Korea embarked on export-oriented industrialization, correcting its previous bias against exports and using its comparative advantage to develop labor-intensive manufacturing industries (Table 2.2). While continuing to pursue export-oriented
Table 2.2  Industrial policy phases of the Republic of Korea

<table>
<thead>
<tr>
<th>Development stage</th>
<th>1960s</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor driven</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial policy</td>
<td>Support export development</td>
<td>Promote heavy and chemical industries</td>
<td>Shift from industry targeting to R&amp;D support</td>
<td>Provide information infrastructure and R&amp;D support</td>
<td>Promote new engines of growth and upgrade R&amp;D</td>
</tr>
<tr>
<td>Science and Technology (S&amp;T) policy</td>
<td>Ministry of Science and Technology/ Korea Institute of Science and Technology S&amp;T Promotion Act Five-Year Economic Plan including S&amp;T</td>
<td>Government research institutes Technical and vocational schools R&amp;D Promotion Act Daedeok Science Town</td>
<td>National R&amp;D Plan Private-sector initiatives in R&amp;D</td>
<td>Information E-government Restructuring of government research institutes University–industry–government linkages</td>
<td>Universities’ leading role Efficient national innovation systems Regional innovation system and innovation clusters</td>
</tr>
</tbody>
</table>

Note:  R&D = research and development.

Source:  Lim (2011).
industrialization based on cheap labor, the country did not just wait for its income and skill levels to rise before developing its potential comparative advantage in more sophisticated industries. Instead, the government and the private sector studied how to fill the missing links in the domestic value chain and move up the quality ladder and enhance international competitiveness. The Republic of Korea’s industrial policy phases are a good example of the changing role of government in promoting new industries depending on the different stages of development.

In the 1960s, the main decision maker for industry selection was the government; specifically the president along with industry-related ministers and policy aides. Yet, private and public enterprises often shared a role in selecting specific export industries, with the government providing subsidies and other assistance if they managed to achieve certain goals (Lim 2011). In the 1970s, after an intensive consultation process with private companies, a government-led industrial targeting policy was applied to develop six heavy and chemical industries. This pattern of increasing private sector involvement in the sector selection process was also evident after the 1970s technological development as decisions to move into information and communications technology industries were led by the private sector. The corporate histories of Samsung, Hyundai, LG and SK all suggest that these firms were willing to pursue vertical integration or related diversification on their own, although this usually worked in conjunction with government policy when they ventured into unrelated industries (Lim 2003).

In the 1990s and 2000s, the government shifted to ‘indicative’ targeted industries as it became increasingly difficult to select and directly support specific industries because of insufficient technological knowledge and concerns for potential international conflict. Assistance was confined to R&D efforts that were usually related to selected high-technology industries and financial guarantees to support private loans from financial institutions. A special committee, comprised of government officials, academic experts, business representatives and engineers, was formed to identify promising high-technology industries.

2.2.2 United States: Network Partners

Advanced economies and particularly the US provide useful examples of subtle industrial policies to leverage the expertise of the private sector, often by absorbing risks. Some risks align with traditional conceptions of market failure, such as investments in early stage research, infrastructure and education. But the experience of the US shows new dimensions of government support in advanced economies that are commensurate with changes in industrial structure and the nature of market competition.
Since the early 1980s, large, vertically integrated corporations have decreased in importance and collaborative, networked relations—encompassing different types of firms, university researchers and government research laboratories—have expanded across a range of industries.

In today’s innovative environment, firms have difficulty finding network partners that are both trustworthy and competent. United States government programs are helping to ameliorate problems in these fragmented production environments through a range of interventions. These include: (1) standards setting—setting common or core standards for products or processes, allowing innovation around shared principles or system parameters; (2) target setting—setting technology road maps (for example, fuel efficiency standards) allowing dispersed actors to orient around common standards or goals; (3) certification and signaling—employing rigorous expert review or evaluations to certify promising ideas and decertify others (for example, the National Institute of Health and the Small Business Innovation Research program); and (4) networking—bringing together otherwise isolated firms, university researchers and government scientists and engineers to forge collaborative linkages.

2.3 RECENT THEORIES ON SECTOR SELECTION

The literature on industrial policy says little on who selects sectors, but this is not the case for how countries select sectors, although there is no proven one-size-fits-all method. Neoclassical trade theory advises countries to specialize in products in which they have a comparative advantage to maximize welfare by allocating resources to their best use. However, this recommendation is very general and static. Moreover, this is actually a strategy for not selecting sectors for promotion or protection, as the neoclassical assumption leads to the conclusion that a market economy will allocate resources efficiently without government intervention.

However, those who believe that the market will not allow developing countries to progress beyond exploiting natural resources and manufacturing simple goods see industrial policy as necessary for leapfrogging.² In the past, countries often selected industries with significant linkage effects and increasing returns to scale by observing the earlier choices of successful countries.

Today, with the renewed interest in industrial policy, a number of authors have suggested methodologies to help guide countries on sector

² However difficult this might be in practice. See Mehta and Felipe (2014).
selection. We now review the recent work on sector selection, in particular
the Growth Identification and Facilitation Framework of Lin and Monga
(2011) and the Product Space theory of Hidalgo et al. (2007). We view these
two approaches as complementary and recommend that policymakers
use them, both within government agencies designing and implement-
ing development plans and in discussions with the private sector. Both
techniques are based on sound rationales and are solid starting points.
The Growth Identification and Facilitation Framework emphasizes that
countries should target sectors that are consistent with their comparative
advantage, and that low- and middle-income countries should study the
experiences of countries that today have two to three times their per capita
income and a similar economic structure. The Product Space theory is
based on the idea that the products a country exports with revealed com-
parative advantage must embody that country’s capabilities. The message
for developing countries is to target products that use capabilities similar
to those that they already have, and to develop new capabilities that allow
them to get into products with higher value-added.

2.3.1 The Growth Identification and Facilitation Framework

This is a tool based on Justin Lin’s New Structural Economics (2012). Its
six-step framework can help policymakers in developing countries identify
industries with ‘latent comparative advantages’ and facilitate competitive
private sector development. The steps are (see also Chapter 6):

1. Choose the right country benchmarks. Policymakers should look to
dynamically growing countries with similar endowment structures
(that is, with about 100% or higher per capita income measured in
purchasing power parity). They need to identify tradable goods and
services that have grown robustly in those countries for the past 15–20
years. These are likely to be new industries consistent with latent com-
parative advantages, as countries with similar endowments are likely
to have similar comparative advantages. A fast-growing country that
has produced certain goods and services for about 20 years will lose
its comparative advantage as its wage levels rise, leaving space for
countries with lower wages to enter and compete in those industries.

---

3 An economy has latent comparative advantage in an industry if, based on its costs
of production (determined by the economy’s endowment structure), the industry has the
potential to be competitive. However, owing to existing high transaction costs (determined
by infrastructure, logistics and other business conditions), the industry cannot yet be com-
petitive in the global market.
Assist domestic private firms. If private domestic firms are already active in these industries, these firms must have local and tacit knowledge as well as the experience that allows them to be competitive. Policymakers should identify obstacles preventing these firms from upgrading the quality of their products and the entry barriers that other private firms face. Policies can then be implemented to remove these constraints and facilitate firm entry.

Attract global investors. In the case of industries in which no domestic firms are present, policymakers can try to attract foreign direct investment from countries applicable to the first step or from high-income countries producing those goods. Foreign investors may possess general and tacit knowledge (the latter being knowledge not codified in books or manuals but akin to learning-by-doing) on a certain product, not only in its design and production technology, but also its entire supply chain and distribution channels. Foreign investors are able to bring in capital and technology as well as tacit knowledge, while governments in developing countries could set up incubation programs to encourage start-ups.

Scale up self-discoveries. In addition to the industries identified in the first step, governments should pay attention to spontaneous self-discovery by private enterprises and support the scaling-up of successful private innovation in new industries to benefit from rapid technological changes and resulting new opportunities. Examples include mobile phones and related e-services, social media and green technologies.

Recognize the power of industrial parks. In countries with poor infrastructure and an unfriendly business environment, governments can set up special economic zones or industrial parks to help overcome barriers to firm entry and foreign investment. These zones can create preferential business environments that most governments are unable to quickly implement on an economy-wide basis due to budget and capacity constraints. Establishing industrial parks can also facilitate the formation of industrial clusters, thus reducing production and transaction costs.

Provide limited incentives to the right industries. Policymakers can consider compensating pioneer firms in industries identified with time-limited tax incentives, cofinancing investments or access to foreign exchange. This is to compensate for the externalities created by first movers and to encourage firms to form clusters. Because the identified industries are consistent with a country’s latent comparative advantages, the incentives should be limited, in both time and cost. To prevent rent seeking and political capture, governments should
avoid incentives that create monopoly rents, high tariffs and other distortions. Moreover, incentives should be linked to performance and continuously evaluated against the stated objectives.

2.3.2 The Product Space Theory

The Product Space theory is an application of network theory, depicting the network of connecting products that tend to be co-exported. The Product Space shows all products exported and how ‘close’ they are with each other (Figure 2.1). It is important to understand what the Product Space is, the information it provides and how it should be interpreted.

The Product Space is constructed using product-level not aggregate sector data. In the original version published by Hidalgo et al. (2007), a representation with data for about 800 products (strictly speaking, classes of products) is used. The authors use exports (rather than output) since this data set is the most comprehensive, although it has some problems which the authors are aware of. Even so, this neither invalidates nor undermines the strength of the analysis.

Figure 2.1 shows a more recent version of the Product Space using 1240 products (Hausmann et al. 2011). Each circle depicts a product and the size of the circles is proportional to the product’s share of world trade. Each product group is represented by different colors. The figure also shows how ‘close’ the products are to each other, with the idea of proximity reflecting whether they are co-exported or not. In this way, one can calculate the likelihood of exporting product A given that the country exports product B (and vice versa); that is, the conditional probabilities \( P(A/B) \) and \( P(B/A) \). For example, if 20 countries export computers (product A), 24 countries export wine (product B) and 8 export both, the proximity between computers and wine is \( 8/24 = 0.3 \) (we divide by 24 instead of 20 to minimize false positives).

The idea behind this conditional probability is that products require capabilities to be made. Capabilities encompass all the tacit knowledge necessary to produce a good or deliver a service. The similarity between the capabilities required to produce two products is inferred by the probability of co-exporting them (it is assumed that if two goods share a high number of capabilities, the country that exports one of them will also export the other and vice versa). Thus, products that share few capabilities are less likely to be co-exported. Products are linked based on the similarity of their required capabilities. For example, the link between shirts and pants is stronger than between shirts and iPods. The rationale is that if two goods need similar capabilities, a country should show a high probability of exporting both with comparative advantage. Thus, the barriers
Development and modern industrial policy in practice

Source: Adapted from Hausmann et al. (2011: 45).

Figure 2.1 The Product Space
preventing entry into new products are less binding for products using similar capabilities. A country’s development path is therefore determined by its capacity to accumulate capabilities that are required to produce a more varied and sophisticated basket of goods.

Hidalgo et al. (2007) show that progress tends to occur in small steps. This means that the new products in which countries can potentially gain revealed comparative advantage are those that require capabilities similar to those already mastered, and which are embedded in the products that the country exports with comparative advantage.

The product space is clearly divided into a core and a periphery. Core products include chemicals, machinery and metal products; isolated products include petroleum, raw materials, tropical agriculture, animal products, cereals, labor-intensive goods and capital-intensive goods (excluding metal products). Core products tend to be more sophisticated than isolated products. Products in the periphery are loosely linked, while links in the core are stronger. This means that it is very difficult for a country stuck exporting products in the periphery to move into products in the core—the dilemma of development. The authors show that some products are ‘close by’ because they require similar capabilities. Here, it is quite easy to jump from one product to another and so export new products with comparative advantage. For isolated products, however, this is difficult.

This discussion raises an important question: what are the likely new products that a country could develop comparative advantage in, given its current export basket? For one thing, these must be products that are ‘close by’ to the products that it already exports with comparative advantage, because these potential exports require capabilities similar to those used by the products exported. It is possible to rank all products not exported according to their proximity to the current export basket. Hidalgo et al. (2007) do not claim that a country should promote or subsidize ‘close by’ products. Rather, their analysis shows how far these potential new exports are from the current export basket. The ‘farther away’ they are (that is, they require capabilities that the country does not have), the more difficult it will be to develop comparative advantage in them. This does not necessarily mean that a country should avoid developing them, but it must be understood that there is a clear trade-off between risks and return, and that choices must be made based on countries’ industrial policy objectives and organizational capabilities.

2.3.3 Identifying the Objectives of Industrial Policy

When developing an industrial policy program it is important to first agree on its objectives. For many emerging economies, the development
Development and modern industrial policy in practice

of a broad-based productive sector is a prime objective. Here, sectors and activities need to be selected in which existing firms already have at least some organizational capabilities, but have not yet achieved sufficient competitiveness to weather international competition. This is in line with choosing ‘close by’ products in the product space. This is important because targeting industries and products that require capabilities too far away from existing ones could lead to overambitious and ineffective industrial policies. In this regard, policymakers could use the first step of the Growth Identification and Facilitation Framework as a reference, although some caution should be exercised because choosing sectors on the basis of a target country’s per capita income alone can give a misleading picture of organizational and entrepreneurial capabilities; for example, in an oil-rich country. The productive and organizational capabilities of entrepreneurs in resource-exporting countries are likely to be well below those of entrepreneurs in a more diversified country, despite the fact that the latter’s per capita income could be lower.

In cases in which countries have more ambitious plans and attempt to leapfrog from the periphery to the core, the challenge is how to build new organizational capacities and address coordination and innovation externalities amid a transition. This might require larger investments to secure economies of scale and complementary infrastructure than those needed in cases of moving to ‘close by’ industries. If, after investments are made, a country fails to achieve international competitiveness, the resulting capacity underutilization and financial distress could massively hurt the economy. Furthermore, even if technological challenges can be overcome at the country level, the world would be awash in overcapacity if too many countries target the same industries. This ‘fallacy of composition’ effect further increases the risks of industrial policy. Accordingly, a country must carefully weigh the challenges of skill accumulation, scale economies and complementary investments against the possibility of capacity underutilization and financial distress before embarking on an ambitious industrial policy.

2.3.4 Pursuing Indirect Industrial Policy through Financial Markets

The Growth Identification and Facilitation Framework and the Product Space theory are useful modern tools to help design industrial policy. Used alone, however, they do not provide a definitive answer on which sectors a country should promote. Rather, these methodologies highlight the high-return, high-risk nature of industry selection. Later in this section, we provide an example of what this means by contrasting the cases of the Republic of Korea and the Philippines. The nature of this trade-off
derives from the fact that for low- and middle-income countries, governments may not have enough technical and expert knowledge to evaluate the risks in expanding the technology frontier to create new industries. The role of the private sector therefore becomes imperative at this juncture. Indeed, an effective multi-phased strategy is needed to leverage private sector expertise in sector selection.

As an operational tool for industry selection, indirect industrial policy is widely used in advanced economies, though its practice is not often visible. This is a strategy for indirectly selecting and supporting industries through private financial markets. Instead of picking specific industries or firms to support with direct assistance, the government broadly defines its favored industries and announces incentives for the private sector to participate in industrial policy.

One example of this is the Multiannual Program for Enterprises and Entrepreneurship, known as MAP, in the European Union’s (EU) Lisbon Strategy. The strategy was a 2000-devised EU development plan to increase the competitiveness and dynamism of a knowledge-based EU economy.\(^4\) It includes a scheme to support innovative SMEs through a creative guarantee mechanism under the European Investment Fund, which shares the risk of guaranteeing bank loans to SMEs with private guarantors (Figure 2.2). For example, if the European Commission wants to promote SMEs in the biotechnology industry, it assigns a budget to the European Investment Fund to provide partial credit guarantees for bank loans extended to the SMEs. Criteria for SMEs to avail of the loans are preannounced, banks select candidate firms and the European Investment Fund and banks jointly determine the beneficiaries. Credit guarantees can also be jointly extended with private guarantors. If the European Commission and the European Investment Fund want to promote riskier industries than, say, biotech, they can increase their credit guarantee proportion to incentivize more active private banking participation in those industries. In other words, they have parameters that allow the European Investment Fund to assume a minority or majority share of the guarantee depending on the risk involved.

Sophisticated capital market instruments are also used to minimize the moral hazard problem in public guarantee programs. For example, as shown in Figure 2.3, the European Investment Fund provides credit enhancement to securitized SME loan portfolios by private banks. But its support is mostly targeted to tranches with mid-level credit

\(^4\) See Chapter 13 for a discussion on the Lisbon Strategy and Europe 2020, which it replaced.
Multiannual Program for Enterprises and Entrepreneurship (MAP)

SMEs → Loan → Banks

Mutual guarantees

Guarantee → Co-guarantee

Private guarantors → EIF

SMEs

EIF

Budget

Note: EIF = European Investment Fund, SME = small- and medium-sized enterprise.


Figure 2.2 The Lisbon Strategy

Credit enhancement in securitization

Originator → Reference portfolio

Sale of portfolio or credit default swap

SPV

AAA

AA

A

BBB

Unrated

Bondholders

Bondholders

European Investment Fund

External guarantor 20% risk weighing

Note: SPV = special purpose vehicle.


Figure 2.3 European Investment Fund
ratings. Higher-rated tranches are sold to market investors without guarantees. Loan originators (banks) must assume the risk for the lower rated or unrated tranches so that they do not have an incentive to sell bad assets to the market or to the European Investment Fund. In doing so, the fund tries to minimize the moral hazard problem while supporting the securitization of bank loans extended to achieve industrial policy goals.

Another example is the on-lending program of KfW (Figure 2.4). Because of its high credit rating, KfW can source funds at lower interest rates than private banks and use these funds for on-lending to private banks to incentivize them to lend to firms in certain targeted industries. The broad conditions for KfW’s support are preannounced and private banks select candidate firms to jointly review with KfW. Depending on the risks involved with a targeted industry, KfW can adjust the proportion of cofinancing. The interest rate margin is another tool used to differentiate risks. KfW used to regulate this within one percentage point for on-lending funds, regardless of the credit ratings of supported SMEs. But this had the unintended effect of directing the majority of funds to low-risk projects and SMEs with good collateral since the regulated interest rate margin acted as a disincentive to private banks to choose SMEs with lower credit ratings. To address this, a risk-adjusted price system was introduced.

Note: KfW = Kreditanstalt für Wiederaufbau (German Development Bank), SME = small- and medium-sized enterprise.

Source: Authors.

Figure 2.4 On-lending by KfW
in 2005 allowing private banks to adjust the interest rate margin with the credit ratings of supported SMEs. The result was an increase in loans to lower-rated SMEs.

The benefits of indirect industrial policy are numerous. For example, risk can be shared between the public and private sectors through on-lending, credit guarantee and cofinancing mechanisms, which reduce fiscal instability in the event that industrial policy does not succeed. Above all, governments can leverage the private sector’s deeper knowledge in selecting potential winners. By making private financial institutions bear significant costs of project failure, the public sector can secure the private sector’s best efforts in selecting industries and firms to support. It also provides useful information for governments to judge whether they should target ‘close by’ or ‘core’ industries. If, despite the offer of significant public support, a government cannot find private sector cofinancing partners after selecting a particular industry, then developing that industry is very likely to be beyond its operational capability. In that case, it would be better for that industry not to be targeted at all. Indirect industrial policy also allows governments to avoid international tensions, which could be triggered if it extends direct assistance to particular sectors. This is one reason why most public support programs in advanced economies are implemented indirectly through private financial markets. These risk-sharing mechanisms also contribute to the development of domestic financial markets.

The other important political benefit of indirect industrial policy is to avoid the potential criticism that governments withdraw assistance in bad times. With the use of indirect industrial policy, private financial institutions extend support to firms and can withdraw it if necessary without the political backlash that would normally follow the withdrawal of direct government lending. This is a very effective way of minimizing the moral hazard problem in traditional industrial policy. However, critics of indirect financial assistance highlight the risk of these programs being captured by private sector beneficiaries or the financial sector. Yet this risk is just as prevalent in direct lending schemes, if not more so.

2.3.5 High Return, High-Risk Policies: Contrasting the Republic of Korea and Philippines

Although quite a number of industrial policies implemented by the Republic of Korea were successful, the country also had setbacks that required massive restructuring. In the 1970s, the country’s heavy and chemical industries suffered from structural difficulties caused by over-investment, over-leveraging and over-competition. As a result, many
chaebols faced excessive supply capacity amid decreasing world demand. To avoid sovereign default, the government launched a huge restructuring drive in the early 1980s that involved closing down and merging several large companies, but still maintaining assistance through fiscal incentives and low interest rates for surviving companies. This example clearly shows that industrial policy is about more than simply selecting sectors, and that risk management and restructuring are essential components of a successful industrial policy.

The high-return, high-risk nature of industrial policy and the importance of risk management and restructuring policies in crisis periods were also evident in the Philippines in the 1970s. Similar to the Republic of Korea, the Philippines at that time embarked on a drive to develop heavy and chemical industries, and selected much the same industries to nurture. Both countries adopted nearly identical development blueprints for these sectors and used a similar set of policy instruments to channel resources to targeted sectors. They also relied heavily on external borrowing to fund domestic investment and struggled through worldwide economic recessions caused by two oil price shocks. Unlike the Philippines, the Republic of Korea weathered and recovered from those shocks—a testament to its successful industrial transition. The Philippine economy, meanwhile, was ruptured by internal and external crises. So what made the difference?

Abrenica (2013) claims the first factor might have been the historical antecedent that rendered economic conditions in the Philippines after World War II less conducive to development. Despite gaining political sovereignty in 1946, the country did not attain economic independence and was locked into a dependent relationship with the US by the Bell Trade Act that lasted until 1974. Apart from granting reciprocal free trade, the arrangement prohibited the Philippines from adjusting its exchange rate until 1955 and taxing exports to the US. This sustained the political and economic domination of the pre-war landed elites who benefitted from export quotas to the US at prices nearly twice world levels. Until the 1960s, both economic wealth and political influence were heavily concentrated among a small number of wealthy landed families, who vigorously opposed a clamor for land reform. The strongest political interest group was the sugar sector, which lobbied for liberal trade and exchange rate policies, as did other traditional export sectors. This put them in constant conflict with import-substituting industrialists over trade and exchange rate policies. It was only toward the end of the 1950s that the latter group won support in congress, paving the way for a new trade and industrial regime based on import substitution. However, an early run of good growth was not sustained precisely because the limits of the domestic market—stunted by skewed income distribution—were reached.
In contrast, the end of Japan’s colonial influence in the Republic of Korea enabled the government to set its own development agenda far earlier than in the Philippines. Furthermore, immediately after the end of World War II, Japanese-owned lands were either redistributed or sold, with land reform energetically pursued by the government. Concentration of land ownership and economic wealth declined dramatically. As a consequence, income distribution became more egalitarian, which helped develop domestic demand for local manufactures. Moreover, since the chaebols grew their wealth out of special privileges received from the state, they were more pliant to government policy designs. With no tensions between landed elites and industrial barons (as there were in the Philippines), it was more feasible to coordinate and implement a centralized and coherent development strategy and to switch paradigms between import substitution and export promotion when conditions warranted. This also provided the government with the power to lead involuntary restructuring during times of crisis.

A second major difference is that the constituency for industrialization was much smaller in the Philippines, where industrial policies were perceived to be championed by US-trained technocrats who enjoyed the confidence of international lending agencies but had no political base. Although part of the bureaucracy, they had to compete against cronies and lobbying groups to influence former president Ferdinand Marcos’s decisions on industrial policy. The narrow constituent base for industrialization is evident in the fact that Marcos’s closest cronies were more interested in accumulating rents from traditional export commodities, such as sugar, bananas and coconuts, and non-traded sectors, such as communications, finance and construction, than in developing the manufacturing sector.

Ad hoc policies were an additional hindrance to development. For example, what the Philippine export promotion measures achieved best was to allow producers access to imported inputs at world market prices. This encouraged the development of processing industries based on imported materials and cheap labor from the Philippines. Since the system protecting manufacturing firms producing for the domestic market was retained despite the shift to an export-oriented industrialization strategy, domestic firms had no incentive to upgrade quality and reduce costs. Exporters were therefore not encouraged to source locally or develop backward linkages. In this policy environment, only export industries with low transport costs and high labor input requirements could thrive. Electronics and garments fitted these characteristics; hence, Philippine exports remained highly concentrated in these sectors.

Industrial policies in the Republic of Korea on the other hand covered comprehensive value chains with forward and backward linkages. For
example, export promotion measures were not limited to tax preferences and interest rate subsidies to exporters. Rather, when the country embarked on export-oriented growth (1962–72), the plan included the development of basic infrastructure, industrial structure reform and the development of raw- and intermediate-material supplying industries. Import restrictions targeted developing infant industries until they were competitive enough to begin exporting or supplying domestic manufacturers with their input requirements.

Another distinction lies in policy and program implementation. The failure of the Philippine automotive, steel and shipbuilding industries shows the kind of policy flip-flopping that created uncertainty and triggered capital flight. By contrast, businesses targeting expansion in the Republic of Korea did not have to deal with policy inconsistencies and reversals as they were given preferential access to domestic credit and external funds, and were bailed out when threatened with bankruptcy during downturns and financial panics.

Such displays of government commitment were not entirely lacking in the Philippines. In 1981 an industrial rescue fund was established to save the business empires of Marcos’s cronies that were rendered insolvent by a string of financial scandals, but the crucial difference here was the extent to which competition was encouraged in implementing government policies and programs to foster favored firms and industries. In the Republic of Korea, the government made the chaebols compete among themselves for protection, and nurtured them by channeling credit, foreign exchange and opportunities to firms that were able to outperform the others, particularly in exports. In the Philippines, rewards were based less on performance than on political patronage. There was less incentive among Marcos’s cronies to strive for efficiency, not only because they chose to concentrate in non-traded and heavily protected sectors, but because rules and policies could be easily manipulated in their favor. For example, a Marcos crony was exempted from a rule that automotive assemblers could offset through exports of manufactured components only 15% of the local content requirement for cars assembled and sold in the Philippines. Thus, the business empires of the president’s cronies thrived by expropriating rents created largely by the uneven application of rules, rather than by generating profits through superior performance.

While performance rather than patronage is the basis for receiving protection and preferential access to resources, the capacity of the bureaucracy to monitor and maintain accurate records of economic performance is crucial for the consistent and credible application of policies. The government of the Republic of Korea has been lauded for maintaining reliable monitoring and record-keeping systems that proved valuable
Development and modern industrial policy in practice

not only in implementing industrial programs, but also in designing macroeconomic stabilization packages. Such capacity was lacking in the Philippine bureaucracy during its industrialization drive. As shown in the case of the automotive industry, the difficulty in monitoring compliance with local content requirements undermined its credibility. Another telling case of this weakness was the overstatement of the country’s reserves that was discovered only when the government declared a moratorium on debt repayments in 1983.

Perhaps the most important component of the Republic of Korea’s success story is the profound understanding by the government that active intervention is needed to achieve technological development. A simple reality, often unrecognized by governments in many developing economies, is that technology does not transfer automatically after opening up to foreign trade and capital flows. The government of the Republic of Korea had a wide array of policies geared toward stimulating market demand for technology, increasing the country’s science and technology base, and creating effective linkages between the demand for and supply of technology. The Philippines, in contrast, did not have a cogent set of technology policies.

Another significant reason for the failed industrialization of the Philippines is the lack of coherence in trade and investment policies, human resources, science and technology, and the regulatory environment that were supposed to complement industrial policies during the 1960s–80s. This lack of coherence is evident in the failures of the Philippines’ automotive, shipbuilding and steel industries. For example, while the country was trying to develop a shipbuilding industry in the 1970s, it allowed liberal entry of cheap imported second-hand vessels from Japan, and offered financing schemes for the acquisition of imported vessels (but none for locally built vessels). What is more, ancillary sectors such as metal casting, forging and machinery were neglected. The automotive industry failed because SME parts manufacturers were similarly neglected and assemblers were subjected to weak regulation on local content and limits on the number of brands and models. As a result, the expectation that foreign assemblers would develop local parts production did not materialize and the program failed to generate externalities.

2.4 THE MAIN POLICY TOOLS USED TO PROMOTE SECTORS

Conventional industrial policy tools such as improving education and infrastructure, modernizing labor markets, reducing red tape, or
facilitating foreign investment or technology transfer, have always been deemed uncontroversial because they were thought as horizontal tools. Vertical or sector-specific tools have, on the other hand, been controversial since they sought to either protect an existing sector from foreign competition or to launch activities in a new or expanding sector needing temporary support. The history of industrial policy is filled with examples of horizontal and vertical policy tools, including the provision of basic infrastructure to support the private sector (electricity, water, roads), different forms of protection (tariffs) and promotion (export rebates), subsidies for R&D and some aspects of public education. The risk is that governments can misuse these tools to the advantage of some groups and the disadvantage of others, with the result that public resources are inefficiently allocated. As argued by Felipe in Chapter 1, modern industrial policy is about using available tools to solve market failures.

Traditional industrial policy tools come in the form of infant industry protection, such as tariffs, export rebates and currency undervaluation. However, if industrial development is seen as a process spanning decades, it is quite natural that tools will change over time. In fact, governments in advanced countries rely increasingly on financial tools as their economies mature, with the public sector’s role in industrial policy becoming less visible. Developing and developed economies use a range of industrial policy instruments. These can be broadly classified into eight categories: (1) fiscal incentives, (2) investment attraction programs, (3) training policies, (4) infrastructure support, (5) trade measures, (6) public procurement, (7) financial mechanisms, and (8) industrial restructuring schemes. The following discussion provides examples of each policy instrument as used in the Republic of Korea and Malaysia (see also Chapters 10 and 12 on these two countries). For developed economies, see Chapters 9 (US), 11 (Australia) and 13 (European Union).

1. **Fiscal incentives.** Beginning in the 1960s, the Republic of Korea offered preferential tax credits and other concessions to manufacturing exporters and allowed exporting firms to retain foreign exchange earnings for import purchases. Preferential export credits were used in the 1970s to promote exports from the rapidly developing heavy and chemical industries. Fiscal incentives were likewise used in Malaysia to attract foreign direct investment for promoted sectors and to meet specific objectives. For example, tax holidays were given to firms awarded pioneer status and special zones with duty free imports were developed to promote exports that were dependent upon imported components.

2. **Investment attraction programs.** In the 1960s, the government of the Republic of Korea established the Guro special export-oriented
Development and modern industrial policy in practice

industrial zone in Seoul, offering qualified labor and improved infrastructure to facilitate exporting. Malaysia created technology parks as part of its Multimedia Super Corridor, which opened in 1999 as a specialized zone to attract high-technology foreign direct investment.

3. Training policies. The Republic of Korea’s heavy and chemical industries drive required developing a technological base. Through a presidential decree, the country upgraded its vocational schools, technical education and engineering based on the German model. The government also set up several research institutes to promote science and technology, as well as industry-specific institutes and science parks. To develop human capital, the government in Malaysia instituted requirements for sectors receiving support that included skills training.

4. Infrastructure support. In the 1970s the Republic of Korea established a number of industrial complexes with modern transportation and energy infrastructure. The cities that flourished around these complexes became synonymous with particular manufactured goods such as shoes or automobiles. Industrial complexes differ from special export promotion zones as their primary objective is to develop the domestic supply chains of specific industries. Similarly, Iskandar Malaysia, a special economic zone in the south, opened in 2006 to spur growth in manufacturing and services.

5. Trade measures. To stimulate exports, the government of the Republic of Korea set export targets that influenced firm behavior, with successful exporters receiving awards from the government. Asymmetric import tariffs were also used—very high tariffs for consumer goods for export and low tariffs for capital goods needed by export industries.

6. Public procurement. The Republic of Korea’s industrial complexes established under the heavy and chemical industries program were expected to provide 30% of their manufactured products to the military, which offered firms a measure of revenue stability. Malaysia’s requirements for the recipients of government support included local content rules, although these have now mostly been phased out due to Malaysia’s World Trade Organization commitments.

7. Financial mechanisms. The Republic of Korea’s complex financial support system for SMEs is detailed in Box 2.1.

8. Industrial restructuring schemes. Oil shocks in the 1970s and 1980s threatened the viability of the Republic of Korea’s heavy and chemical industries that were already under strain from overinvestment. The government directly intervened to close down less competitive firms or merge them with successful ones. Fiscal incentives and low interest rates buttressed the surviving firms.
The Republic of Korea is a good example of how industrial policy tools change depending on the stage of development. In the 1960s, when the processing trade was a major target of industrial policy, preferential export credits and special export zones were the country’s primary policy tools. In the 1970s, when the domestic industrial base started to emerge, the government backed policy loans and special industrial complexes that brought together domestic firms seeking access to modern transportation and energy infrastructure. After the two oil shocks, the 1980s saw industrial restructuring, facilitated by fiscal incentives for corporate restructuring, a low interest rate policy and the depreciation of the exchange rate as a tool of export promotion.

As the Republic of Korea advanced beyond middle-income status, developing a knowledge economy became a key objective of industrial policy and the government allocated special funds for R&D and education.

**BOX 2.1  THE FINANCIAL SUPPORT SYSTEM FOR SMES IN THE REPUBLIC OF KOREA**

To promote SMEs as a potential growth engine, several financial support facilities were developed in the Republic of Korea with assistance from industry, academia and research institutes:

*Credit guarantee funds.* Since 1976 the government has provided public credit guarantees through the Korea Credit Guarantee Fund and Republic of Korea Technology Credit Guarantee Fund to SMEs ineligible for bank loans due to lack of collateral. This risk-sharing mechanism bridges the financing gap stemming from the absence of a credit evaluation system.  

*Policy loans.* The government supplies loans either directly or indirectly to a host of SMEs at lower-than-market interest rates through the Small Business Corporation.  

*Asset-backed securitization.* The Asset Backed Securitization Law was passed in 1998 to govern securitizations originated by financial institutions. The Korea Mortgage Corporation was established in 1999 as a joint venture between the International Financial Corporation and domestic banks. The corporation issued securities collateralized by mortgage loans acquired from the National Housing Fund.  

*Fund of Funds.* In 2005, the government started to create so-called Fund of Funds to promote investment funds for SMEs and venture businesses. In contrast to the previous system, in which the government directly chose the recipient companies, the Fund of Funds allows fund managers to evaluate, select and distribute capital to SMEs, and is therefore a tool for indirect industrial policy.

*Source: Authors.*
in the 1990s. As a new source of innovative growth, the role of SMEs was emphasized and various credit guarantee programs strengthened. By the 2000s, the government realized the practical and political limitations of traditional industrial policy and tried to benchmark the indirect industrial policies being used in advanced economies. Tax exemptions and financing schemes, such as the Fund of Funds, venture capital and asset-backed securitization, became the new focus of industrial policy. As the private sector became more complex, previously used policy instruments lost their effectiveness and, in some cases, their use led to economic distortions. In their place, financial tools that supported risk sharing, R&D, education and SME development gained favor. This dynamic shift in policy tools was not solely the result of government decisions, but also reflected the private sector’s evolving capacity to influence policy.

Although the Republic of Korea achieved rapid growth by exporting labor-intensive, low-end goods, this strategy reached its peak by the mid-1980s with the emergence of manufacturing capacity in lower-wage countries at the same time that domestic wages were rising. As firms realized that they needed to upgrade to higher-end or value-added goods, they began to establish in-house R&D centers, at which point the tools of industrial policy began to include tax exemptions for R&D activities. The experience of the Republic of Korea reflects progress in government activism from traditional industrial policy tools (tariffs, fiscal subsidies, financial repression and currency undervaluation) in the early stages of development to financial-based instruments (cofinancing, credit guarantees, SME financing and R&D subsidies) in later stages.

2.5 RISK-ADJUSTED INDUSTRIAL POLICY

This chapter ends with a brief discussion of risk management and industrial policy. Risk management is an important tool in modern industrial policy. Considering the high-return and high-risk nature of industrial policy, governments engaging in industrial policy need to manage their risk exposure. Although there are potentially significant social returns in pursuing industrial policy, the fiscal cost of failures needs to be absorbed by the government and, ultimately, by taxpayers. A continuation of policies with major underwriting costs that fail to deliver economic success will eventually strain public resources. Therefore, it is critical that industrial policy not only selects the right sectors for promotion, but also effectively manages the risks involved in the selection process and its subsequent development.

For example, the US government manages risk in its various credit
programs by closely monitoring its budget support for such programs (see Chapter 9). Through the Federal Credit Reform Act 1990, it improved the accountability with which it measures the cost of federal credit programs. The Act places the cost of credit programs on a budgetary basis equivalent to other federal spending; that is, if underperformance reaches a certain level, then the following year’s budget is at risk of an automatic decrease. In effect, a stop-loss mechanism is in place to ensure that ineffective or wasteful credit programs are not continually funded. This practice is virtually *ex-ante* risk management.

**REFERENCES**


3. Issues in modern industrial policy (II): human capital and innovation, and monitoring and evaluation\textsuperscript{1}

\textbf{Jesus Felipe and Changyong Rhee}

3.1 INTRODUCTION

This chapter looks at the two remaining issues in the design and implementation of modern industrial policy—how can innovation, technology and human capital development be fostered? And, what are the most appropriate monitoring and evaluation mechanisms? We start with a discussion of the role of education promoting economic diversification, a key aspect of industrial policy. We then look at how innovation and human capital development strategies, like most aspects of industrial policy, change depending on the stage of development. Case studies from the Republic of Korea, Malaysia and the United States (US) examine the implications for innovation and human capital development policies.

3.2 EDUCATION AND ECONOMIC DIVERSIFICATION

Innovation and human capital are often the weakest links in industrial diversification in many low- and middle-income countries. Indeed, the acute shortage of highly skilled professionals, particularly professional managers, is one of the biggest challenges in these economies. Because of this shortage, and other business and investment climate factors, it is difficult to attract foreign investors and companies in strategic economic areas. The structure of research and development (R&D) in many low- and middle-income countries reflects a model that is not conducive to commercial success, either because the private sector plays only a limited role in knowledge generation or because market-driven demand

\textsuperscript{1} This chapter is based on Felipe and Rhee (2013).
Development and modern industrial policy in practice

for technology is weak, as evidenced by low R&D spending. Such countries do not have many high-technology sectors owing to the lack of a competitive environment, insignificant business incentives to introduce and absorb technologies, insufficient legal mechanisms and protection of intellectual property rights, and a poor culture of innovation management. Underdeveloped financial sectors also constrain innovation. Overall, there is space for enhancing the knowledge-generating capacity of economies through targeted policy interventions.

Recent research by Mehta and Felipe (2014) addresses the question of whether diversification of the production structure is a path-dependent process (in other words, history dependent), and how education contributes to facilitating economic diversification. History provides many examples of economies where educated workforces proved crucial to efforts to enlarge the export mix. Japan began this process in the late 1950s after attaining quite a high level of education. Educational attainment in the Republic of Korea and Taipei, China rose rapidly between the 1960s and 1980s, when their shares of the global market for many products increased dramatically. The People’s Republic of China began making inroads into global product markets in the 1980s with already high education levels for a developing country. The successes of Germany and Switzerland, whose exports are among the most diversified and sophisticated in the world, are often credited to the rigor and practicality of their basic education systems. Conversely, the export baskets of Pakistan and Bangladesh, which lag behind Asia in education attainment, display little diversity. So can we infer from this that a country that rapidly increases its education level is more likely to achieve a diverse export mix? Using a large data set, Mehta and Felipe studied the link between diversification and education. The following is a summary of their conclusions:

1. The analysis confirms the view that development of comparative advantage is a path-dependent process—stepping-stone products must usually be developed to approach new products.
2. Having said this, there is strong evidence that education helps reduce this path dependence by facilitating more rapid incremental movement across the stepping stones of industrial development. Put differently, education helps countries overcome the unfamiliarity of target products. In contrast, the sophistication of target products is generally only an impediment for those countries with the least educated populations.
3. The analysis also shows that education quality matters more than education quantity. Likewise, there is strong evidence that high quality basic education matters for export diversification, and that
conditional on the quality of basic education, college and secondary attainment are important.

4. The dynamics of export diversification are fairly similar in emerging and mature industries, while the development of comparative advantage in nascent industries is extremely difficult to predict.

5. Countries require only modest amounts of education to overcome barriers posed by the sophistication of peripheral products (relatively simple products and not well connected to others), while education does not help overcome distance in peripheral products.

6. Finally, core products (the most unique, sophisticated and well connected) pose very different problems: while product sophistication among core products is only an impediment to poorly educated countries, high-quality education is required to significantly overcome unfamiliarity with core products. Perhaps most importantly, we find evidence that only the best educated among the developing and newly industrialized countries were able to leapfrog into core products.

This analysis has several implications. First, countries wishing to transform their human capital stock into industrial development will need to consider carefully the path dependence that is in store. The most difficult product markets to crack are difficult for a reason—they involve severe learning-by-doing. Stepping-stone industries will therefore need to be supported, and attempts to move directly into sophisticated industries without first developing stepping-stone industries may reflect excess optimism. Second, education that endows high-school graduates with strong cognitive skills could be more important for development through export diversification than ratcheting up the quantity of education. Countries committed to growth through human capital accumulation need to refocus their efforts on increasing education quality, and should think carefully about which stepping-stone industries to support so that workers can acquire useful knowledge in the workplace.

3.2.1 Republic of Korea: Industrial Policy for Technological Adaptation

The Republic of Korea understood early the importance of education, innovation and R&D investment for diversifying and upgrading its economy. In the 1960s, most of the workforce needed in export-oriented labor intensive industries came from undereducated groups, usually with only middle school (or even elementary school) education. However, the government created a series of industrial high schools in agriculture, commerce, engineering, maritime and fisheries to build a more skilled workforce for nascent industries. In the 1970s, the newly targeted heavy
and chemical industries needed highly skilled engineers. The government supported universities in establishing engineering faculties, especially in mechanics, chemistry and electronics.

As part of this process, private companies contributed significantly as suppliers of education services to secure qualified workers (Box 3.1). During 1973–79, the government selected 19 Specialized High Schools for Machinery Industry and provided them financial assistance. In 1976–77, 11 Exemplary Engineering High Schools, which provided students with six months of on-the-job training during their senior years, were established to provide skilled workers for overseas construction industries. In 1978–79, an additional 12 Specialized Engineering High Schools were selected to meet the demand from firms in electronics, chemistry, construction, steel, railroads and military-related manufacturing under the heavy and chemical industry program.

Despite demonstrable success, by the 1990s the Republic of Korea’s industrial model of education was becoming less effective as the country gradually transformed into a knowledge-based economy. Exposed to global competition in manufacturing industries, and with domestic wages

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**BOX 3.1 THE RAPID DEVELOPMENT OF HUMAN CAPITAL IN POSCO**

The Pohang Steel Corporation (POSCO) provides a good example of how companies in the Republic of Korea tackled the problem of weak human capital in the early days of the country’s industrialization. When POSCO was established in 1968, many international organizations, based on assessments of the venture’s feasibility, refused to provide assistance. The construction of the country’s first integrated steelworks began at a time when even its experienced steelworkers did not have the skills to run an integrated steel plant. The knowledge they had was from small-scale, separated steelmaking processes that were not applicable to a large-scale environment.

The Pohang Steel Corporation acquired the skills and knowledge for its workforce primarily through overseas training involving field observation for two to four weeks and on-the-job training for two to six months. In 1968 and 1969, it dispatched its first 39 trainees to Japan; during 1968–83, some 1861 workers trained overseas and returned to train other workers.

The Pohang Steel Corporation initially focused on building technological capabilities for plant operation, maintenance and repair before giving priority to computerization and quality control. It successfully and quickly built sufficient capabilities for plant operation and the skills of its employees improved significantly over time. Later POSCO established its own high schools and universities to further develop its base of human capital.

*Source:* Lee et al. (2012).
rising, private firms increasingly realized that innovation was crucial to survival. They responded by dramatically increasing R&D expenditure from the 1980s (Figure 3.1). The old education system, meanwhile, started to show its limitations in supporting economic transformation for a knowledge economy, as it was based on teacher-centered, one-way learning with an excessive focus on memorization, a lack of diversity in educational programs and a preoccupation with examination preparation.

Figure 3.2 shows that, given its income per capita, the Republic of Korea is an outlier in R&D expenditure as percent of GDP. However, it was a public-led industrial policy that played a fundamental role in helping private sector R&D take-off in the early 1980s (the formation of public–private R&D consortiums during the 1970s had been an effective industrial policy tool to enhance the low R&D capabilities of private firms). Public research institutions were mandated by the government to lead efforts to promote new industries and were encouraged to share their research outcomes with participating private firms with the goal of successful commercialization. The development of the Republic of Korea’s telecommunications industry in the 1980s and 1990s is an example of successful cooperation between the public and private sectors.

In the 1970s and 1980s, the Republic of Korea grappled with telephone service bottlenecks. Until the late 1970s, the country had neither its own telecommunications manufacturing equipment industry nor a relevant R&D program for telecommunications. The country imported most equipment and technologies from foreign suppliers at very high prices, with local technicians merely installing foreign switching systems.
However, with rising demand, the government decided that it should build its own manufacturing capabilities and the R&D infrastructure necessary for creating a state-of-the-art digital phone switching system. To this end, it provided financial support to a public–private research consortium. From 1981 to 1983, the government-backed Electronics and Telecommunications Research Institute developed a proprietary digital switching system—the time-division exchange series—in collaboration with a national network of switching system manufacturers and distributors. The institute’s earlier experience producing analogue switches through licensing agreements with international firms such as ITT Corporation, AT&T and LM Ericsson was vital to this process. To access manufacturing technology and produce switches in the Republic of Korea, state-owned Korean Telecom—which Samsung Semiconductor & Telecommunications later acquired and then merged with Samsung Electronics—purchased in 1977 the M10CN electronic switchboard system from ITT Corporation.
via Bell Telephone Manufacturing Company. Because one company alone was not able to meet the market demand for switches, another joint venture, between GoldStar Semiconductor and AT&T, was established to import the No.1A electronic switchboard system from AT&T in 1979 (Hwang 1993). As a result of these joint ventures, 300,000 new telephone lines were activated yearly, although this was still not enough to meet the explosive demand for telephone services.

In 1982, the government concluded that it had to build its own telecommunications technology and, to this end, provided support to a public–private research consortium. Led by the Electronics and Telecommunications Research Institute, the consortium purchased digital switching design and engineering technology from Ericsson, eventually developing its own prototype model. This made the Republic of Korea the tenth country in the world at that time to develop an electronic switching system. The institute then succeeded in developing a more sophisticated switching system before transferring the technology to four private-sector firms—GoldStar Semiconductor, Daewoo Telecom, Dongyang Electronic & Telecom and Samsung Semiconductor and Telecommunications—that would go on to contribute significantly to the development of the country’s semiconductor industry (Mu 2002).

Even after the technology transfer to the private sector, the Electronics and Telecommunications Research Institute continued to improve its technology in collaboration with a network of actors, including universities and manufacturers of digital switches (the so-called TDX switch) to produce more advanced versions of telecommunications products. The experience of the Republic of Korea in this area is a good example of how industrial policy can effectively promote new technological adaptation together with the private sector.

3.2.2 Malaysia: Foreign Direct Investment and Technology Transfer

Malaysia illustrates the fact that promoting foreign direct investment (FDI) in industrial policy is not necessarily an effective tool for acquiring advanced technology in industrial policy. The country has traditionally used FDI to acquire foreign technology, which has led to a degree of technology transfer, with some Malaysian companies linking up with global supply chains as suppliers and design houses. One benefit of such an approach is that it does not require the high level of public-debt financing that was part of the Republic of Korea’s technology pursuit through licensing agreements. However, Malaysia’s approach has not produced many domestically owned and designed products with global reach, unlike the Republic of Korea. The use of R&D incentives for multinational
corporations might have increased the profitability of these firms operating in Malaysia, but this did not automatically result in the transfer of technology to domestic firms. So even though Malaysia’s trade and investment liberalization policies were effective in attracting FDI and capital flows, thereby helping the country transition from low- to middle-income status, the widespread transfer of technology was not part of this process. Multinational corporations doing business in Malaysia maintained tight control over their technology while at the same time benefiting from a liberal investment and labor climate.

The Asian Development Bank (2013) argues that FDI inflows and openness, as well as buoyant exports and resource intensity, are not significant indicators of the probability of a country becoming a high-income economy, and that these variables are not associated with achieving or not achieving advanced-country status beyond the explanatory power provided by industrialization. This is a somewhat surprising result. One possible interpretation is that openness and exports are important for the transition from low- to middle-income status, but their contribution declines significantly further up the income ladder—and as a factor for avoiding a middle-income trap. In other words, countries need more than openness to reach high-income status. The same logic could also apply to FDI inflows: these might be important for low-income countries, but they do not necessarily imply that technologies are effectively transferred.

By contrast, the People’s Republic of China’s ‘50–50’ ownership model offers an interesting approach to addressing this very conundrum. Local ownership is a prerequisite for FDI in the country, which facilitates the process of technology transfer. This has allowed the People’s Republic of China to harness FDI to rapidly advance from a low technology base.

3.2.3 United States: Building Human and Organizational Capital

The US has historically invested substantial resources in human and organizational capacity building. This has included federal and state support for its world class university system, funding for scientific research, particularly involving investment in early stage research, and, after World War II, in strategic partnerships with industry. Its political and legal institutions have also underpinned economic growth. Achieving industrial development and diversification would have been next to impossible without these basic building blocks of human and organizational capacity. The US system also thrived when forward-looking labor policies and investments in, and access to, education and training systems were pursued. Though not sufficient for industrial development and diversification by themselves, such initiatives have certainly
broadened the base of potential contributors to innovation and industrial development.

The US has built on its strengths in innovation systems, supporting existing sites of science and technological expertise (such as universities, public laboratories and standards agencies) and established new sites of expert knowledge by drawing on multiple sectors and institutional contexts. Over the past several decades, these efforts have been most effective when the US relied on decentralized agencies and programs that simultaneously pursued upgrading and diversifying strategies for overcoming technical barriers within and across a range of technical and industrial fields, rather than using centralized bureaucratic development strategies.

Since the 1980s, the US has been particularly effective in correcting network failures in an increasingly fragmented and decentralized production environment. A range of programs and policies have helped dispersed network partners acquire a degree of certainty about the trustworthiness and competence of one another. In addition, linking entrepreneurs and technologists with support networks has been important to US technological dynamism.

Program evaluation methods are diverse in the US, but successful programs have relied heavily on expert knowledge—often, though not exclusively, through peer review systems—in evaluating technology ideas, programs and policy effects. The US has developed an array of programs that are potentially valuable models in developing contexts. Clearly, it is difficult to create advanced scientific laboratories staffed by experts in short order. But smaller, targeted programs, such as the Small Business Innovation Research program, provide useful models that other countries have emulated in recent years. The program requires that federal agencies with external research budgets exceeding $100 million reserve at least 2.5% of their budget for small businesses (those with less than 500 employees). In 2010, the Small Business Innovation Research program set aside more than $1 billion in research funding to US small businesses.

3.3 LESSONS FOR MIDDLE-INCOME COUNTRIES

Because of different stages of development and internal conditions, the country case studies in this section cannot be automatically replicated by middle-income economies. However, they do highlight the importance of human capital development and innovation as an essential part of industrial policy. Without a supply of high-skilled labor, upgrading an economy’s industrial structure is not possible. Advanced middle-income economies cannot rely on cheap labor or low-technology industries to
compete in international markets. Rather, innovation and self-sustaining R&D capacities are key to industrial diversification. More than anything else, middle-income economies need to improve the quality of their basic and secondary education.

Policymakers need to understand that while developing high-quality tertiary education is important, the key to diversification into industries that are ‘close by’ is basic education and developing cognitive skills. The private sector has to participate as a supplier of education and training. Good benchmarks are the public support for private sector job training and apprenticeships in Australia and the Republic of Korea. Middle-income countries have to increase their R&D expenditure, both public and private. The public sector alone is not capable of leading R&D efforts as it does not have active incentives to commercialize R&D outcomes. Initiating R&D consortia with the private sector in targeted industries can be an effective strategy for jump-starting R&D expenditure, as was the case in developing a telecommunications switching system in the Republic of Korea.

Most middle-income countries rely in different ways on FDI to acquire advanced business administration skills and foreign technology. Foreign direct investment is an important element to gain industrial diversification. However, if not managed properly, preferential treatments and R&D incentives for multinational corporations can increase the profitability of their operations without resulting in the transfer of technology to domestic firms. Industrial policy should focus more on the acquisition of advanced technology through strategic FDI. Sometimes, buying technology and paying royalties is an effective approach to developing domestic technology bases.

For countries with large public sectors, it is important to have qualified public sector workers. Sending public sector employees oversees for higher education and training is very important for providing more effective public services in transition economies while their private sectors mature. In doing so, the public sector plays an important role by providing a high-quality supply of labor to the private sector. For countries with relatively small populations, immigration policies that bring in high-quality workers can be a wise strategy.

3.4 EFFECTIVE MONITORING AND EVALUATION MECHANISMS

The outputs and outcomes of industrial policy are hard to identify and evaluate considering the long-term nature of structural changes and the potentially wide spillover effects. This final section addresses this difficulty
by providing a discussion of effective monitoring and evaluation mechanisms, which are important in the conduct of successful industrial policy to minimize fiscal risks.

There are several general rules for effective monitoring and evaluation; among them, establishing clear objectives, developing simple check-up mechanisms and ensuring accountable coordination among relevant agents. Furthermore, governments must ensure that new programs will not be started if existing programs with similar policy objectives are left unfinished and unevaluated.

Monitoring and evaluation mechanisms of industrial policy vary with a country’s development stage. When industrial policy covers a few specific industries in a less developed economy, monitoring and evaluating outcomes are technically feasible though not easy. However, as economies mature and industrial policies become more complex, it is virtually impossible to trace all spillover effects across industries and come up with a comprehensive macroeconomic evaluation of various industrial policy packages. Therefore, in advanced economies, industrial policies are usually reviewed and monitored on a program-by-program basis rather than evaluating overall industrial policies.

This section includes a description of evaluation indicators (Box 3.2) and a review of the basic elements of monitoring and evaluation systems based on the experiences of the Republic of Korea, Malaysia, the European Union and the US.

3.4.1 Republic of Korea: From a Top-Down to a Decentralized Approach

During rapid industrialization in the 1960s and 1970s, the Republic of Korea developed a monitoring and evaluation system that was simple but powerful. In the 1960s, the president convened and chaired monthly export promotion meetings attended by ministers, the central bank governor and experts from the private sector, such as members of the business community and academics. The aim of the meetings was mainly to monitor the progress of exports against annual targets set by the Ministry of Commerce and Industry. The business community was given an opportunity to raise complaints and suggestions. Based on their inputs, the president would set new goals and put pressure on the ministers to address grievances and resolve problems within an agreed period.

In the 1970s, a committee to promote heavy and chemical industries was established by the Office of the Prime Minister. It was chaired by the president even though the prime minister was officially chairman, and committee meetings were attended by ministers, business leaders, and eminent engineers and scientists. The committee’s major functions were
BOX 3.2 DESIGNING EVALUATION INDICATORS

The aim of evaluation is to establish an objective source of information to determine policy effectiveness and outcomes. At a general level, this requires establishing a baseline data set of firms and their characteristics and performance that is regularly updated, and a control group of nonparticipant firms. Evaluation indicators vary with the policy objectives at different levels of policy intervention and with the institutional, historical and technological context of specific sectors or activities.

Macro-level indicators. These are often the easiest to design since they usually rely on highly aggregate quantitative (statistical) data. For example, indicators used by the Organisation for Economic Co-operation and Development, such as export unit values of manufacturers, unit labor costs in manufacturing and consumer price indices, could easily be adapted to the specificities of an individual economy. The downside of macro-level indicators is that they are useful only if longitudinal data sets are available or can be constructed. In addition, while they provide basic ex-post information to policymakers about the overall failure or success of industrial policy strategies, they tend not to provide information about the main causes of policy outcomes.

Meso-level indicators. These are more difficult to design. In the case of a specific policy objective of creating or enhancing the organizational capabilities of a broad entrepreneurial base in targeted manufacturing sectors, both quantitative ex-post indicators as well as qualitative ongoing indicators are relevant. As with macro-level indicators, aggregate (sector level) quantitative indicators provide ex-post information about the economic performance of targeted sectors in the context of the economy as a whole. Examples of such indicators for this policy objective include growth of gross value-added in manufacturing industries, competitiveness indicators (for example, export performance), employment growth and investment rates in targeted industries.

Some of these quantitative indicators require quite sophisticated data, such as input–output tables, highly disaggregated statistics, that may be difficult to obtain. Qualitative evaluation indicators of meso-level performance provide information about ongoing organizational changes at the sector or industry level, and about technology diffusion and adoption. These can be useful to approximate so-called spillover effects or externalities that are difficult to encapsulate in numerical measures yet represent a significant aspect of meso-level industrial policy success or failure. Examples of such qualitative evaluation indicators include entry and exit from network activities, contractual arrangements with foreign direct investors and technology providers, and inter-firm alliances (for example, knowledge sharing platforms).

Micro-level indicators. Similar to meso-level indicators, micro-level indicators combine quantitative and qualitative features. Where data access and availability allow, quantitative indicators of organizational and technological learning efforts can include firm-level profitability measures, sales and employment growth, and competitiveness measures such as product price relative to the market leader and changes over time. Qualitative indicators can include product quality relative to the market leader and changes over time; product differentiation capabilities (number of new product and process developments over a period of time); and broader innovation capabilities.
to formulate plans and support programs to develop heavy and chemical industries and to evaluate their progress and implementation. It also reviewed the details of the investment plans of individual companies.

By the 1980s, industrial policy and industrial structure in the Republic of Korea had become too complex to be managed solely through a top-down process. To adapt to changing circumstances, monitoring and evaluation was decentralized to the ministry and agent level. With an expansion in the number of programs came a range of new indicators to be monitored by ministries. Sophisticated performance-based evaluation systems were designed to measure actual outcomes generated by policy initiatives rather than outputs, and evaluation orientation gradually shifted from the short term to the medium term. Greater emphasis was placed on risk management, while transparency and accountability were enforced by audit departments and parliamentary reviews.

Today, the Republic of Korea’s industrial policies have advanced even further in sophistication and include a range of financial instruments in support of small- and medium-sized enterprises and R&D. Consequently, the monitoring and evaluation mechanisms used to assess these financial policies became more sophisticated, as explained in Box 3.3.

3.4.2 Malaysia: Improved Transparency Reviewing Industrial Plans

Malaysia has not used monitoring and evaluation for industrial policy. The United Nations Industrial Development Organization assisted the government in reviewing industrial development under the First Malaysia Plan, 1966–70, and the policy assessments were used to formulate the Second Malaysia Plan, 1971–75. This was also reviewed with the assistance of the United Nations Industrial Development Organization. But except for those relating to broad macroeconomic targets, the results were not used as inputs in drafting the Third Malaysia Plan, 1976–80. Hence, this plan cannot be viewed as a continuation of industrial planning in the same way that the first and second plans were. Although subsequent five-year plans were subject to review, there are no available public documents on the findings.
Attention has since shifted to the Economic Transformation Plan for 2010–20, which provides periodic updates on new projects and investments in 12 targeted areas and a publicly available annual report (see Chapter 12). Overall, greater transparency exists in the review process for sector performance under the Economic Transformation Plan than under the five-year industrial plans. In addition, the Ministry of International Trade and Industry has institutionalized annual policy dialogue with the private sector.

sector that focuses on operational issues and, occasionally, strategic issues. Unfortunately, the ministry’s follow-up on the results of the consultative mechanism has been uneven and a risk assessment process is lacking.

3.4.3 European Union: A Wide Variety of Evaluation Practices

The sophisticated industrial policies of the European Union (EU) are too broad to be monitored or evaluated in a systematic way (see Chapter 13). Instead, the European Commission regularly monitors and evaluates individual policy initiatives on a program basis, seeking to ensure regulatory quality throughout the policy cycle; that is, from design to implementation, enforcement, evaluation (midterm, end of term and annual) and revision. Evaluations require a range of different approaches to assess a policy’s impact, although there is a focus on four trends: (1) productivity and cost developments relative to international competitors; (2) creation of jobs in industrial and related sectors; (3) growth in manufacturing output, with particular reference to developments in technologies, products and services that reduce environmental risk and minimize pollution and resources such as waste-water management, renewable energy sources, environmental consulting, air pollution and control, and eco-construction; and (4) the contribution of medium- and high-technology manufacturing sectors in terms of value-added and employment.

Impact evaluations of policies (ex-ante evaluations of the potential outcomes of a given industry policy) are as important as ex-post evaluations. Impact evaluations apply to policy proposals deemed to have a significant impact on industry development, including, for example, policy proposals for new internal market legislation and financial market regulations. In such cases, impact assessments are intended for competitiveness-proofing; they assess investment, cost, price and innovative implications for industry and individual sectors, as well as consumer satisfaction and the potential overlap between a policy proposal and other existing or planned legislation and regulations. Impact evaluations involve identification of problems and objectives, definition of policy options, analysis of impacts and comparison of policy options. They also outline monitoring and evaluation options. An important part of an impact assessment is consulting stakeholders and external experts since the involvement of the private sector yields a better understanding of problem areas and the feasibility of a policy proposal.

According to a study by Technopolis France and European Policy Evaluation Consortium (2005), evaluations have an impact on policy design and intervention, and on reallocations of resources within given policy schemes. Nevertheless, this study also revealed that the allocation
of resources is influenced by political rather than efficiency motives. An analysis of the evaluation practices of government aid to small- and medium-sized enterprises reveals wide variation in the degree to which EU member states evaluate their assistance to this sector: one-sixth evaluate all government aid to small- and medium-sized enterprises and another one-sixth do not evaluate any government aid to them. The other two-thirds of member states evaluate some government assistance programs to the sector.

The Technopolis France and European Policy Evaluation Consortium study also found that the scope, focus and methods of evaluation differ substantially across the EU. For example, industrial policy evaluation in the Netherlands focuses on assessing the extent to which it responds to its objectives. In Slovakia, government aid is evaluated using input–output analysis that compares the characteristics of aid recipients with non-aid recipients.

A more recent review of innovation activity evaluation practices for 2007–12, conducted by the Technopolis Group and the Manchester Institute of Innovation Research (2012), concluded that some member states focus more on qualitative methods of evaluation and others more on quantitative methods. Furthermore, the policy impact on the wider community is less frequently analyzed than the impact on project participants.

### 3.4.4 United States: Noticeably Decentralized Evaluation Programs

The evaluation of federal programs is given considerable attention in the US. This focus was sharpened in the 1990s with the Clinton administration’s enactment of a number of policies as part of its new public management approach to governance. The key piece of legislation during this period was the Government Performance and Results Act of 1993, under which federal agencies were required to develop five-year plans and formulate annual performance indicators (see Chapter 9).

In 2002, the George W. Bush administration implemented its Program Assessment Rating Tool to streamline what it regarded as unnecessarily diverse and uneven methods for setting program targets and evaluating program efficacy. Under the Obama administration, efforts have been made to further improve performance indicators through the appointment of a chief performance officer, who works with the Office of Management and Budget to implement reforms, including the Accountable Government

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3 For an overview and discussion, see Brass (2004).
Initiative, a series of measures to evaluate programs and reduce wasteful spending. 4

Federal programs rely heavily on expert evaluations, both at the level of project selection and development, and in the evaluation of outcomes. More broadly, multiple layers of monitoring and evaluation tools and different constituencies within the government can determine funding allocations and programmatic priorities. Although there are centralized aspects to budgetary allocations and evaluation processes, much of the system remains decentralized.

The Office of Management and Budget is one of the key agencies involved in monitoring and evaluation activities, serving the executive branch in preparing budget proposals, assessing legislative proposals and their implementation, and monitoring and coordinating programs. The Government Accountability Office, known as the investigative arm of Congress, is charged with auditing programs and assessing the use of taxpayer funds. 5 Congressional committees and subcommittees are charged with various monitoring and evaluation functions and can call upon advisory bodies to conduct research into specific questions. In addition, legislation often includes mandatory external reviews of programs. Individual agencies employ performance monitoring and evaluation metrics, auditing and investigation tools. In sum, programmatic efforts are subject to a range and multiple layers of evaluator scrutiny. Each layer of oversight—from internal agency evaluators to congressional and executive branch actors—has varying degrees of inputs and potential sanctioning power in shaping future programs and budgetary allocations.

Recent efforts have been made to bring a greater degree of scientific standards to program planning and evaluation, particularly in developing R&D policies. A key agency in this respect is the National Science Foundation, which has funded a series of studies investigating programmatic monitoring and evaluation metrics, standards and approaches.

Overall, the government’s evaluation programs are strikingly decentralized owing to the large and diverse sets of programmatic elements and the structure of the federal government. This should not be taken to suggest that the government does not rigorously evaluate its programs. Agencies generally do not control their own overall budgetary allocations; hence, they have incentives to maintain high-performance programs. At the top levels of government, executive and congressional decision makers are generally not deeply involved in micromanaging programs, but they

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4 See Government of the United States of America (2010).
5 For the government’s most recent statement on designing program evaluations, see United States Government Accountability Office (2012).
do have oversight authority and are typically willing to use it in the event of demonstrable program failures or shortcomings. In worst-case scenarios, these multiple layers of oversight can lead to overevaluation at the expense of program implementation efforts, partisan political pressure or even program closures. Generally, this diffuse system allows programs a degree of flexibility in their design and implementation, while providing incentives to design appropriate monitoring and evaluation systems with rigorous standards that can withstand the scrutiny of debates over budgetary allocations and programmatic priorities.

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4. Capability building and industrial diversification

Keun Lee

4.1 INTRODUCTION

Structural change, the transformation of a country’s productive structure, has historically been a slow process. This process is what ultimately development is about. For this reason, countries need to nurture it using a variety of policies to deal with the different dimensions of development. Particularly important in this respect is the accumulation of capabilities. These differ across economies depending on whether they need knowledge in simple operational and production areas or have to assimilate advanced technologies.

This chapter argues that latecomer countries should implement capability-based industrial policies as they develop and recommends strategies to build capabilities at the various stages of economic development. In particular, developing countries must enhance their capabilities to produce and sell products in international markets to earn foreign currency to pay for imports of investment goods. The challenge is how to increase capabilities, an area of increasing interest in the development and academic communities. A World Bank (2005) assessment of reforms many developing countries undertook in the 1990s notes that economic growth entails more than just the efficient use of resources. It argues that specific actions (policies) to enhance technological catch-up or to encourage risk-taking for faster accumulation of capabilities may be needed.1

Lee and Mathews (2010) synthesize the capability-based model for economic catch-up as the Beijing–Seoul–Tokyo consensus, or BeST as they call it, and capability building is the focus of their firm-level study (Lee and Mathews 2012). The issue is also examined in a country study on the Republic of Korea (Lee 2012).

The question of how to develop a country’s technological capabilities is

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1 See also World Bank (2006).
highly relevant to the discussion of the middle-income trap. This is defined in this analysis as a situation in which a middle-income country loses its cost-based competitiveness as a consequence of rising wages, although the sophistication of its products does not warrant higher wages (Yusuf and Nabeshima 2009; World Bank 2010). Numerous developing countries have achieved growth for a certain period (usually less than a decade), but have been unable to sustain it (Hausmann et al. 2005; Jones and Olken 2005). Rodrik (2006) stresses the importance of sustaining rather than simply initiating growth. Brazil and Argentina, where growth stalled during the 1980s and the 1990s, provide examples (Lee and Kim 2009; Paus 2011).

Several economies have made the leap from middle-income status to join the group of high-income economies, including the Republic of Korea and Taipei, China, where per capita incomes increased threefold from the 1980s to the 1990s from original levels similar to those of Latin American countries in the early 1980s (Lee 2013).

The chapter examines the need to build capabilities as part of an industrial policy in middle-income countries, with a focus on experiences in those two economies. It argues that the goal of industrial policy for middle-income countries is to promote technology rather than traditional, trade-based specialization, which may be more relevant to low-income countries. Justin Lin’s (2012a, 2012b) concept of New Structural Economics recommends that latecomer countries follow their comparative advantage and target mature industries from countries that are slightly ahead, and that they target industries in which they have latent comparative advantage.²

4.2 ADAPTING POLICY TOOLS THROUGH STAGES OF DEVELOPMENT

Economic development, as noted earlier, takes time and is intrinsically different across countries. Despite this rather obvious feature, the literature has not paid sufficient attention to the need for different policy tools for countries at different stages of development. In the recent debate on the relative importance of policies, institutions and geography for economic development, most studies have searched for a single universal determinant of economic growth, regardless of the stage of development.

² These are industries that have low wage costs but transaction costs are too high to be competitive. These industries can become competitive with government assistance to reduce transaction costs.
However, Rodrik (2006) and Hausmann et al. (2008), among others, have forcefully argued the importance of identifying a country’s binding constraints to growth.

An ideal compromise may come in the form of stage- or group-specific factors for economic growth that are neither universal nor country specific. This view is consistent with Lin’s *New Structural Economics* (2012b). Consistent with this, Lee and Kim (2009) find that technological development and higher education are more effective in generating growth in upper middle- and high-income countries, whereas secondary education and political institutions seem to be more important for low-income countries.

If this logic is extended to a country’s industrial policy, then the toolbox of that policy should also depend on its stage of development. Traditional industrial policy tools come in the form of infant industry protection through tariffs or undervalued local currencies. But if industrial development expands over 10 to 20 years, it is natural that policy tools change. This dynamic view of industrial policy is warranted because the capability level of the beneficiaries of the policy interventions will change as well.

Consider industrial policy in the Republic of Korea. Shin and Lee (2012) report that tariffs and other forms of protection contributed to the expansion of exports and output during the 1970s and 1980s, whereas investment in research and development (R&D), stimulated by tax exemptions, was key from the mid-1980s to 2005, as shown in Jung and Lee (2010). The first study found that the disciplinary impact of export orientation during the 1970s and 1980s allowed the country to use the rents associated with the imposition of tariffs for fixed investments. The second study found that an oligopolistic market structure motivated R&D investments in the mid-1980s to 2005. This suggests that the form of government activism in the Republic of Korea evolved from a ‘traditional industrial policy’ (that is, a trade policy) toward a ‘technology policy’, such a dynamic shift in policy tools was not simply imposed by the government, but reflected the available and desired level of firm capabilities.

Although the Republic of Korea grew fast on a strategy that relied on exports of labor-intensive and low-end goods, the effectiveness of this strategy reached its peak by the mid-1980s. At that time, the country was experiencing an increase in wage rates that coincided with the emergence of lower-wage countries competing against it in world markets. Firms were aware of the need to upgrade to higher value-added goods and, for the first time, established in-house R&D centers, which the government facilitated through tax exemptions for R&D (Lee 2012; Lee and Kim 2010). Another important new type of state activism came in the form of
a policy of directly targeting the learning process of firms by involving them in public–private R&D consortia. A significant example of this is the local import-substituting development of telephone switches in the 1980s (Lee et al. 2012b).

This shift in government activism—from traditional industrial policy (tariffs and an undervalued currency) in the early stages of development to technology policies promoting R&D, public–private research, and development consortia later—is also required of other developing countries that want to evolve from low- to middle-income and progress to higher-income status. Without it, developing countries will reach the middle-income level, but struggle to remain competitive as a site for low-cost, high-volume production (World Bank 2010; Yusuf and Nabeshima 2009). The Republic of Korea achieved middle-income status in the mid-1980s, with a per capita gross domestic product of $5814 (in constant dollars of 2005). Its current per capita income is about $22,000.

4.3 SHIFTING TO A MORE ADVANCED FORM OF INDUSTRIAL STRUCTURE

Moving from an industrial structure dominated by low value-added activities to one with a large component of higher-valued-added activities does not occur automatically, even if a country is open to trade and foreign direct investment. Achieving such a shift involves deliberate learning and risk-taking by firms and other public actors, which increase the chance for capitalizing on ‘windows of opportunity’ (Perez and Soete 1988), such as the rise of new technologies and markets.

For example, it would have taken Taipei, China longer to achieve its higher value-added industrial structure without active public–private R&D cooperation, the first successful example of which was a consortium to develop laptops (Mathews 2002). Public–private joint ventures offer no guarantee of success in entry into the higher-end segment of any industry, but they may be the only possible way to shift from specializing in traditional, low value-added-based sectors, as the Republic of Korea and Taipei, China show.

The public–private R&D consortium that developed digital telephone switches in the Republic of Korea marked the beginning of the country’s emergence as a leader in telecommunications and information technology devices. That success also provided learning and confidence that led to further public–private cooperation in the production of memory chips, mobile phones and digital televisions. By entering new industries with this form of collaboration, the Republic of Korea gradually reduced its
Development and modern industrial policy in practice

reliance on low value-added industries such as apparel, textiles, cookers and refrigerators.

4.4 THE THREE STAGES OF ACCESS AND LEARNING FOR ENTERING HIGH-VALUE SECTORS

For developing countries catching up, entering and specializing in higher value-added sectors is essentially a three-stage process. The first stage is the assimilation of foreign technology and know-how. In the second, learning and access come from codevelopment contracts and public–private consortiums once latecomer firms establish their own in-house R&D centers for indigenous learning. The third and most ambitious stage is ‘leapfrogging’ to emerging technologies.

4.4.1 Assimilating Foreign Technology and Know-How

Since the publication of an influential article by Cohen and Levinthal (1990), absorptive capacity has come to be recognized as one of the major binding constraints for the economic development of latecomer countries. In the case of the Republic of Korea, scholars have emphasized the importance of increasing absorptive capacity that enables companies to learn and assimilate the inflow of external knowledge (Kim and Dahlman 1992; Pack 1993; Evenson and Westphal 1995). Efforts to build up such capacity should focus not only on enhancing the level of generic human capital, but also on providing learning opportunities for workers in private firms. The experience of the Republic of Korea validates this point. In the 1960s, when the country began to modernize through an export drive, its human capital base was poor: the enrollment rate in 1965 in primary schools was 29.6%, 10.9% in secondary schools and 2.6% at the tertiary level. Thus, the main emphasis was on increasing the level of human capital, and by the mid-1970s there was considerable improvement. In 1975, primary school enrollment rose to 106.86 percent, secondary enrollment to 56.35% and the tertiary level to 6.90% (World Bank 2005).

Imports of technology and the provision of the training needed to operate equipment and facilities also enhanced the country’s absorptive capacity. Especially during the 1960s and 1970s, firms acquired the know-how to construct and operate manufacturing facilities (Chung and Lee

3 This section draws on Lee (2013: ch. 7).
The typical knowledge bundle consisted of technological contents in printed form as well as related training and services provided on site by foreign engineers. Local engineers were occasionally sent to the transferring firm to learn implementation processes. According to Chung and Lee, the technology, including patent rights, came later, when Koreans could better decipher the codified contents of patents.

Using firm-level data on know-how licensing, the authors show that firms went through a lengthy period of learning, assimilating and adapting foreign technology in the 1970s before beginning to conduct in-house R&D in the mid-1980s. Foreign technology flowed into the country in three main forms: licensing contracts of know-how, patented know-how and licensing of patented technology.4 LG, for example, contracted know-how licensing in 1969, the year it was founded, followed by know-how plus patents and then patent-only licensing. LG’s first investment in R&D was in 1976 and its first patent applications were filed two years later. This was the typical sequence firms followed at that time, though there were variations.

4.4.2 Codevelopment, Home-Grown Research and Development

Setting up local public research institutes that can conduct R&D and problem-focused development, and then transfer outcomes to the private sector, is essential to the process of enhancing absorptive capacity. In the Republic of Korea in the late 1960s, the government recognized the need for advanced training for scientists and engineers to prepare for the development of indigenous technologies. In 1972, the government established a new graduate school of engineering and applied sciences, the Korea Advanced Institute of Science (later renamed the Korea Advanced Institute of Science and Technology). Adequately funded, this institution has provided high-quality education since its establishment.

Establishing joint ventures with foreign partners or an assembly arrangement with a foreign original equipment manufacturer is also an effective channel for learning basic operational skills and production technologies (Hobday 2005). Attracting foreign direct investment is one of the best strategies to guarantee learning and access to knowledge.

However, it may not be reliable for longer-term purposes and certain conditions must be met, including local control and content requirements. Amsden and Chu (2003) state that technological catch-up requires

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4 Chung and Lee (2011) present selected cases of the leading firms in the dates and sequence involving the phases of foreign technology acquisition, in-house R&D and own-patent applications.
the use of assets related to project execution, product engineering and a form of R&D that straddles applied research and exploratory development. If such assets are accumulated at all, this tends to be done by local firms. By their very nature, foreign firms have no reason or incentive to develop their own capabilities in host countries as these are already present in the mother company abroad. Thus, ownership matters in R&D and foreign direct investment may not be effective as a mechanism for learning higher-tier capabilities. In their early days, many chaebols in the Republic of Korea had foreign direct investment or established original-equipment manufacturer relationships with foreign multinational corporations. According to Lee and He (2009), Samsung was originally a joint venture with Japanese firm Sanyo, which enabled Samsung, with no prior experience in the electronics industry, to acquire know-how and technologies. Hyundai Motors was once in an original-equipment-manufacturer arrangement with Ford, although it did not last long. Taipei, China’s path to own-brand manufacturing via own-design manufacturing also involved a great deal of interaction with foreign firms.

Once rising latecomer firms have built a certain level of absorptive capacity, they must establish their own R&D centers. This is because foreign firms are generally reluctant to grant technology licenses to rising latecomer firms, especially when they attempt to enter the skill-intensive markets that advanced countries dominate. Investment in R&D is therefore required not only for the further absorption of advanced technology, but also for developing the technological capabilities of latecomer firms. Developing in-house R&D capabilities is critical because initial success leads to an increase in wage rates, resulting in loss of competitiveness compared with other economies offering cheaper costs or wages (Lee and Mathews 2012).

Once firms have established in-house R&D centers, they then need to explore more diverse channels of learning and access to foreign knowledge from licensing. The alternatives include codevelopment contracts with foreign R&D specialist firms and with public R&D institutes, mastering the literature, setting up overseas R&D outposts, and initiating international mergers and acquisitions. It was from the early 1990s that a small number of firms in the Republic of Korea established overseas R&D outposts to obtain easier and faster access to foreign technology that was difficult to acquire through licensing. These outposts also tracked trends on technological development (OECD 1996).

Gaining access to foreign knowledge and trying new modes of learning is critical, because isolated in-house R&D efforts are often insufficient to build indigenous capabilities in these areas. At this stage, there are two important modes of new learning: codevelopment contracts with foreign
or external R&D specialist agencies or firms, and participation in public–private R&D consortia. In both cases, the best targets are those industries or technologies that are relatively mature, but which the latecomer economies are importing or buying at monopoly prices from foreign companies. In this situation, import-substitution targeting involves taking rents away from foreign companies and giving them to local firms. Under this process, local firms face fewer uncertainties and risks, because the targeted technologies are often mature ones that R&D consortia can emulate. One factor that could hinder targeting is the uncertainty inherent in choosing the right industries and technologies, as it is difficult to tell which will prosper in a particular country. This concern makes particular sense in the context of developed countries where firms at the forefront of technologies face greater uncertainties. For latecomers below the frontier, a ready justification for targeting industries exists.

Hyundai is a good example of the first mode (codevelopment). The group’s main business used to be construction, a long-cycle technology-based sector. Hyundai entered the shorter-cycle business of automobiles in the early 1970s as an assembler for Ford. Such a mode of entry is common in developing countries. However, Hyundai’s and the Republic of Korea’s status as a stronghold of the automobile business would not have been possible without the company’s brave decision to cut ties with Ford and to sell its own brand of automobiles. Hyundai then formed a joint venture with Mitsubishi, under which the Japanese carmaker provided engines and other components and Hyundai assembled the vehicles as a licensed producer. However, when Hyundai wanted to develop its own engines, Mitsubishi, which held 20% of the equity in the joint venture, refused to teach its partner how to design and produce its own engines. Many companies in developing countries in a similar situation would probably have given up at that point. But Hyundai’s founding chairman Chung Ju-yung instead invested heavily in R&D to develop locally made engines. For details on the history of Hyundai, see Lee and Lim (2001). Fortunately, Hyundai was able to gain access to external specialized R&D knowledge, such as from engineering firm Ricardo in the United Kingdom in the early 1980s. The process was not easy, with the two companies trying out more than 1000 engine prototypes until they came up with a successful design and a prototype in the late 1980s (Lee and Lim 2001).

The second mode, participation in a public–private R&D consortium, can also be an effective school for private firms when their capability is low. For this reason, private firms generally cannot take the lead in these consortia, in which public research agencies teach and transfer R&D

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5 For details on the history of Hyundai, see Lee and Lim (2001).
outcomes to participating private firms. There are many examples of this process from the Republic of Korea and Taipei, China.

Government-led R&D consortia in the telecommunications equipment industry, particularly the development of telephone switches, are notable examples of the second mode. This led to the successful localization of telephone switches in the 1980s and 1990s in several latecomer countries, including Brazil, the People’s Republic of China (PRC), India and the Republic of Korea (Lee et al. 2012b). Most developing countries had serious telephone service bottlenecks in the 1970s and 1980s and had neither their own telecommunications manufacturing equipment industry nor their own R&D programs. As a result, they relied on imports of expensive equipment and related technologies, with local technicians merely installing foreign switching systems into domestic telephone networks. But with industrial and commercial bases developing rapidly, along with population growth, a number of developing countries decided to build their own manufacturing capabilities.

Brazil started in the 1970s, followed by the Republic of Korea and India in the mid-1980s, and the PRC in the late 1980s. All these countries launched state-led systems of innovation in the telecommunications equipment industry, with government research institutes at the core to develop ‘indigenous’ digital telephone switches that were then licensed to public and private domestic enterprises. In all these countries, a common pattern in the development of local digital switches was the tripartite R&D consortium comprising government research institutes in charge of R&D functions, state-owned enterprises or a ministry in charge of financing and coordination, and private companies in charge of manufacturing. However, privatizations and market liberalization in Brazil and India and infant industry protection in the PRC and the Republic of Korea led to different trajectories (Lee et al. 2012b). In the PRC and the Republic of Korea, local manufacturers took over from the importers and multinational corporations. Their enhanced capabilities in wired telecommunications, accumulated over the preceding decades, also led to the growth of indigenous capabilities in wireless telecommunications. In contrast, Brazil and India have increasingly become net importers of telecommunications equipment and affiliates of multinational corporations now dominate their industries.

As Lee and Mathews (2012) note, Taipei, China’s production of laptops is an example of an acquisition of a fundamental design capability or basic design platform made possible with the help of a government entity; in this case, the Industrial Technology Research Institute. A public–private R&D consortium launched the laptop industry in the early 1990s (Mathews 2002) by developing a common mechanical architecture for a
prototype that could easily be transformed into a series of mass-produced standardized components. This was an industry watershed, albeit after several failed attempts, and succeeded in establishing new ‘fast follower’ industries.

4.4.3 Leapfrogging to Emerging Technologies

The final stage for building capabilities is leapfrogging to emerging technologies. Here, latecomer countries do not aim to imitate existing products or plants, but explore ways to develop products in newly emerging technologies. An example from the Republic of Korea is digital television development (Lee et al. 2005), a decisive and final watershed that enabled the country to begin overtaking Japan in the television manufacturing business.

An example of leapfrogging from the PRC is its recent move toward electric-engine cars and the use of solar power. In both these areas, there are no products to imitate from the latecomers’ point of view; here, advanced and latecomer countries enter the market at the same time. A strong momentum for latecomer countries to go beyond the middle-income group and join the rich-country club is if they succeed first in this endeavor. In leapfrogging, public–private R&D consortiums take a more vital role given that the risk is considerable. Furthermore, coordinated initiatives for exclusive standards and incentives for early adopters are important for reducing the risk of a weak initial market.

Although the second and third stages involve public–private R&D consortiums, there is a marked difference between the two. In the third stage, private firms take the lead over public laboratories in conducting R&D jointly, whereas in the second stage, public research laboratories are mainly in charge of R&D with private actors doing the manufacturing. Thus, in the final stage of an R&D consortium, the role of public research arms is to monitor the trend of technologies and provide information about the choice of proper technology standards and the identification of suitable foreign partners in collaborative development. Examples of public–private consortiums in the Republic of Korea with foreign partners include wireless technology firm Qualcomm for mobile phone development and Zenith for digital television development (Lee and Lim 2001; Lee et al. 2005).

In the second stage, the foreign company is the direct teacher in a codevelopment contract. In the final stage, however, it becomes the supplier of source technology to be commercialized by the latecomer firm or its consortium. In terms of relationships with foreign actors, the final stage features horizontal collaborations or alliances based on complementary
assets. Some firms (such as Samsung) have reached this stage and are now engaged in diverse alliances with Intel, Sony, Toshiba and Microsoft.

In light of the above, the probability of the success of leapfrogging may be higher when a new techno-economic paradigm or a new generation of technologies emerges. Perez and Soete (1988) and Freeman and Soete (1997) observe that some latecomers have been able to leapfrog older versions of technology, bypass heavy investments in previous technology systems and adopt new technologies to take over the market from incumbent firms or countries. This leapfrogging strategy makes more sense at the time of a paradigm shift because every country or firm is a beginner in using a new techno-economic paradigm and the barriers to entry tend to be low. Furthermore, the so-called winner’s trap may come into play in the sense that incumbent firms of countries tend to ignore new technologies and continue using the existing dominant technologies until they exhaust their investment in an existing facility. The concept of leapfrogging is consistent with the idea of technological discontinuity, proposed by Anderson and Tushman (1990) and Tushman and Anderson (1986), according to which competence-destroying discontinuity may lead to the emergence of new entrants.

The Republic of Korea’s catch-up with Japan in the development of high-definition televisions would not have been successful if Korean electronics firms did not target the emerging digital technology-based products more aggressively than the Japanese firms that opted to continue manufacturing the dominant analogue products. Japanese firms developed analogue-based, high-definition televisions in the late 1980s and suggested that Korean firms follow the new technologies and products by learning from them. Initially, they considered going in that direction, as they had in the 1970s and 1980s. But instead they opted for a leapfrogging strategy by developing an alternative and emerging technology (digital-technology-based, high-definition televisions). These companies succeeded by forming a public–private R&D consortium, which marked the beginning of the Republic of Korea’s hegemony in the global display market previously dominated by Japan. Without such risk-taking and leapfrogging strategies, the catch-up with Japan would have taken much longer or might have never happened.

Leapfrogging is more likely to happen when there are more frequent changes in technologies or generation changes in products, and when there are certain technological sectors with such features. Lee (2013) argues that

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these are closely linked with the length of the cycle time of technologies as they indicate the speed at which technologies change or become obsolete, thus paving the way for the continued emergence of new technologies. It can therefore be reasoned that it is advantageous for qualified latecomers to target and specialize in such sectors. Although this may be risky, it is nevertheless logical because latecomers do not have to rely on existing technologies dominated by incumbents. Moreover, there are always more growth opportunities associated with emerging technologies.

A word is needed on the importance of carefully handling the risks in opting for a leapfrogging strategy. Lee et al. (2005) point out that one of the biggest risks is choosing the right technologies or standards in the ex-post sense. In the competition for standard setting and market creation, the role of government is to facilitate the adoption of specific standards, thereby influencing the formation of markets at the right time. In general, when the target is in the area of information or another emerging technology, the critical function of standard setting should be emphasized. Aiming to achieve isolated development without consideration for standards might lead to the failure of the entire project. In standard setting, collaboration and partnerships with rivals or suppliers of complementary products are essential. Another key factor is determining who creates and reaches the market first, given that market size determines the success or failure of one standard in relation to another.

4.5 INTRA- AND INTER-SECTORAL DIVERSIFICATION

The experiences of successful catching-up economies such as the Republic of Korea and Taipei, China suggest that if industrial policy is successful, it should be able to achieve both intra- and inter-sectoral upgrading and diversification. A study by Lee and Mathews (2012) of successful catching-up economies shows that upgrading in the same industry and successive entries (another kind of upgrading) into new, promising industries happened over the course of their industrial development. The authors argue that unless these two kinds of upgrading are pursued, the chances for successful catch-up are slim.

But two issues are at play here: one from the perspective of the latecomer country and the other from the front-runner country or incumbent firm. From the latecomer’s perspective, success with a strategy of original equipment manufacturing tends to push up local wage rates, a problem as cheaper labor sites in next-tier countries are always emerging. This forces firms to move to higher value-added activities in the same industries,
which can better withstand higher wage rates (and beyond the current capabilities of the next-tier countries). Unless this happens, countries are more likely to fall into a middle-income trap.

Front-runner countries tend to generate new industries that correspond to higher value-added, and these countries look to latecomer countries to host outsourcing activities in new industries. With the rise of new products and new industries, old industries degrade into lower value-added activities, forcing firms to enter emerging high value-added industries. Firms must undergo this renewal or be overtaken by followers.

Suárez and Utterback (1995) note that the need for these two types of upgrading and diversification stems partly from the international industrial life cycle in which the developed world tends to create new industries, and partly because latecomer countries and firms tend to inherit these industries after they become mature and their products become standardized. Given this life cycle, an important feature of successful catch-up is to be able to enter at an earlier, higher value-added stage of a cycle, which is only possible with enhanced absorption or technological capabilities. Otherwise, firms are doomed to be stuck in lower-wage activities or industries. This is why building technological capabilities is critical for the success of industrial policy in shaping a diversified and dynamic industrial structure. Only then can a typical middle-income economy break out of the low-competence trap and become a major player in the industrial arena. This is the challenge companies face in late-industrializing countries such as Brazil, the PRC and India.

Intra- and inter-sectoral upgrading and diversification are linked in the sense that inter-sectoral entries and diversification are possible only after latecomer firms acquire design capabilities (possibly from reverse engineering) for upgrading in a given industry. That is, to overcome the dilemmas and potential dead ends of a growth model based on original equipment manufacturing, latecomer firms should first acquire design capabilities to tap into emerging industries. Latecomers cannot stay long in a given industry because old industries are themselves changing, driven by the more profitable initiatives of forerunners.

4.5.1 Intra-Sector Upgrading and Diversification

Examples of upgrading in the same industries are numerous in East Asia. For example, semiconductor firms in the Republic of Korea and Taipei, China started from integrated circuit packaging and testing, both low-value-added activities, to fabrication and eventually design, the highest level of valued added (Mathews 2006).

The same sort of upgrading is now emerging in the PRC, as in the case
of the electronics firm Konka, which started out in 1979 as a producer of cassette players in Shenzhen. At that time, the company was one of the first high-tech firms established in the country’s south as a result of the opening-up policy. Although controlled by a state-owned enterprise, Konka is essentially a private firm, listed on the Shenzhen Stock Exchange in 1992. Like its counterparts in the Republic of Korea and Taipei, China, Konka began its quest for technology as a contractor for original equipment manufacturing to advanced firms, but profits were volatile. In 1987, Konka began to produce branded products for the domestic market and to compete with imported brands, signalling a move to become an original brand manufacturer (Xie and Wu 2003; Mathews 2008). Ten years into this new strategy, Konka set up an R&D facility in Silicon Valley to develop digital televisions, producing the first such sets in the PRC. A year later, Konka began mass producing high-definition digital televisions.

Konka replicated many of the features observed in the Republic of Korea and Taipei, China, particularly in leveraging technologies by the use of outsourcing contracts to enable firms to upgrade their capabilities from original equipment manufacturing to original design manufacturing and then to original brand manufacturing (Hobday 2000; Lee 2005). This is necessary because front-running vendor firms tend to move their orders for original equipment manufacturing to cheaper wage sites, and thus late-comers need higher value-added orders.

4.5.2 Inter-Sectoral Upgrading and Diversification

The Republic of Korea and Taipei, China offer many examples of inter-sectoral diversification as a result of successive entries into higher value-added industries. Consumer electronics manufacturer Tatung has done this since the 1960s, starting with black-and-white televisions and, over the following decades, moving into video cassette recorders, desktop computers, hard-disk drives, and workstation clones (Khan 2002). Samsung is well-known for making successive entries into new industries since starting out in light manufacturing in the 1960s and moving into consumer electronics in the following decade (Chang 2003).

In the process of successive entries into new sectors in the Republic of Korea, the state played an important role in providing institutional support, including through joint R&D consortiums, technology transfer arrangements, and tax and credit concessions for newer industries. Lee’s (2013) study on the country’s patent portfolio shows that the process of successive diversification was accompanied by the filing of more patents in shorter-cycle technologies and doing so in a step-by-step manner. For instance, the leading sectors with more patent files have moved from the
long-cycle technology of apparel (with a normalized average cycle time of 1.18) in the 1960s and 1970s to the medium cycle of steel and automobiles (0.89) in the 1970s, desktop computers (0.84) in the 1980s, and to the short-cycle technologies of memory chips (0.79) and mobile telecommunications (0.74) in the 1990s.\(^7\)

In the process of inter-sectoral diversification or entries, one of the longest distance jumps in the Republic of Korea was the entry into steel in the early 1970s, without which the country’s subsequent venture into other steel-consuming industries, such as automobiles and ships, would have been more difficult or even impossible. Had that not happened, it would have been harder for the country to move up the value chain beyond being a producer of light industry goods. Steel is worth looking at in some detail because the rise of the Pohang Steel Corporation (POSCO), the country’s first integrated steel producer, from a highly protected state-owned enterprise to eventual privatization provides insights for developing countries striving to build up capabilities, particularly in acquiring skills and technology.

### 4.6 CATCH-UP IN THE STEEL INDUSTRY: THE POSCO STORY\(^8\)

During the reconstruction period after the Korean War, rising domestic demand for steel products led to the need for the construction of an integrated steelwork. At that time, most local steelmakers used scrap iron rather than pig iron as the raw material for steel making.\(^9\) With scrap metal running out, the need for a stable supply of pig iron increased. Furthermore, steel firms were small and specialized in only one segment of the process of steel production, an inefficient separation that underlined the advantage of having an integrated steel mill.

In the absence of private investors able to take on a capital-intensive integrated steel project, government intervention was inevitable. However, six attempts to build an integrated steel mill between 1958 and 1968 foundered, mainly because of financial problems. Both the World Bank and the United States Agency for International Development opposed the government’s plan to build an integrated steel plant on concerns over

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\(^7\) Numbers in parentheses denote normalized time: a figure below 1 indicates shorter-than-average cycle times and above 1 longer-than-average cycle times. See Lee (2013: ch. 4) for details.

\(^8\) This section draws from Lee et al. (2012a) and Song (2002: 123–54).

\(^9\) For a detailed history of the Korean steel industry, see Korea Iron & Steel Association (2005: 100–102).
the country’s ability to repay foreign loans. They also questioned the very need for a large-capacity steel mill in a small developing economy (D’Costa 1999: 64; Song 2002: 57), and suggested that the country first develop steel-consuming industries, such as machinery, automobile and shipbuilding. The government rejected this, insisting that steel-consuming industries were not a prerequisite for the successful development of a steel industry, which should grow first for the effective development of steel-consuming sectors. Former president Park Chung-hee took the initiative and prioritized the steel project in the Second Five-Year Economic Development Plan, 1967–1971.

Pohang Iron and Steel Company, later renamed POSCO, was created in 1968, with the government holding 56.2% of the firm’s shares and state-run Korea Tungsten the rest. Two years later, POSCO began construction on the first phase of the country’s first integrated steelworks in the city of Pohang. The financing problem was overcome by ‘ingenious’ methods (D’Costa 1999: 63–4). Through agreements with Japan, the government allocated part of war reparation funds to the Pohang project. Government intervention and assistance also enabled POSCO to access domestic and foreign funding sources, accounting for about 66% of the cost of the project. The main domestic funding sources were state-run and private bank loans with very low interest rates (negative real rates). To mobilize resources from abroad, the government negotiated with foreign lenders on behalf of its national producer and guaranteed loans to POSCO.

Construction began in 1970. This was uncharted territory for the country and even experienced workers in the steel industry did not have the knowledge and skills for building an integrated steel plant. So POSCO had to access the knowledge externally to build the plant and acquire the skills to run it. Overseas training was the primary source, taking two forms: field observation training for 15–30 days and on-the-job training for 2–6 months (Song 2002: 128). In 1968 and 1969, the company dispatched 39 trainees to Japan, and between 1968 and 1983 some 1861 POSCO workers were trained overseas. After returning, they trained other workers and saved the training materials they received abroad in a database. In its early stage, POSCO focused on building technological capabilities for plant operation, maintenance and repair.

The overseas companies to which POSCO’s trainees were dispatched also changed over time. In the early stages, Japanese steel firms agreed to transfer their technology and provide training to POSCO, then still a small company. However, they were surprised at POSCO’s early success in the world export market for steel and soon became averse to transferring technology to a firm that they increasingly regarded as a competitor. In the later stages of its development, POSCO turned to western countries,
including the United States and the former West Germany, for equipment and training.

So POSCO’s oversees trainees aggressively obtained knowledge, including through informal channels. In Japan, they forged close personal ties with local engineers through activities outside of working hours, pumping them with technical questions and requests to see plant blueprints. When equipment broke down during their training, they sketched all the tools used for repair. Retired Japanese experts in the steel industry were hired as consultants and became an important source of knowledge. Equipped with a wealth of field experience, they taught POSCO’s engineers plant operation skills and the contract period of one to two years was long enough for the transfer of the needed technical knowledge.

With these tactics, POSCO quickly built sufficient capabilities for plant operation and the skills of its workers improved significantly. The learning cycle of the plant’s first blast furnace reached the standard tapping ratio 107 days after its commencement, much earlier than the target of 120 days—and the 29 days of the fourth blast furnace topped the previous world record of 31 days. The firm’s basic oxygen furnace operation had increasingly shorter learning cycles, as did the cycle of the hot strip mill operation (Song 2002: 148; Ki 2010).

In the very early days, POSCO’s technological capability building was limited to skills for plant construction, operation and maintenance. From the mid-1980s, as POSCO became increasingly competitive in the global export market, access to foreign knowledge became more difficult. To address this, POSCO established its own R&D system comprising industry, POSCO itself, Pohang University of Science and Technology and the Research Institute of Industrial Science and Technology. The company’s stage-skipping catch-up was facilitated by POSCO’s in-house R&D system as it adopted up-to-date technologies in the construction of a second steel plant. The building of POSCO’s technological capabilities was a path-following catch-up at the initial stage and a stage-skipping catch-up at the later stage, according to the classification of the three types of catch-up proposed by Lee and Lim (2001).

To provide a conducive environment for the country’s fledgling steel industry, the government passed the Steel Industry Promotion Law on 1 January 1970, three months before the construction of the first phase of the plant started. This law demonstrated former president Park’s determination to strengthen policy instruments to develop a domestic steel industry. The law, which was in effect for 30 years before it was scrapped in 1986 (D’Costa 1999: 65), empowered the government to grant POSCO financial and administrative support to: (1) access long-term and low-cost foreign capital; (2) purchase equipment and raw materials; (3) construct
port facilities, water and electricity systems, roads and railroads; and (4) research and technical training. The law allowed POSCO to pay reduced prices on electricity, gas and water, and qualify for discounts for rail transport and port dues (D’Costa 1999: 65; Korea Iron & Steel Association 2005: 132–3). It was also exempted from corporate tax and received an 80% tariff cut on the import of equipment (Nam 1979, 78).10

Practically from the outset, POSCO received a big boost through a substantial change in the government’s economic growth policy. The Park administration’s Heavy and Chemical Industrialization Program (1973–79) was designed to shift the economy from low value-added light industry to a focus on steel, petrochemicals, automobiles, machine tools, shipbuilding and electronics (D’Costa 1999: 65). The Heavy and Chemical Industry Promotion Council and its planning office were set up to implement the program,11 with the latter serving as a bridge connecting the administration to industry.

These initiatives accelerated POSCO’s growth in two ways. First, the government strengthened its support for the steel industry through low-interest financing and tax cuts. Second, and more importantly, the drive to develop heavy industry and chemicals made the government realize the necessity for expanding the Pohang plant, which was done four times from 1973 to 1983, and building a second steel plant. This began in 1985 amid a thriving heavy industry sector (Song 2002: 99, 159–60).

From the 1980s the government gradually decreased support for the steel industry as POSCO grew and became more competitive. In 1981, it lifted POSCO’s tax-exempt status (Song 2002: 193–4). In 1986, it replaced the Steel Industry Promotion Law with the Industrial Development Law, which encouraged market mechanisms and competition among firms, thus replacing the former emphasis on direct intervention and government regulation (Choi 1991).12 It also shifted the government’s industrial policy from directly nurturing target industries to universal functional support, indicating that the government wanted to see technical development and productivity improvement (Kim 2005; Korean Economy Compilation Committee 2010: 233). Discounts on public utilities were terminated and discounts and tariff cuts on imported equipment discontinued amid import decontrol in 1988 (Song 2002: 194).

10 Steel firms with integrated mill annual capacity of more than 100,000 tonnes were eligible for this tariff cut.
11 For details, see Park (2011).
12 The Industrial Development Law replaced seven industry promotion laws in the steel, machinery, shipbuilding, electronics, nonferrous metals, petrochemical and textile industries.
The impact of reduced support was offset by POSCO with a strong and sustained business performance. The share of POSCO’s own funds in financing the construction of its second mill was 45%, almost double that of the financing for the first mill (Song 2002: 193). Not surprisingly, POSCO’s performance made it very attractive to potential investors. In 1987, the government announced plans to privatize state-owned enterprises to invigorate the financial market and to help low-income people by assigning them shares in state-owned enterprises.13

For POSCO, the plan was to reduce the shares in the company held by the state and state-run Korea Development Bank shares from 71.4% to at least 35%. Given POSCO’s strategic importance, the government did not want a private company, especially a chaebol, to control POSCO. To prevent this, a cap was placed on a single shareholder holding more than 1% of the company’s stock.14 In 1988, 34.1% of POSCO’s stock was sold to 3.2 million people, including 20,000 employees.

The government undertook a second round of privatization in 1998 when former president Kim Dae-jung announced public offerings for 11 state-owned enterprises and POSCO’s full privatization. The aim was to introduce free competition and market mechanisms in industries still dominated by state-owned enterprises and to improve the efficiency of their management. During the 1997–98 Asian financial crisis the government struggled financially. It decided to secure financial resources, especially foreign currency, through privatization. In December 1998, its remaining stake in POSCO, as well as that of the Korea Development Bank, was sold to foreign investors in the form of depositary receipts. POSCO’s privatization was finalized in 2000, 32 years after the state created the company. The stake of foreign investors steadily increased, from 25.1% in 1997 to 66.5% in 2003. In 2000, Forbes and Fortune ranked the company number one among global steel firms in net income to sales ratio and net income to total asset ratio.

4.7 CONCLUSIONS

In the development literature, low-income countries are often advised to follow trade-based specialization to exploit the comparative advantages associated with their natural resources. In this way, such countries can command international competitiveness in certain industries, which are

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13 Information on privatization is mainly from Kang (2001) and POSCO Thirty-Five-Year History Compilation Committee (2004).
14 The limit was raised to 3% in 1998 and erased from articles in the company in 2000.
Capability building and industrial diversification

typically inherited from higher-income countries. This process is predicted
by the product life-cycle theory (Vernon 1966) and, along this line, low-
income countries can grow to middle-income status.

However, the medium-term risk to the initial comparative advantage
of industries operating in these countries is associated with wage rate
increases in labor-intensive industries that are dependent on low wages. By
comparison, new and cheaper labor sites in next-tier countries are always
at hand, ready to emerge and assume markets previously occupied by their
predecessors in the global value chain. Thus, so-far successful latecomers
could be falling into the middle-income trap associated with the so-called
adding-up problem (Spence 2011).

A long-term challenge for low-income countries is to move to higher
value-added activities in the same industries and gain entry to emerging
industries through intra- and inter-sectoral upgrading and diversification.
To realize these two kinds of upgrading, technological capabilities are
required, as the POSCO story has demonstrated.

This chapter suggests an implementation strategy based on acquiring
technological and design capabilities based on a combination of
acquired external knowledge and in-house R&D efforts. Three stages are
described. The first involves the assimilation of foreign technology, mostly
operational skills and production technology, and know-how through
licensing, original equipment manufacturing, foreign direct investment
arrangements or technology transfer from public research agencies.

In the second stage, the learning and access channels change to code-
development contracts and public–private consortiums once latecomer firms
establish their own in-house R&D centers as a physical base for more
indigenous learning. In this stage, R&D targets can be mature segments
in mature technology sectors, which translate into fewer uncertainties in
feasibility and market potential. The varied experiences in the production
of telephone switches in Brazil, the PRC, India, and the Republic of Korea
are prime examples of this.

The final stage of learning is the more ambitious strategy of leapfrog-
gging to emerging technologies, as the Republic of Korea did with digital
television development and the PRC did with indigenous 3G wireless
standard development. When technological specialization involves leap-
frogging, two kinds of risk may be involved: whether the countries are
making the right choice over technologies or standards, and whether
there is an initial market for these technologies. Thus, gaining entry into
emerging industries must involve government assistance in the form of
technological policies that guide public–private R&D consortiums as well
as exclusive standard policy, procurement and user subsidies for initial
market provision.
The case of POSCO suggests that a discontinuous diversification into a totally new sector was made possible by the combination of government activism and deliberate strategies for aggressive learning and capability building. State activism is justified when there are market failures such as positive externalities, which create a gap between private and social returns. POSCO’s case fits this category. Steel is an input in diverse sectors of production. Given the high degree of scale economies and the limited size of the domestic market in the Republic of Korea, steel goods were expected to be under-produced if left with private firms and a private steel monopoly would doubtless charge considerably higher prices. Relying instead on imported steel would have led to no benefits from backward and forward linkages. Under these conditions, entry by establishing a state-owned enterprise appeared to be the rational choice in the context of past economic conditions. A late entry such as POSCO can be replicated in other developing economies that have the financial resources.

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Capability building and industrial diversification


5. Industrial policy design and implementation challenges

Mushtaq H. Khan

5.1 INTRODUCTION

The design of industrial policies depends on three interrelated issues. First, industrial policy can be designed to address very different economic and social objectives in different countries. However, clarity about objectives and priorities is important to avoid addressing contradictory objectives with the same policy. Second, the design of industrial policy depends on identifying the constraints and contracting failures that may be preventing the achievement of particular objectives. Third, appropriate policy design depends on initial institutional and political conditions, since all instruments may not be equally effective in different contexts, and success requires selecting instruments that are most likely to be effective in specific country contexts.

The achievement of most economic and social objectives, such as employment generation, wage growth and the financing of public goods, requires the growth of a diversified base of competitive industries, broadly defined to include all modern high-productivity sectors.

This chapter discusses coordination and externality-related contracting issues that can affect the development of a broad base of competitive industries. Many contracting failures can stall the emergence and growth of a diversified competitive sector, but one of the most important is often given very little attention in the design of industrial policy. Competitive industries often do not emerge in developing countries, because firms lack the organizational and technical capabilities to achieve competitiveness using known technologies. These capabilities are not based on formal knowledge that can be learned in colleges or schools. They are largely tacit knowledge that is only acquired through learning-by-doing. We can therefore also describe these capabilities as tacit productive capabilities. Developing these capabilities requires financing learning. This is the only way in which firms will begin to operate and, if their learning is successful, they will eventually become competitive. But these investments are potentially subject to significant contracting failures. Solving these is a
necessary condition, possibly more important than other externalities and coordination problems affecting competitiveness.

The East Asian countries that implemented successful industrial policies did so by developing effective strategies for financing learning-by-doing. Governments financed this, but imposed conditions that ensured that firms put in high levels of effort. In countries without a strong developmental state, on the other hand, ambitious industrial policies often failed because financing strategies could not induce a high learning effort. As a result, many of their infant industries failed to become competitive. The design of an effective industrial policy has to ensure that, given the enforcement capabilities of the state, the financing instruments for supporting capability development do actually result in a high level of effort so that competitive firms emerge. This is the key argument this chapter develops.

Most contracting failures require policy solutions that involve external financing or subsidies that can be described as rents for the firms supported. Successful outcomes require that these rents are provided with conditions, and are withdrawn if the conditions are not met. Permanent subsidies for firms that fail to become competitive (such as those that do not meet agreed export or quality targets) are clearly not sustainable. Moreover, subsidies perceived as permanent (that is, provided without sunset clauses) are not likely to result in a high learning effort that translates into gains in competitiveness. Given these considerations, it is not surprising that the design of the financing instruments, the selection of firms and sectors to be supported, the co-investment by other stakeholders and the compatibility of the financing conditions with the enforcement capacities of the state all determine the likelihood of success. Financing strategies that worked for firms and sectors in one country can fail in another if the ability of firms of a particular type to capture these rents—without meeting conditions for achieving competitiveness or the capacity of the state to enforce conditions on particular types of firms—is significantly different.

When a country has a potential competitive advantage in a new sector, private market contracting should be able to organize the necessary investment in equipment and capability development. If a sector is potentially profitable, it should be possible to borrow against its future profits to invest in the machinery and technologies of production and to invest in learning-by-doing. In theory, with efficient markets and low transaction and enforcement costs, private contracts between different beneficiaries should enable these types of investments. However, private contracting frequently fails to organize these investments because of a wide range of contracting failures.

Industrial policy recognizes these problems, but, often, differences between contracting failures and the conditions required to solve them
are not properly identified. All contracting failures involve some level of explicit or implicit support to be provided to firms. But the solution of a specific contracting problem requires not only financial support, but also the enforcement of very specific conditions on firms to ensure that the problem is overcome. The design of the support and the associated monitoring, evaluation and governance structures required are therefore likely to vary given the contracting constraint perceived as most important in each case. The absence of appropriate structures to enforce these conditions is the most common cause of poor performance associated with specific industrial policy strategies. A holistic industrial policy strategy has to recognize the interrelationships between objectives, contracting constraints, and the institutional and governance conditions to maximize the chances of success.

5.2 CONTRACTING FAILURES IN TECHNOLOGY ACQUISITION

Table 5.1 shows the main types of contracting failures that can affect the acquisition and adoption of new technology in developing countries, which, in turn, can constrain the development of new sectors and the upgrading of existing ones. The third column is particularly important because it identifies the critical governance capabilities required for effectively implementing the necessary conditions associated with the provision of support. A policy that is effective in theory can be useless in practice if the agencies charged with its implementation are unable to identify and enforce the conditions required for its success. Moreover, poorly designed and implemented policies can be worse than useless if the net effect is further resource misallocation through rent seeking (Krueger 1990). Unlike Krueger and the standard neoclassical approach to rent seeking, however, we argue that policy-induced rents provided under the appropriate conditions can solve important contracting failures even in the presence of rent seeking (Khan 2000a; Khan and Blankenburg 2009).

The solutions to specific contracting failures require monitoring, evaluating and enforcing particular sets of conditions. Because the broad governance capabilities of states and their political constraints are difficult to change in the short to medium term, it is important to design policies that can address the most important contracting failures given the current institutional and political context. Any particular contracting failure can be addressed with different types of policies and the range of sectors and technologies being adopted can be more or less ambitious. Just as an environmental externality can be addressed with taxes, subsidies, regulation or property right solutions, each of the contracting failures in Table 5.1 can
**Table 5.1  Major contracting failures affecting technology acquisition**

<table>
<thead>
<tr>
<th>Contracting failures affecting investment</th>
<th>Likely policy instruments</th>
<th>Governance capabilities required for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriability problems facing investments in formal skills: Investors cannot capture the full benefits of training</td>
<td>Public cofinancing of labor training and investments in skills</td>
<td>Capabilities in relevant agencies to ensure that the investment develops skills that are actually in demand and that the skill quality is high</td>
</tr>
<tr>
<td>Appropriability problems facing innovators: Poor protection of innovation rents can discourage advanced technology investors</td>
<td>Protection of IPRs. But TRIPS may prevent technology transfer and foreign investors may have weak incentives to transfer technologies</td>
<td>Enforcement capabilities for protecting IPRs but also policies and capabilities to encourage technology transfer by foreign investors</td>
</tr>
<tr>
<td>Appropriability problems facing ‘discovery’: First movers do not capture full benefits of discovering comparative advantage</td>
<td>Subsidies for first-movers and start-up companies in new sectors</td>
<td>Capability to make subsidies time limited</td>
</tr>
<tr>
<td>Coordination failures: Complementary supporting sectors do not develop, constraining investment</td>
<td>Indicative planning or incentivized strategies for coordinating investments</td>
<td>Significant governance capabilities required to coordinate and discipline investments across sectors</td>
</tr>
<tr>
<td>Contracting failures in learning organizational capabilities: Firm-level competitiveness remains low because of low effort when learning-by-doing is financed</td>
<td>Public cofinancing or risk-sharing is required to finance learning-by-doing for acquiring organizational and technological capabilities</td>
<td>Financing instruments supporting learning must have credible incentives and compulsions for stakeholders to put in high effort in learning given the institutional and political context</td>
</tr>
</tbody>
</table>

**Notes:**
IPR = intellectual property right, TRIPS = trade-related aspects of intellectual property rights.
Appropriability problems are a general type of contracting failure that emerge when investment in a particular activity is potentially profitable, but investors fear that they will not be able to capture or ‘appropriate’ enough of the returns on these investments and so fail to engage in private contracting.

**Source:** Author.
be addressed with different instruments. Some policy responses may have conditions for success that are enforceable in the current political context, while others may not be feasible. The policy task is to remain within the bounds of the feasible. It is important to precisely identify the most important contracting failures and design policies that have the greatest chance of implementation given the existing governance and enforcement capabilities of the state. The presence or absence of a good fit between problems, policies and capabilities explains why some countries or sectors can do well with industrial policies, even when many aspects of their overall governance capabilities appear weak.

The following discussion on the sources and effects of contracting failures will hopefully be useful for decision makers facing these issues. We argue that while each of these contracting failures is potentially important, the last one is the most important. Without an effective strategy that can support firms in their acquisition of the tacit production capabilities required for using existing production technologies competitively, other parts of an industrial policy package are not likely to be effective.

5.3 INVESTMENT IN FORMAL SKILLS AND Appropriability Problems

Appropriability problems are a general type of contracting failure that emerge when investment in a particular activity is potentially profitable, but investors fear they will be unable to capture or appropriate enough of the returns on these investments and, as a result, the investment undertaken is below the optimal level. The failure of new sectors to become competitive or existing sectors to improve competitiveness is often attributed to missing formal skills of the type that can be acquired in training programs. Indeed, missing formal skills can often be a serious constraint to achieving competitiveness in new sectors. Contracting problems can often prevent high levels of investment in formal skills. This is because there is no credible mechanism to ensure that workers will remain with a firm after it has invested in enhancing their formal skills. If workers could credibly promise to stay on long enough after their training to enable firms to recover their investment, then skills training could be privately financed.

The appropriability problem results because such a promise may not be enforceable in a contract and employers may, consequently, not invest in training their workforce. Similarly, if the skills are very specific to working in a particular sector or firm, workers may be reluctant to pay for it themselves unless the employer guarantees employment—and this, too, may not be enforceable in a contract. The result can be low investment
in productivity-enhancing education and skills development. This is essentially a problem of positive externalities or spillover associated with investments in formal skills. The obvious policy response is for the state to share some of the training costs or provide training through publicly funded training organizations. Getting the right outcome, however, is by no means simple and requires careful policy design and governance capabilities to monitor outcomes and, if necessary, to withdraw support for programs falling short of the mark.

Subsidies for companies to invest in training may be wasted if firms provide poor quality training, and this can happen if the subsidy is poorly designed. If a skills training subsidy is provided to a firm, the governance requirement is to ensure that employers are not using the assistance to simply reduce employment costs without providing the training. Support to firms therefore has to be effectively monitored with observable conditions that can be enforced. If training institutes are subsidized, the requirement is to ensure that the courses taught have a market value for future employers. In this case, coordination with the private sector is necessary, together with appropriate incentives and sanctions for training providers. These are difficult governance requirements even for developed countries, and public money is often wasted in poorly designed training support schemes. The appropriate mechanism for delivering public support for training therefore needs to be carefully considered in the context of the governance capabilities available to developing countries.

However, formal skills shortages may not be the primary cause of low productivity and competitiveness in all sectors and countries. The low productivity and competitiveness of a firm can indeed sometimes be due to missing formal skills, and this is most likely because of gaps in filling skill-intensive jobs such as accountancy, engineering and computing. A much more important and widespread problem is that workers with the appropriate formal skills may still have low productivity in developing countries because firms collectively lack the tacit knowledge necessary to organize high productivity production routines. These organizational capabilities are also skills, but they are informal or tacit knowledge skills that cannot be learned in formal training programs—they have to be acquired through learning-by-doing processes, which are discussed later in this chapter. Most manufacturing processes in developing countries actually require fairly basic prior knowledge of the technology of production by the majority of the workforce. That has been the case for blue-collar workers in sectors such as textiles, electronics and light to moderately heavy engineering. What is usually required is not the acquisition of formal skills through training in external institutes, but the development of the productivity
of the workforce through the acquisition of tacit productive capabilities learned through firm-level experimentation.

Developing countries often make the mistake of responding to low competitiveness by assuming that the problem can be solved by investing increasingly more in formal skills training, only to find that the expected improvement in productivity and competitiveness does not materialize. Indeed, most developing countries have an excess supply of formally skilled workers in most skill categories. In general, increasing this supply will not solve the problem of low productivity and competitiveness, and may simply cause formally skilled workers to emigrate. One of the paradoxes of developing countries is that they regularly export skilled workers who could not be competitively employed in their own countries.

The answer to the paradox of migration is that workers have low productivity in their home countries because they are working in firms that lack organizational capabilities and routines for organizing efficient production. However, as soon as these formally trained workers migrate and join an efficiently run organization in another country, they quickly learn on the job and their productivity jumps several times, showing that the problem was in many cases not the absence of formal training, but of knowledge and know-how of a different kind.

As emigration becomes more difficult, many developing countries face a crisis in providing jobs for the large numbers of students being churned out every year by their higher education facilities. Attempting to tackle the problem of low productivity and competitiveness in these contexts by further increasing the supply of formal skills, without addressing the problem of creating competitive firms, may simply result in even higher levels of unemployment and underemployment of skilled workers. Of course, once competitive sectors begin to take off, formal skills shortages of specific types soon emerge that have to be addressed. Indeed, for some categories of formal skills, such as accountancy, computing skills or mechanical engineering, there may be genuine shortages even at the initial stages of sectoral development, depending on the types of industrial processes being attempted.

It is therefore important to identify the main causes of low competitiveness. If a wide range of competitive enterprises struggle to find skilled workers, the problem could be one of formal skills shortage, but this is not typical in a developing country. The low productivity problem in most developing countries is not primarily due to the limited supply of formal skills, but to the limited capacity of enterprises to use the existing supply of skills competitively. This problem is not likely to be solved by accelerating the rate at which the supply of formal skills is increasing. Genuine pockets of formal skills shortages may exist in emerging enterprises that are
otherwise competitive. In these areas, the policies for supporting formal skills development discussed in this section are relevant.

5.4 THE APPROPRIABILITY PROBLEMS THAT INNOVATORS FACE

It is widely recognized that investment in innovation may be constrained if the returns on these investments cannot be appropriated. The problem here is that innovation can be imitated and, if this happens too rapidly, the innovator could earn an insufficient prize, which may deter further investments in innovation. Private contracting between the innovator and imitators to prevent imitation is unlikely and this appropriability problem therefore requires public policy. There is extensive literature on the benefits of temporarily protecting the high profits of innovators by preventing imitation or otherwise providing large profits to innovators to provide incentives for more innovation. These high profits are known as Schumpeterian or technology rents and are often based on the enforcement of intellectual property rights for particular periods after an innovation is declared (Dosi 1988; Khan 2000a). The implications of preventing imitation are obviously different for innovators, imitators and consumers. Long periods of protection can hurt consumers and imitators and so there is a trade-off between the immediate costs of preventing imitation and the long-term benefits of faster innovation. Moreover, very long periods of protection can even slow the pace of innovation by making it difficult for new innovators to build on previous innovations.

While advanced countries largely rely on innovation to drive growth, a significant part of growth in developing countries is based on the adoption and adaptation of existing technologies. Although innovation is undoubtedly happening in many developing countries, most growth comes from adopting and adapting known technologies. East Asia’s high growth in the 1960s and 1970s was based on rapid technology transfer and imitation, primarily of Japanese and American technologies. The emergence of trade-related aspects of intellectual property rights under the World Trade Organization and other intellectual property rights protection agreements means that strategies of catching up now have to be very different. Given the international architecture protecting technology rents, it is now argued that to attract foreign technology providers, developing countries have to credibly protect their intellectual property rights since global companies are likely to choose production locations where illegal imitation is least likely.

Strong protection of intellectual property rights is therefore often
recommended for middle-income developing countries to attract high-technology foreign direct investment (Hoekman et al. 2004). Here too, however, important governance questions are at stake. Effective protection of intellectual property rights is not enough. Developing countries have to be able to select the technologies that are most attractive for them and create appropriate incentives to attract these technologies. Governments need specific negotiating skills and knowledge of World Trade Organization rules to negotiate incentives and contracts with multinationals so that the most desirable technologies (those with the highest spillover for domestic companies) are transferred to their countries.

The current system of global intellectual property rights is not necessarily immutable and there are many questions about how desirable this architecture is for both developing and developed countries. We do not have the space to review these questions here, but there is a strong case to be made that the definition of intellectual property rights in international agreements, such as the 1994 agreement on trade-related aspects of intellectual property rights, is detrimental to the interests of developing countries. The high level of protection has arguably made it more difficult for developing countries to imitate, engage in backward engineering or develop their own component supply industries independently of the locational decisions of global multinationals. Developing countries have much less freedom now to improve their position in the global value chain by attempting to catch up independently of the locational decisions of global multinational companies.

Ironically, the high level of protection for innovators may also be slowing innovation in advanced countries (Stiglitz 2007: 103–32). Long periods of protection of technology rents can harm innovation in advanced countries because they can slow the flow of knowledge to new innovators. Innovations are obviously built on previous ones, but if the latter remain protected for long periods, innovators require complex and expensive licensing arrangements with previous patent holders, which can slow the flow of innovations.

Given that the current international agreements are here for now, the protection of intellectual property rights to attract higher-technology foreign investment creates opportunities and challenges for developing countries. With accession to the World Trade Organization, developing countries cannot just copy advanced technologies or even set domestic content requirements that induce foreign technology owners to transfer technological knowledge to local companies. At the same time, the importance of technology transfer to domestic companies remains just as important for sustaining broad-based national development (Stiglitz 2007;
Cimoli et al. 2009). A more complex structure of incentives and strategies is now required to attract the desired technologies and induce technology transfer to domestic firms. A failure of policy in this area can result in a reduction in growth, particularly in middle-income countries. In the longer term, the architecture of trade and intellectual property rights may also need revisiting to develop a more equitable set of global rules that protects the interests of different countries more fairly.

5.5 ‘DISCOVERY’ AND APPROPRIABILITY PROBLEMS

Investments to discover activities that are profitable in developing countries can also face appropriability problems (Hausmann and Rodrik 2003). The issue here is that countries may be good at making some products, but this may not be known to the investment community. Investors putting their money into different production activities will sometimes lose, but they will occasionally discover products that can be profitably made. If other investors can easily imitate this discovery, the original investor could even lose money (for instance, if wages go up as a result of rapid imitation and the initial investors cannot recover their investments in discovery). Put another way, the first mover’s projected profits may be too low to warrant investing in discovery. This contracting problem can result in underinvestment in discovery, which public policy needs to address with appropriate tools. Unlike innovation, the policy of preventing imitation through patents will not work in this instance because there cannot be a patent for discovering the products that can be profitably produced in a country.

The discovery argument is compelling in theory, but the proposition that countries have hidden comparative advantages that need to be discovered is not particularly convincing (Khan 2009). For one thing, countries are unlikely to have ‘hidden’ comparative advantages that they are unaware of. It is implausible that some developing countries have an innate advantage in producing, say, hats rather than bed sheets, and that the task is simply to discover the latter. It is more likely that countries are not competitive in sectors in which they should have comparative advantage owing to lack of the tacit organizational knowledge required to organize production competitively. If so, then without a solution to the problem of how to acquire this organizational knowledge, investments in discovering new sectors will fail because there may be no hidden and ready-made sectors with comparative advantage waiting to be discovered. In general, however, the possibility that first movers may be unable to
capture the full benefits of their investment can sometimes justify subsidizing investments in new sectors.

If the development of new sectors is indeed impeded by contracting failures in financing investments in discovery, the appropriate policy would be to subsidize experimental investments in new sectors. The governance capability required to ensure that these investments are not wasted is quite simple. Governance agencies would have to ensure that subsidies are only available for start-ups in new sectors and that the financing is time bound; that is, just long enough to discover whether or not hidden comparative advantage exists in a particular sector. The important governance capability here is to identify what counts as a new sector and to ensure strict time limits for subsidizing trials in new sectors. In other words, if discovery were the primary problem, the monitoring and evaluation requirements for industrial policy solutions would be straightforward. Unfortunately, this is unlikely to be the main contracting failure preventing the emergence of new competitive sectors in developing countries. In reality, the task of entrepreneurs in developing countries is generally not to discover the hidden comparative advantages of the country, but to create comparative advantage by building efficient organizations. This requires the acquisition of firm-level organizational and technical capabilities in ways that will be discussed later.

While the discovery problem is unlikely to be the primary barrier to the growth of modern sectors in developing countries, there may nevertheless be significant positive spillovers associated with investments in new sectors. The first investors in a sector that is not yet competitive may have to grapple with correcting government policies in appropriate ways, and to acquire organizational and technological capabilities. This may then make investment easier for followers, whose task is then the simpler one of imitating the organizational design of the first-movers. Follower firms would still have to do some organizational learning, but the time and risk involved would be less if the successful organizational design of the first firms could be observed and if managers and supervisors from the first firms could be persuaded to migrate to new firms.

If the lower rate of return that the first mover gets as a result of this imitation is insufficient to induce the initial investments in capability development, then, in addition to the learning problem, there may also be a spillover problem for the first mover that policy has to address. If investments in new sectors are judged to be constrained by these spillovers (in addition to low competitiveness due to missing organizational capabilities), additional public subsidies for investments by first movers may be justified. However, we will see later that ensuring high effort in learning can be a problem even if there are no spillovers that deter first movers from investing.
5.6 COORDINATION FAILURES

Development economists have long recognized that private contracting may fail to coordinate investments across sectors; this can be a problem in some contexts (Rosenstein-Rodan 1943; Nurkse 1953; Scitovsky 1954; Murphy et al. 1989). Moreover, in the presence of ‘lumpiness,’ investments in one sector or firm can have more than a marginal effect on the profitability of other sectors by raising the demand for their products or by cheapening the price of their inputs.\(^1\) The efficiency attributes of market prices as signals of social costs and benefits can break down in this context, making private contracting based on existing prices inefficient.

It is theoretically possible that an unprofitable investment in a particular firm or sector can become profitable if there are complementary investments in other sectors. In developing countries, this has been the justification for planning exercises and even for state-coordinated ‘big-push’ industrialization. This could involve the coordination of investments across sectors enjoying complementarities and external economies. The problem is that the governance requirements for achieving successful big-push industrialization are very significant and few developing countries have the governance capabilities to identify and implement coordinated industrial policy of this type.

To achieve successful coordination, government agencies must be able to identify the sectors for inclusion in a big push or coordinated plan on the basis of objective data and analysis, without being overly influenced by special interests. Otherwise, sectors that cannot be justified on economic grounds may be included for promotion. Furthermore, to effectively coordinate investments, the state’s planning exercise has to be aligned with the interests and capabilities of the private sector. Incentives and instruments supporting investments have to be effective for achieving the desired resource allocations, or the desired coordination will not be achieved. The capacity to monitor and identify mistakes early on, so that policy can be changed or abandoned quickly, is also required.

Without these conditions, there is not much point in spending public resources on constructing and publishing detailed plans that only get ignored. Unfortunately, this frequently happens in developing countries, particularly because constructing detailed plans can serve to employ large numbers of economists and officials in an apparently useful activity. In reality, plans of this type are rarely implemented. Without very significant implementation capabilities, a broad, indicative plan setting out

\(^1\) Lumpiness refers to large fixed costs that result in scale economies.
a government’s strategy for investment in infrastructure and the policy framework may be all that is required.

It should be noted that there is a separate requirement for governments to coordinate their own agencies to ensure that policy and service delivery tasks are adequately coordinated and financed. At the simplest level, government agencies have to ensure that different policies and incentives are coordinated so that they do not cancel each other out. It often happens, for instance, that taxes on the inputs used by a firm can wipe out the implicit subsidy the firm gets as a result of tariff protection. Coordination within government is essential for delivering services and policies effectively, but this is not what is referred to as investment coordination in the literature. The latter refers to the coordination of sectoral investments in contexts where contracting failures prevent investment coordination by private firms. This is a much more ambitious objective requiring governance and implementation capabilities that most developing countries lack.

However, as countries progress from lower to higher levels of middle income, and move toward increasingly complex industrial clustering, there is an increasing need for complementing market coordination with industrial policy. For instance, policy may attempt to coordinate sectoral investments to promote the emergence of viable production clusters; for instance, in electronics or automobiles. The emergence of competitive industrial clusters may require the presence of a variety of suppliers of components. This, in turn, may require policy-induced incentives to achieve coordinated investments to support the clustering. Industrial policy of this type can reduce the long-term costs of firms, and thereby increase their competitiveness by encouraging the clustering of complementary suppliers in industrial parks. However, governance capabilities to ensure coordination are critical, and in their absence resources invested in coordination can be wasted.

The risk of wasting resources can be reduced if governments follow the demand coming from private investors rather than attempting to direct investors to locate in sectors the government chooses. There have been many failed attempts to develop clusters and special economic zones in developing countries, and much successful clustering has happened through natural processes of private location without much government assistance. To ensure that public money is not wasted, coordination attempts should start off as small-scale trials, but even these may require quite significant agency capabilities. Financing arrangements, again, are important, and industrial parks are much more likely to be successful if government support complements private investments so that private investors pre-commit their own funds at the outset of such a development.
This ensures that the right firms and locations are selected. It may also help to have dedicated agencies responsible for delivering the coordination, in independent parks, say. Competition between different regions, each with their own budget for setting up clusters, can also result in effective outcomes, as the experience in the People’s Republic of China shows.

An important advantage of competition between experiments is that it is possible to try several experiments simultaneously with different financing instruments and conditions in different sectors or regions to see what is likely to work in the local context. Ultimately, it is this type of pragmatic strategy that the Chinese call ‘crossing the river by feeling the stones’ that has delivered results in the most successful countries. Follower countries have to learn to devise their own strategies based on an understanding of the problems that they are trying to solve and their own institutional and political constraints in implementing particular solutions.

5.7 LEARNING ORGANIZATIONAL CAPABILITIES AND RELATED CONTRACTING FAILURES

The most important constraint to the development of modern sectors in developing countries is frequently the absence of a broad base of firms that have the technological and organizational capabilities to adopt, adapt and use available technologies profitably. The technological capabilities of workers and managers refer to their abilities to use particular machines and technologies. These are acquired partly through formal education and training, but often the acquisition of the missing tacit knowledge by doing and experimentation is more important. Consider the technical capabilities required to drive a car. Classroom instruction on driving is helpful, but it does not provide the required tacit knowledge; gaining it involves actually driving. Driving capabilities can take a longer or shorter period to acquire, depending on how committed the learner is, the effort he or she puts in, and the initial level of formal skills. The same is true for operating many machines and production processes, including sophisticated machines that workers with limited formal education can operate.

While the technological capabilities of individuals within a firm are important, firm competitiveness depends even more on the whole firm working together as a team. The critical characteristic of a team is that the productivity of individuals in the team is not entirely determined by individual skills or effort, but depends on the collective organization of the team (Alchian and Demsetz 1972). An individual’s productivity can be high or low depending on the type of team that the individual is in. Think of the productivity of a single worker on a production line; how well a
firm is organized is a function of the tacit production capabilities that have been gradually acquired and that are embedded in the routines of the firm. These routines do not just describe how particular processes are carried out, but also how the firm responds to new challenges to change existing routines. The organization of a firm describes its internal management systems, incentive structures and systems for monitoring work, ensuring quality control, reducing input wastage and effective inventory management. These organizational systems are critical determinants of the productivity and competitiveness of a firm as a whole as well as the productivity of its individual workers. The organizational structure that achieves competitiveness cannot simply be a copy of the organizational structures of competitive firms producing similar products in more advanced countries. Each country has specific initial conditions that determine the organizational structures that work best, and this has to emerge through experimentation and the acquisition of tacit knowledge through high-effort learning-by-doing.

The critical point is that the productivity of individual workers depends not just on their own technological capabilities (both formal and tacit), but also on the organization of the firm they are working in, which we describe as its tacit productive capability. A worker with high technological capabilities will register low productivity if poor inventory management or bottlenecks elsewhere in the firm result in long periods of idle time. Similarly, input productivity depends on input wastage and product rejection rates that can be attributed to poor organizational design; and capital productivity depends on capacity utilization, downtime and so on, which are in turn functions of successful organizational design. Thus, all the critical productivities that determine competitiveness are functions of a firm’s tacit productive capabilities, which are embedded in its production routines. Because new firms in developing countries typically have low organizational capabilities, they tend to have low competitiveness even if they acquire the most appropriate machines and have workers and managers with the formal knowledge required to use this technology. This is true even for low-technology production processes, such as garments manufacturing, and much more so for sophisticated products. The acquisition of the required tacit productive capabilities is one of the most general problems that affect almost all areas of technology acquisition in developing countries, and is subject to important contracting failures. In the absence of solutions to these problems, a new firm or an entire country can find its technology acquisition strategies unsuccessful as competitive firms will fail to emerge.

Countries that have few firms with the appropriate tacit productive capabilities will fail to benefit from industrial policy strategies that address
other problems. For example, strategies to increase the supply of skilled workers to firms or to support first-mover investments assume that there is a base of firms that can potentially benefit from these strategies because they already have the tacit productive capabilities to organize competitive production if these other problems could be addressed. In reality, capabilities are typically missing and require the acquisition of tacit knowledge about routines and processes. Tacit knowledge cannot be acquired through formal education, but has to be acquired through experimentation and doing. As a result, progress is difficult to test using formal means like examinations. Yet this process of capability development has to be financed, even if progress is hard to monitor, evaluate and control. The problem is that financing ‘doing’ without a large effort is unlikely to generate much ‘learning.’ Effort is particularly important for developing organizational capabilities because it involves continuous changes in firm organization that involves adjustment costs and is often likely to face internal resistance. Managers and other stakeholders therefore have to assume risks and costs during this process. They would, quite rationally, want to avoid this unless they had a strong compulsion to increase their competitiveness. Given the high internal costs of continuous adjustments to acquire productive capabilities, effective learning requires pressure or compulsion on managers and workers to achieve competitiveness rapidly.

This brings us to the contracting problem that these investments face. Investors in developing country firms that are initially uncompetitive have to take significant risks to finance this process on their own. The difficulty of monitoring effort means that external financiers are exposed to significant contracting risks. Since it is not possible to directly observe the effort put into learning, evaluating it by looking at intermediate outcomes sometimes gives the wrong answers. On the other hand, if the effort is too low, the entire investment in plant, machinery and learning can be unprofitable.

The policy response to this contracting failure is for the government to share some of the risks and costs of this financing. Protecting domestic markets, providing export subsidies and other types of explicit and implicit subsidies can assist infant industries engaged in developing their productive capabilities. Yet, public financing is likely to be wasted if it does not address the underlying problem of how to ensure a high level of effort. Unless the financing comes with conditions that induce high effort, competitiveness will not improve rapidly enough and the industrial policy can become unsustainable due to the fiscal burden of growing subsidies. When infant industries fail to become competitive despite decades of subsidies, it is almost always due to a failure of ensuring effort to become competitive.

This is the most general contracting problem affecting technology adoption. If a firm lacks these tacit productive capabilities, it will not become
Development and modern industrial policy in practice

competitive even if other problems constraining its competitiveness are solved. Strategies for developing organizational and technological capabilities are therefore an essential component of successful industrial policies. The problem for policy design is that the strategies for supporting effective learning have differed greatly across countries because states differ a lot in their monitoring and enforcement capabilities. As a result, financing strategies that worked in one context have frequently failed in others.

Historical experience suggests that supporting capability development using the top-down industrial policy of the type seen in the Republic of Korea requires very strong monitoring and enforcement capabilities on the part of government agencies. The political economy underpinning this enforcement is typically missing in most developing countries (Khan and Blankenburg 2009). Without the requisite institutional and political capabilities, top-down industrial policy is likely to allocate resources to firms without achieving high effort, and competitive firms are unlikely to emerge. However, the experience of other developing countries with weaker state enforcement capacities shows that productive capabilities can still be developed if the industrial policy instruments are designed differently and the conditions that induce high effort can be enforced given the institutional and political capabilities of the state.

5.8 LEARNING, CATCHING UP AND POLICY

The essential features of the catching-up problem can be made explicit using a simple mark-up pricing model for products of defined qualities. The model helps explain why low wages are insufficient to achieve competitiveness in developing countries even if they are adopting simple labor-intensive technologies. By decomposing the components of competitiveness, it can be seen that firm-level organizational capabilities are vital for raising all the productivities that determine competitiveness. The global price of a particular product of quality \( Q \), denoted by \( P_{\text{global}}^Q \), is set by its cost of production in the most competitive country producing that product. The price can be arithmetically broken down into a unit labor cost component, unit input costs and the amortized unit capital costs representing the unit costs of machinery and buildings:

\[
P_{\text{global}}^Q = \left[ \frac{W_{\text{leader}}}{Q_{\text{leader}}} + \sum_{i} \frac{P_{Q_i}^{\text{leader}}}{Q_{Q_i}} + \sum_{k} \frac{P_{Q_k}^{\text{leader}}}{Q_{Q_k}} \right] (1 + m_Q) \tag{5.1}
\]

(unit labor cost) (unit input cost) (unit capital cost) (markup)
To simplify the notation, we do not denote products and simply refer to a particular quality of a product indexed by $Q$, so that $Q + 1$ represents a product with a higher-quality than that of product $Q$. $P_{Q}^{\text{global}}$ is the international price of a particular product of quality $Q$. $W_{Q}^{\text{leader}}$ is the wage level in the leading country in the industry producing the product of quality $Q$. $\Pi_{Q}^{\text{leader}}$ is the productivity of labor in this sector in the leader country, measured by the output per person in this activity. The first term on the right-hand side of the equation is therefore the unit labor cost.

The second term is the unit input cost. The production of the product requires $i$ inputs such as raw materials or semi-manufactured inputs. To simplify, we assume that these inputs are globally traded, each with a global price of $P_{Qi}^{g}$. The efficiency with which inputs are used is measured by the productivity of input use (output per unit input). In the leader country, the input productivities of each of the $i$ inputs are represented by $\alpha_{Qi}^{\text{leader}}$. Input productivity primarily measures input wastage due to poor skills and management processes as well as input losses due to rejected final products. Both depend on the efficiency of the organization of production within the plant. In many production processes, levels of input wastage are a critical determinant of competitiveness.

The third term refers to the unit capital cost attributable to the cost of machinery and buildings. The firm uses $k$ types of capital inputs, the most important usually being machines with a globally traded price, though land and buildings can also be significant in some cases. The unit cost of capital is determined by the fraction of each component of the capital cost attributed to the particular period of production, represented by $P_{Qk}^{r}$, divided by the output-capital ratio for each type of capital (the productivity of capital) measured by $\beta_{Qk}^{\text{leader}}$. The output-capital ratios or capital productivities depend critically on capacity utilization, which depends on how successful the organization is in preventing production bottlenecks, enhancing sales and reducing machine down time. The mark-up is set at $m_{Q}$.

In the same way, the cost of production in the catching-up country (in a common currency) is the domestic cost $C_{Q}^{\text{domestic}}$ for the product of quality $Q$, given by an exactly equivalent equation, but with the appropriate domestic productivities and prices:

$$C_{Q}^{\text{domestic}} = \left[ \frac{W_{Q}^{\text{domestic}}}{\Pi_{Q}^{\text{domestic}}} + \sum_{i} \frac{P_{Qi}^{d}}{\alpha_{Qi}^{\text{domestic}}} + \sum_{k} \frac{P_{Qk}^{d}}{\beta_{Qk}^{\text{domestic}}} \right] \left( 1 + m_{Q} \right) \quad (5.2)$$

The follower country becomes competitive when $C_{Q}^{\text{domestic}} \leq P_{Q}^{\text{global}}$. The decomposition shows that wages are potentially a small contributor to the competitiveness of a firm. The problem of missing tacit knowledge is that
the productivities of labor, inputs and capital are likely to be significantly lower in follower countries. Typically, this makes the domestic cost of production higher than the world market price, even for relatively low-technology products and despite lower wages. It may appear that a low enough wage level can compensate for these productivity differentials, but this may not be feasible in reality. Indeed, in many cases, even zero wages may not be able to compensate for lower input and capital productivity even in labor-intensive technologies. This is because inputs and capital equipment have global prices that have to be paid. If $Q_i^{domestic} < Q_i^{leader}$ for globally traded inputs, the greater wastage of inputs alone could result in a higher domestic cost of production even if the domestic unit labor cost could be reduced to zero. This is why efficiency in controlling the wastage of inputs and reducing product rejection rates is often a critical variable in achieving competitiveness.

In addition, the productivity of capital equipment is also often lower in the catching-up country, with $Q_k^{domestic} < Q_k^{leader}$ as a result of machinery not being properly set up or the scale of production being too low. Indeed, a small disadvantage in these input and capital productivities could mean that even with low or zero wages, the cost of production in a developing country may be higher even in technologies in which it should theoretically have comparative advantage. For countries where wages are not that low, the need to increase productivity through the acquisition of tacit productive capabilities is even more pressing.

5.8.1 The Sources of Productivity

The productivity of inputs including labor depends on various economy-wide and firm-level factors. The economy-wide determinants of a firm’s productivities include the quality of public goods, the supply of utilities, formal education quality in that society and infrastructure. Input productivities are also determined by firm-level variables such as the capital equipment used and the technological capabilities of the workforce. The latter depends partly on their formal training and education and on their tacit knowledge of operating the equipment efficiently. An even more important determinant of firm-level productivity is the firm’s organization: how the production team is set up to ensure a smooth flow of production, how machinery is set up to reduce bottlenecks and how management systems are set up to reduce input wastage, maintain quality and respond to challenges. These tacit productive capabilities of the firm are embedded in the internal routines of the firm and learned through continuous experimentation with firm organization to enhance high productivity.

Huge differences in productivity persist across firms in different countries
even when they use identical machinery (Clark and Wolcott 2012; Sutton 2007). The importance of firm-level organizational capabilities as the critical determinant of competitiveness is supported by many observers of technological capabilities. They point out that the technological and organizational knowledge necessary for the success of firms is tacit knowledge embedded in routines (Nelson and Winter 1982; Dosi 1988; Pelikan 1988; Perez and Soete 1988). Developing efficient routines inevitably involves experimentation and the adaptation of practice to local conditions and not just the implementation of blueprints from a manual (Lall 1992, 2000a, 2000b, 2003).

The importance of organizational capabilities becomes obvious when individual workers migrate from developing countries to more advanced ones. In migrating to join an already efficient organization, an individual worker slots into existing routines and thereby rapidly improves productivity. In contrast, if the production team as a whole is experimenting with routines, the achievement of effective individual work routines can take a long time and, until then, the individual productivities of each worker remain low, as do those of other inputs and capital.

Thinking about competitiveness and productivity in this way also underlines a further problem. If organizational know-how is largely tacit knowledge, then a firm has to engage in learning-by-doing before it has achieved competitiveness. This implies that a firm in a new sector in a developing country will require a period of loss financing as it engages in capability development. But the loss financing will only be validated if stakeholders within the organization put in high levels of effort and actually achieve competitiveness.

5.8.2 Loss-Financing for Learning

Figure 5.1 shows some of the fundamental issues that developing countries face in catching up with the leaders and in acquiring and absorbing technology. The competitiveness curve for a country summarizes its distance from global competitiveness across different qualities of the product. The x-axis measures the quality of the product, and the y-axis the follower’s competitiveness in producing that quality. Competitiveness is measured by the ratio $\frac{P_{\text{global}}}{C_{\text{domestic}}}$. The closer this ratio is to unity, the closer the competitiveness of the firms in the follower country to those in the leader country. When this ratio is 1 or higher a country can sell a product of this quality in global markets and therefore the horizontal line at 1 can be read as the global competitiveness frontier for the follower country. When the ratio is less than 1 for a particular quality, a country will either be unable to produce that quality or will require temporary loss-financing to allow
Development and modern industrial policy in practice

The required rate of ‘subsidy,’ \( S_Q \), equals \( 1 - \frac{P_{\text{global}}}{C_{\text{domestic}}} \) and is shown in Figure 5.1 as the gap between the global competitiveness frontier (the horizontal line at \( P / C = 1 \)) and current competitiveness at quality \( Q \), defined by the current competitiveness curve.

The loss-financing required to engage in learning-by-doing at quality \( Q \) depends on the gap between the domestic cost of production and the global price for products of that quality. Products of higher quality generally require more sophisticated organizations and technical capabilities to produce, and so the gap that the developing country has to jump becomes wider as product quality increases. The competitiveness curve can be extended to apply to related products of different complexity. For instance, different ‘qualities’ could be seen as components of a product in a vertically organized value chain. Low qualities could be low value-added parts of the value chain, such as packing and assembling; medium qualities could be intermediate products involving assembly; and higher qualities could be design, product development, and marketing.

Absent financing for capability development, the wider productivity gap

Figure 5.1 The competitiveness curve: catching up and technology absorption

Source: Khan (2009).
in higher qualities forces market-reliant developing countries to specialize in low-quality products. This may have nothing to do with the relative price of labor and capital, as in standard neoclassical theory. It is possible for a developing country similar to B in Figure 5.1 to have organizational capabilities that are so low that it cannot even produce the lowest qualities of most products.

The loss financing necessary to allow production to commence can be measured as a per unit ‘subsidy,’ $S_Q$, which brings the initially higher domestic cost of production $C_{domestic}^Q$ into line with the global price $P_{global}^Q$. The subsidy need not be a government transfer. It could be private loss-financing in the form of investors accepting a lower mark-up or providing additional cash to cover a period of loss-making. Public subsidies can also be delivered in a variety of ways; some explicit, others more subtle. They include export subsidies, import protection, subsidized interest rates, subsidized inputs or infrastructure or a cash subsidy. Thus, many different financing instruments are available and these can broadly be described as ways of providing ‘rents for learning’ (Khan 2000a).

An important consideration for industrial policy is the determination of the levels of quality of the products at which capability development is attempted. Under the plausible assumption that $S_{Q+1} > S_Q$, a higher subsidy is required if a firm wants to engage in producing higher-quality products. A number of propositions are relevant for policymakers to consider when making decisions about the types of products and qualities that should be supported by industrial policy.

**Proposition 1:** The loss-financing required for enabling learning-by-doing is, in general, higher the higher the quality of the product. This is because the competitiveness curve slopes downwards with higher quality because although the world prices of higher-quality products are higher (which is why they are more desirable to produce), the productivity gap between follower and leader countries is likely to be even greater at higher qualities, implying that the follower country is less competitive in higher-quality products (Khan 2009). Moreover, the subsidy will be required for longer if the gap in competitiveness is greater to begin with, as more complex organizational capabilities have to be developed. Attempting to move too far up the quality ladder too fast therefore has costs in terms of the size of the financing and the period for which it is required.

**Proposition 2:** It is more desirable to produce higher-quality products because they add more value to the economy than lower-quality products. Furthermore, success in higher-quality products is likely to make the future adoption of superior technologies easier since sophisticated
organizational capabilities would already have been acquired in some firms. The acquisition of tacit productive capabilities at a particular level by firms in a country explains why countries specialize in clusters of related qualities. Once firms with particular organizational capabilities emerge, they are likely to diversify into areas where similar capabilities are required. Innovation in advanced countries is also more likely in higher-quality products, such as electronics, than in lower-quality products, such as garments, and within the higher-quality segments of these sectors. A follower country with firms capable of producing higher-quality products is more likely to benefit from future innovations by being able to adopt these innovations as they happen in more advanced countries.

Proposition 3: The trade-offs between these considerations affect the choice of quality to aim at. The aim should be to achieve the highest value-added, and therefore quality, that is feasible, given the initial organizational and technological capabilities of firms and the governance capabilities of policymakers to manage and impose conditions on the financing. While higher qualities are more desirable, the higher the targeted quality, the bigger the immediate subsidy required and the longer it has to be managed. The governance requirements of monitoring and evaluation are therefore greater for a policy that targets higher qualities; and if the gap in initial productivities is too great, traversing it in a feasible time frame may not be possible for domestic firms. Moreover, the competitiveness gap is only partially due to the absence of tacit knowledge. Part of the gap could also be due to low levels of formal education and skills, and to the poor quality of economy-level public goods. If the initial gap is too big, no amount of firm-level capability development is likely to remove it entirely. Given the costs and risks of aiming too high, there is a limit to how high up the quality ladder it is feasible to go. An excessively ambitious strategy can fail to achieve the desired results and may be less desirable than a less ambitious strategy.

Figure 5.1 suggests that a country like B will need loss-financing of $S_{Q1}^B$ from the outset to begin production even of the lower-quality product $Q_1$ at point U. The success of a strategy of loss-financing is measured by the pace at which productivity increases. Success should result in the competitiveness curve rapidly moving up until the loss-financing is no longer required at V. For country A, which can produce $Q_1$ competitively, the imperative may be to move to a higher quality, not only to prepare for future competition from B, but also to benefit from faster productivity growth clustered around quality $Q_2$. Thus, for country A, there may be a policy justification to assist learning-by-doing around quality $Q_2$ by
organizing temporary loss-financing of $S^A_{Q}$. The challenge for A would be to go from point X to point Y to achieve competitiveness at this higher-quality level. This would not only allow the country to raise its domestic value-added and living standards, but also to ensure faster productivity growth in the future.

### 5.8.3 Effort Levels and Learning Success

Time and effort are inversely related in the development of technological and organizational capabilities. The lower the effort, the longer it takes to achieve competitiveness. The rate at which the competitiveness curve rises is critical for the success of the financing strategy and depends on the degree of effort in developing competitiveness through organizational experimentation with new routines. Unfortunately, disciplining the learning process to ensure consistently high levels of effort is very difficult. Effort cannot be directly observed and intermediate levels of productivity growth are hard to measure unless a firm is already close to the competitiveness threshold, in which case market tests like export growth can be used as proxies for effort. If the firms being supported have not yet achieved a significant level of export, or if variations in exchange rates create too much interference to assess underlying competitiveness fairly, looking at export performance or any single indicator may fail to give a fair idea of effort.

Even if proxies were available to measure how competitiveness was improving, a credible contract for financing effort would also require compulsions for the production team to put in high levels of effort in a sustained way. Without this pressure, a production team receiving a subsidy that allows it to produce could simply replicate its existing routines without experimenting to improve its productivity. Given that raising productivity involves costs and risks for the management teams of a firm, it may be rational for them to try and live off the subsidies. Management effort could then go into sustaining the subsidies by making political alliances or sharing some of the rents with factions within government and the bureaucracy. The political links of firms can make subsidy withdrawal too costly for many governments, and firms with such links are unlikely to put high levels of effort into the process even if performance could be measured. The characteristics of firms, the types of markets they operate in and the institutional and political context can each define constraints on measuring and ensuring high levels of effort in learning.

Figure 5.2 shows what happens to competitiveness over time with different levels of effort. Firms begin at point X where they require an initial loss-financing of $S^A_{Q}$ to produce a product of quality $Q$. With high effort, firms can increase their productive capabilities to become competitive.
at time $t = n$. But with low effort, their productivity growth is not high enough to catch up with the leaders (whose productivity is also growing), and in this case the continuation of production will require indefinite loss-financing. An important consideration, often not recognized, is that when governments provide the financing for learning, firms face adverse incentives for putting in high effort. The ‘prize’ for firms that put in high effort and become competitive is the loss of their financing! Successful firms effectively substitute uncertain market profits for the subsidies that allowed them to operate with much lower levels of uncertainty.

The result is often a serious incentive compatibility problem in a context of uncertainty that can induce ‘satisficing’ behavior from management. The existing routines of production within such firms may be difficult to change and it may be easier to expend management effort on ‘political

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2 Herbert Simon argued that in contexts of bounded rationality, where it is not possible to know all the consequences of actions, decision makers will not necessarily maximize. Instead, satisficing can be a sensible strategy whereby the aim is to achieve satisfactory levels of returns, without exposing firms to uncertain outcomes (Simon 1956).
activity’ to protect subsidies. Not surprisingly, managers are only likely to put a lot of effort into developing organizational capability and competitiveness when there are credible pressures on them from outside, such as from financing agencies or the state. Otherwise, satisficing strategies may emerge, with low effort in raising competitiveness and more effort in protecting subsidies. Even if there is productivity growth, if this is too low the competitiveness threshold may never be achieved if productivity is also increasing in the leader country. The infant industry will fail to grow up and eventually catching-up strategies will have to be abandoned, but this may be years later and managers and workers may not be too concerned about this right away.

5.9 CAPABILITY DEVELOPMENTS IN ASIA

Most of the literature on industrial policy refers to the East Asian experience, particularly the Republic of Korea, during the 1960s and 1970s, when the financing of organizational capability development took place through significant ex-ante rents to firms, with enforceable conditions that ensured high effort in raising competitiveness. However, for historical reasons, the East Asian economies were unusual in that they had political settlements that allowed the enforcement of tough conditions on the domestic firms that received this type of support (Khan 2009; Khan and Blankenburg 2009). In the Republic of Korea, significant rents were allocated ex ante to large firms to provide time and resources for learning-by-doing. The financing provided to the chaebols through low-interest loans, protected domestic markets and export subsidies came with credible sanctions if export targets were not met. The buoyant global markets at that time and the ability of diversified chaebols to start exporting quickly meant that export performance was a good indicator of effort. The political and institutional conditions in the Republic of Korea also allowed corrective and sometimes punitive action to be taken against recipients of subsidies if export and other evidence suggested low effort. For instance, the state could not only withhold export subsidies if export growth was not achieved, it could also reallocate the ownership of plants to different chaebols if they were more likely to acquire the necessary organizational capabilities. Not surprisingly, this ensured high effort in acquiring the requisite productive capabilities by all the organizations receiving support.

When other developing countries, such as India and Pakistan, attempted broadly similar types of industrial policy support for infant industries in the 1950s and 1960s, they did not have the institutional and political conditions that could define and impose credible conditions for ensuring high
levels of effort. As a result, effort was often low and technological and organizational capabilities developed much more slowly. Indeed, many firms and sectors that were supported at that time never became competitive (Khan 1999, 2011, 2013a).

Today, these instruments for financing capability development would only make sense if market conditions for a contemporary late developer allowed a similar export-oriented manufacturing growth strategy, and if the political and institutional conditions allowed the enforcement of similar conditions on firms receiving support. Not only have the rules for participating in global trade changed, but the relevant features of the political settlement in the Republic of Korea that allowed its state to monitor and discipline particular types of rents were very different than political settlements today in most developing countries (Khan 2010, 2012b). If the only instruments available for financing the development of organizational capabilities were those the Republic of Korea used, most developing countries’ industrial policies would fail because they typically lack the institutional and political capabilities to monitor and police significant rents allocated ex ante to large firms in this way.

Fortunately, the Republic of Korea’s model of centralized subsidy allocation is not the only one for addressing contracting failures affecting learning (Khan 2000a, 2000b). The experience of successful sectors in developing countries with very different political settlements shows that other types of financing instruments can be effective even when governance conditions appear to be adverse for the type of industrial policy used in the Republic of Korea (Khan 2013b). The critical requirement is only that the institutional and political conditions have to be appropriate for creating credible incentives and compulsions for high effort given the financing instruments that are being used. This is borne out by examples of successful technology adoption in some sectors in Bangladesh, India and Thailand (Khan 2009, 2011, 2012a, 2012b).

Effort can be forthcoming if the financing instruments not only provide the resources for financing learning, but also create compulsions on firms by imposing conditions for a high degree of effort that are credible given the enforcement capacities of the state. Where this happened, the state still had to do some monitoring and enforcement, but this was successful if it was restricted to conditions that the state could credibly monitor and enforce. The development of India’s automobile sector provides one such example.

In the 1980s and 1990s, India’s automobile sector made the transition from a protected and largely inefficient sector producing low-quality cars for the domestic market to become a major global player. This was made possible by a unique combination of industrial policy instruments that
financed capability development in the 1980s in the automobile sector based on a combination of public and private financing instruments (Khan 2009, 2011). Under the earlier strategies of centrally administered protection, there was no compulsion on India’s protected automobile manufacturers to make the effort to achieve competitiveness in global markets. But the new strategies in the 1980s provided public rents with conditions attached that resulted in credible compulsion for a high degree of effort in building the organizational capabilities of producers.

When domestic companies were the only producers that received rents, the state failed to impose effective conditions on them. The learning effort, and therefore productivity growth, was low, resulting in the production of globally uncompetitive cars. Change came in the 1980s when Japan's Suzuki became a joint venture partner in a public sector Indian automobile company, and Maruti-Suzuki was born. In contrast to previous strategies for financing, this time there were credible conditions that induced high effort. Suzuki was given access to the significant rents in the protected domestic market, where tariff protection was still around 85% in the 1980s, but it had to achieve 60% local content within five years. Denying Suzuki access to the domestic market if the target was not met was a credible threat that forced Suzuki to transfer organizational and technological capabilities to local component suppliers. Clearly, this instrument cannot be used for countries that have already joined the World Trade Organization, which generally does not allow domestic content conditions. But this example shows how the design of financing conditions that are credible can have a remarkable effect on effort in countries where standard infant-industry protection strategies had failed to induce much effort.

To meet local content requirements, Suzuki had to invest significant resources and effort in upgrading tacit productive capabilities, not only in its own joint venture plant, but also along the entire Indian supply chain for automobile components. Suzuki's incentive was the significant rent it could achieve after meeting the local content target, but to get there, it had to invest in learning and in the transmission of organizational capabilities to a range of Indian component producers. The company therefore had no possibility of satisficing, because its ex-ante investments had to succeed if it was to collect the promised future rents. This created a financing instrument with both incentives and credible compulsions for high-effort development of organizational capabilities. Suzuki invested in and worked with its local suppliers to improve their quality-control procedures and internal organization of production to achieve the local content it had committed to. The results of its effort to transform the productive capabilities of India’s tier-one and tier-two producers were spectacular. Maruti rapidly became the dominant model in the Indian market.
This financing arrangement was repeated in subsequent government-supported deals, allowing other major foreign automobile producers access to the rents in the Indian domestic market in exchange for further investments in the organizational capabilities of domestic component producers over the next decade. By the late 1990s Indian automobile component producers were competitively entering the export market in their own right, and winning international quality recognition, such as the Deming Prizes. The viability of a globally competitive but domestically owned automobile industry depends on the presence of domestically owned globally competitive tier-one and tier-two components producers who can make the parts required for a domestically produced car. By the 2000s, the emergence of a broad range of globally competitive Indian components producers allowed Indian auto companies such as Tata and Mahindra to launch Indian branded cars.

Other examples of successful learning from Bangladesh, India and Thailand show that organizational capability development can be successfully financed in contexts very different from that of the Republic of Korea provided appropriate financing instruments are used. These successful strategies were based on combinations of public and private financing instruments that were appropriate for the context and created incentives and compulsions for high effort in developing productive capabilities that were credible given the enforcement capacities of the state.

It is important to distinguish between the problem of financing learning and the first-mover problem because the types of financing and the conditions required for success are very different. If the development of organizational capabilities is important, then support should not be limited to ‘new’ sectors. Many sectors that lack competitiveness, such as India’s automobile sector in the 1980s, can be supported with appropriately designed financing to help them achieve competitiveness. Equally, time-bound support for new sectors may not lead to discovery unless there are actually hidden areas of comparative advantage that only need to be discovered. It is unlikely that countries have hidden comparative advantages that experiments will ‘reveal.’ Repeated experiments in different sectors are only likely to reveal that the country is not competitive in anything because it lacks organizational capabilities in every sector.

The emergence of new sectors, even those using very simple technologies such as the Bangladesh’s garments industry, are usually not discoveries of innate capabilities, but rather the results of successful organizational development. The upgrading of sectors, such as the development of the competitive automobile sector in India in the 1980s, is also clearly not the result of a discovery of hidden comparative advantage, but rather the result of finally acquiring the necessary tacit productive capabilities. The
challenge is to design incentives for partnerships between technology providers and domestic firms to transfer competitive production capabilities to domestic firms. However, the structure of the financing is critical and has to ensure that all parties put in a high level of effort in raising competitiveness while they are enjoying the additional financing. The design of the financing instrument is therefore essential for industrial policy success.

5.10 CONCLUSIONS

While countries define their own industrial policy objectives, in general it will be desirable for developing countries to (1) become competitive in a variety of products at the highest feasible levels of quality, (2) ensure these capabilities can rapidly spread to create clusters of firms creating new jobs and (3) move up the quality ladder across product categories to achieve wage and productivity growth. These goals require solutions to a number of potential contracting failures, but the most essential failure to address is the low levels of organizational capabilities in firms in developing countries. In financing this process, it is safer to be conservative at the early stages of industrial policy by choosing somewhat simpler technologies and qualities to support, for two reasons.

First, simpler technologies and qualities in which the learning periods are shorter require simpler monitoring and enforcement conditions to be successful. Where the gap in competitiveness is small, the results of successful learning are more rapidly observed and instruments that are not effective can be abandoned before the social loss of failed financing becomes too great. Second, if the organizational capabilities in a society are generally low, clustering through imitation is more likely if the technological and organizational capabilities required to imitate the successful first movers are closer to the average capabilities of firms in that society. In general, these spread effects are very important and there is little point in creating one or two high-quality firms that produce high-quality products that other firms in that country are too far behind to feasibly imitate.

The important point that theory and evidence suggest is that forms of financing that worked in some political and institutional conditions will not necessarily work in others. The critical requirement for success is that the conditions of getting support should also create credible compulsion for a high degree of effort in raising competitiveness. The historical experience from a number of developing countries suggests there are examples of successful capability development even in countries that have political settlements that appear to be adverse for industrial policy as traditionally
understood. This suggests that closer attention to the design of financing instruments for supporting learning, such that they create credible compulsion for high effort given the political settlement of the host country, can help develop policies that can accelerate the development of new sectors and upgrade existing sectors.

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Industrial policy design and implementation challenges


6. Catching up: structural transformation and diversification

Justin Yifu Lin and Yan Wang

6.1 INTRODUCTION

Structural transformation is critical to economic development. It is the reason why some nations have prospered since the Industrial Revolution while others have languished. The former are those whose economies became more diverse (they produce a wider range of products and services) and more sophisticated (they make products/services that contain a higher value-added). In today’s globalized world, structural transformation is even more critical—and difficult—because even though goods and services are reasonably freely traded across borders, other factor endowments—physical, human and natural capital such as land—face barriers or are completely immobile across borders.

In recent decades, many developing countries have tried but failed to catch up with the industrial countries, often because they are unable to transition beyond exporting natural resources and primary products—the well-known resource curse. Indeed, in the past half century, only 28 developing countries have closed the income gap with industrial countries by 10% or more, and among these only 12 were non-European and non-resource-based countries, mostly Asian. In this region, the past decades have seen rapid catch-up growth in the People’s Republic of China (PRC), Indonesia, India, the Republic of Korea, Malaysia, Singapore, Thailand and Viet Nam. In these countries, industrialization quickly transformed subsistence, agrarian economies and lifted several hundred million people out of poverty in the span of a generation. However, much of the rest of the developing world, where one-sixth of the world’s population lives, is struggling to sustain economic growth (Lin 2012a: 14).

This chapter builds on the intellectual foundation of the theory of New Structural Economics proposed by Justin Lin (2010, 2012a). It discusses structural transformation as a source of growth and job creation in developing countries. It reviews the historical experiences of successful transformation to point out the importance for a country to follow
its comparative advantage and invest its resource rents in productive assets. We argue that as labor costs rise rapidly, the PRC will lose its comparative advantage in labor-abundant products and, consequently, it will abandon labor-intensive industries. This will lead to the relocation of low-skilled manufacturing jobs to other low-wage countries. We apply the Growth Identification and Facilitation Framework to identify appropriate strategies for catching up in low- and middle-income countries.

The theory of New Structural Economics is based on three main ideas. First, an economy’s factor endowment structure evolves with its level of development. As a consequence, its industrial structure will vary with that level. Each level of industrial structure requires corresponding degrees and types of infrastructure, both tangible and intangible, to facilitate operations and transactions.

Second, each level of economic development is a point along a continuum that ranges from a low-income agrarian economy to a high-income, post-industrialized economy. Development is not a dichotomous process with just two levels. This means that industrial upgrading and infrastructure improvement targets in developing countries should not necessarily draw from those in high-income countries.

Third, at all levels of development, the market is the basic mechanism for effective resource allocation. However, economic development, as a dynamic process, entails structural changes involving industrial upgrading and corresponding improvements in ‘hard’ (tangible) and ‘soft’ (intangible) infrastructure at each level (Lin 2012a: 14–15).

During the last six decades, countries that took off and caught up with advanced economies were mostly labor-abundant East Asian economies, and vastly different from other resource-abundant and labor-scarce countries. This chapter analyzes all three types of economies: resource-poor and labor-abundant, resource-rich and labor-abundant, and resource-rich and labor-scarce. We argue that both the New Structural Economics and the Growth Identification and Facilitation Framework can be used to analyze the three groups of economies.

This chapter briefly reviews the literature, examines the experience of industrialization in today’s advanced countries and discusses strategies appropriate to countries that are either labor abundant or resource rich for transforming their assets (that is, their endowments) into productive assets. We present specific strategies for resource-rich countries and use the Growth Identification and Facilitation Framework to identify latent comparative advantages. We provide two examples of the first step of the Growth Identification and Facilitation Framework. We propose Australia as a target country for Kazakhstan (a resource-intensive and labor-scarce country), and look at how to use the PRC as a target for labor-abundant countries.
6.2 STRUCTURAL TRANSFORMATION: THE KEY TO PROSPERITY

History shows that modern economic growth is a process of continuous changes in technology, the structure of industry and socioeconomic institutions. Except for a few oil-exporting countries, no country has achieved high-income status without industrializing and upgrading. To make the transition from a traditional agriculture-based economy, or from a resource-based economy, into a modern one, economies need to develop a full and longer value chain of production in, for example, processing trade, light and heavy manufacturing, and services. They also need to shift from land- and resource-intensive sectors to labor-intensive or to capital- and technology-intensive ones. This requires learning, innovating and upgrading across these production areas.

Since productivity growth is associated with technological change and industrial upgrading, it can be said that continuous structural change in technology and industry is the main feature of modern economic growth (Kuznets 1966). In Western Europe, annual income per capita growth before the eighteenth century was about 0.05%. It accelerated to about 1% in the eighteenth and nineteenth centuries and reached 2% in the twentieth century. The time needed to double per capita income thus fell from 1400 years before the eighteenth century to 70 years in the eighteenth and nineteenth centuries and to 35 years in the twentieth century.

History also shows that following comparative advantage to tap late-comer advantages is the best way for developing countries to initiate and then sustain diversification, industrialization and growth (Lin 2009; Lin and Monga 2011). The spread of industrialization in Western Europe throughout the nineteenth century, rapid catch-up after World War II and the East Asian ‘miracle’ during 1980–2000 are all reminiscent of the ‘wild-geese flying pattern’, briefly discussed later in this section.

Early structuralist economists, such as Kuznets (1930) and Akamatsu (1962), missed an important aspect of the catch-up process, namely, the importance of comparative advantage. These economists argued that catch-up was not random. Kuznets (1930) and later Rostow (1960) explored the conditions under which the Industrial Revolution occurred in the United Kingdom (UK) and how it spread only to countries with sufficient accumulation of capital, skilled labor and other appropriate conditions. Gerschenkron (1962) observed that rapid industrialization started from different levels of ‘economic backwardness’ and that capital accumulation was not a precondition for success. In fact, ‘the more backward a country’s economy, the greater was the part played by special institutional factors [government agencies, banks] designed to
increase the supply of capital to the nascent industries’ (Gerschenkron 1962: 354).

Akamatsu’s (1962) work on Japan is of great interest for developing economies. In a seminal 1932 paper, only translated into English in the 1960s, he documented the wild-geese flying pattern of economic development (Akamatsu 1962: 3–25), noting that ‘wild geese fly in orderly ranks forming an inverse V, just as airplanes fly in formation’ (Akamatsu 1962: 11). This pattern describes the sequential order of the catch-up process of industrialization of latecomer economies. It focuses on three dimensions or stages: intra-industry, inter-industry and the international division of labor. The last dimension involves the relocation of industries across countries, from advanced to developing. A prominent feature of this dimension is that exports of consumer goods start declining and capital goods start being exported. In this stage, too, a group of economies advance together through emulation and learning-by-doing.

However, as noted earlier, Akamatsu missed an important aspect of catch-up: he did not link the flying-geese pattern to the endowment structure of countries and comparative advantage. He did not recognize that the market mechanism is a necessary condition for a country to successfully follow its comparative advantage. However, he did note that the accumulation of capital, people’s technological adaptability and government protection policies to promote consumer goods industries matter for the flying-geese pattern (Akamatsu 1962: 13).

Traditional structuralist views and New Structural Economics differ significantly. The latter contends that latecomers can use the flying-geese model to catch up and move up the value chain only if they follow their comparative advantage when they upgrade their endowment structure. This is called ‘comparative advantage following’ (Lin 2010). Here, latecomers can follow the lead goose if their income levels and endowment structures are not too far apart, and can tap into the latecomer’s comparative advantage and reduce their risk and cost of innovation. As long as a country’s industrialization is in line with its comparative advantage, there is no need for governments to adopt protectionist policies, because firms will be able to withstand market competition. Rather, the role of government is limited to facilitating the entry of firms into new industries

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1 Gerschenkron did not account for the possibility that a poor country may be able to build up capital-intensive industries through government resource mobilization, although firms will not be viable in an open, competitive market and their survival will rely on continuous government protection and subsidies, not only causing misallocation of resources but also rent seeking and political capture. After initial investment-led growth, the economy may encounter stagnation and frequent crises (Lin 2009).
in which a country has latent comparative advantage by overcoming the externalities and coordination issues inherent in industrial upgrading and diversification.

6.3 THE SPREAD OF INDUSTRIAL REVOLUTIONS: CHOOSING THE RIGHT TARGET

The Industrial Revolution started in the UK during 1730–80, although Belgium and the Netherlands were more industrialized at the time. For about half a century, it did not spread because the British government forbade the export of machinery, manufacturing techniques and skilled workers. Eventually, in the nineteenth century, the Industrial Revolution gradually spread to other countries in Western Europe, the United States (US), Russia and Japan. The first steam locomotive was invented in the UK in 1804, while other European countries did not start building railroads until the 1830s. Germany only built its first locomotive in 1835, and railway construction lagged because the country lacked an integrated central government to make these decisions. After the 1840s, however, German coal and iron production rocketed, and construction of a rail network began by the 1850s. After political unification in 1871, Germany exceeded the UK in length of new railroads, as well as in the production of pig iron and other materials.

Industrialization was delayed in the US because the country lacked the basic factor endowments, labor and capital to invest in business. When industrialization finally began in the 1820s, after capital and labor reached sufficient levels, growth was explosive. Workers and capital, fleeing political revolution in Europe, poured into the country. The US built its first locomotive in 1826 and constructed 9021 miles of track by 1850—longer than the UK’s network. By 1890 it had 129,774 miles of track as the rail network expanded westward (Depew 1895: 111), surpassing continental Europe’s entire network. Rapid industrialization and structural transformation followed. In 1800 some 85% of US workers were farmers; by 1860 this had declined to 50%.

As with Akamatsu’s theory, a weakness of Gerschenkron’s theory is that it does not stress the fact that for latecomers to be competitive, they must identify industries consistent with their comparative advantage.

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2 An industry has latent comparative advantage if, based on its factor costs of production (determined by its endowment structure), it is competitive. However, owing to high transaction costs (determined by infrastructure, logistics and other business conditions), the industry is not yet competitive in the global market.
Industrialization can start from a low level of economic development. However, if the level is too low, industries that are too advanced will be ‘comparative advantage defying’ and require heavy subsidies and protection from the state. With government support, it is possible to set up advanced industries, but as long as they are comparative advantage defying, they will be neither viable nor competitive.

Japan’s income level in 1850 was only one-third of the West’s, but it achieved rapid catch-up to become Asia’s first industrial country by 1904. After opening up trade in 1854,3 the government sent high-level missions, including nearly half of the country’s government ministers, to the US and Europe to learn about western technologies and institutions. After signing the Ansei Treaty in 1858, Japan lost control of tariff policy, but the government acted as facilitator by building modern infrastructure and encouraging learning-by-doing. Telegraph services between Tokyo and Yokohama began in 1870 and the first railroad, connecting Yokohama and Shinbashi, began running in 1872. By 1900 the country had 3875 miles of track (Ito 1992). To introduce foreign technology, the government in the late 1800s imported modern machines and hired thousands of foreign experts to instruct Japanese workers and managers.

Throughout the Meiji period (1868–1912), Japan’s top exports were raw silk yarn, tea and marine products, shipped mainly to the US. As Japan’s cotton industry grew, cotton imports fell steadily, but by 1890 the country was exporting large quantities of yarn and cloth to neighboring countries—intra-sector upgrading, as Akamatsu (1962) notes. On the institutional side, a banking system arose and a central bank was established in 1882. The government used gold from China as compensation for the 1894–95 war as reserves, enabling the country to set up a well-functioning gold standard system (Ito 1992: 21).

Just before World War II, textiles and other light industrial goods accounted for 60–75% of Japanese exports. Japan’s textile industry was at its peak before the war (Ito 1992: 24). By the 1960s, when per capita gross domestic product (GDP) was only 35% of that of the US, Japan started to target US industries (Table 6.1). Historical labor statistics show that a rising labor share in Japan’s manufacturing sector coincided with a declining labor share in the US manufacturing sector. In the 1960s and 1970s, Japan supported its heavy manufacturing sectors, notably machinery and automobiles, through policy actions. In the 1980s and 1990s, just as the

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3 In 1853 the US dispatched Commodore Matthew Perry to force Japan to open a port for free trade to supply ships to and from China. During 1854–58, Japan signed a series of treaties and three ports were opened by 1859: Kanagawa, Nagasaki and Hakodate. See Ito (1992).
### Table 6.1  Catch-up in pre- and post-war era, per capita GDP in 1990 international Geary–Khamis dollars

<table>
<thead>
<tr>
<th>Europe targeted the UK, gaps were small</th>
<th>Japan targeted Germany during the Meiji Restoration</th>
<th>Japan targeted the US after World War II</th>
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<tbody>
<tr>
<td>1870 % of UK’s GDP per capita</td>
<td>1890 % of Germany’s GDP per capita (in 1900)</td>
<td>1950 % of US’s GDP per capita (in 1960)</td>
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<tr>
<td>France</td>
<td>2376 % of UK’s GDP per capita</td>
<td>5186 % of US’s GDP per capita (in 1960)</td>
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<tr>
<td>Germany</td>
<td>2428 % of Germany’s GDP per capita (in 1900)</td>
<td>3881 % of US’s GDP per capita (in 1960)</td>
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<tr>
<td>UK</td>
<td>4009 % of Germany’s GDP per capita (in 1900)</td>
<td>6939 % of US’s GDP per capita (in 1960)</td>
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<tr>
<td>US</td>
<td>3392 % of Germany’s GDP per capita (in 1900)</td>
<td>9561 % of US’s GDP per capita (in 1960)</td>
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<tr>
<td>Japan</td>
<td>1012 % of Germany’s GDP per capita (in 1900)</td>
<td>1921 % of US’s GDP per capita (in 1960)</td>
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<tr>
<th>The Republic of Korea targeted Japan in 1960–80</th>
<th>Late comers started to target the People’s Republic of China (PRC) (after 2000)</th>
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<tr>
<td>1960 % of Japan’s GDP per capita (in 1970)</td>
<td>1980 % of PRC’s GDP per capita (in 2008)</td>
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<tr>
<td>UK</td>
<td>12931 % of Japan’s GDP per capita (in 1970)</td>
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<tr>
<td>US</td>
<td>13428 % of Japan’s GDP per capita (in 1970)</td>
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<tr>
<td>PRC</td>
<td>2167 % of Japan’s GDP per capita (in 1970)</td>
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<td>Korea, Rep. of</td>
<td>22 % of Japan’s GDP per capita (in 1970)</td>
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<td>PRC</td>
<td>4114 % of Japan’s GDP per capita (in 1970)</td>
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<tr>
<td>India</td>
<td>1061 % of Japan’s GDP per capita (in 1970)</td>
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<tr>
<td>Viet Nam</td>
<td>753 % of Japan’s GDP per capita (in 1970)</td>
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</table>

**Notes:**
- The Geary–Khamis dollar is a hypothetical unit of currency with the same purchasing power parity of the US dollar in the US at a given point in time.

**Source:** Authors, based on Maddison (2007); see also Chandra et al. (2013).
US was upgrading its industries, the Japanese home appliance, electronics and computer markets increased their shares (Chandra et al. 2013).

In sum, the historical experiences of these industrial revolutions offer several insights. They show that latecomers have the economic advantage of backwardness and can, under certain conditions, catch up quickly and even overtake leaders. Capital accumulation in itself is not sufficient for catch-up; political stability, openness to trade and labor mobility are also important for countries to acquire new technology and develop new industries. Governments need to play a facilitating role for development, as happened in Germany, Japan and the US. Indeed, without unification in 1871 and the creation of a centralized state, Germany would not have had either a railroad system or an industrial revolution at that time. Most importantly, choosing the right target is crucial to catching up. Some European countries caught up with the UK quite quickly because they were not too far behind in their development (Table 6.1). According to Maddison’s estimate, the per capita incomes of France and Germany were about 60–75% of the UK’s in 1870.4

Similarly, during the Meiji restoration, Japan targeted Germany’s industries at a time when its per capita income was about 40% of Germany’s. This was a realistic target rather than the UK or the US, which were too far ahead of Japan in their development. In the 1960s, Japan started to target the US, when the former’s per capita GDP was about 35% of that of the latter, and when it had already established a solid industrial base. Even though many nations tried to catch up, Japan succeeded and became the first industrialized nation from East Asia to do so because it made correct targeting choices.

In contrast, many developing countries failed to catch up after selecting targets that were too far ahead in per capita income. In the 1960s and 1970s, governments in Africa, Latin America and South Asia adopted well-intentioned policies and protective measures to catch up, but they selected leading countries with income levels ten or twenty times their own. For example, the PRC tried to target the automobile industry when its income level was only 5% of that of the US, and Indonesia tried to build ships when its income level was 10% of that of the Netherlands. These countries put a high priority on the development of capital-intensive heavy industries when, in fact, capital was scarce. To compensate for the absence of private firms in capital-intensive sectors, governments identified large state-owned enterprises to produce capital-intensive products. As comparative advantage defying industries, however, the state-owned enterprises were not viable without government subsidies and they inevitably failed.

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4 The UK’s per capita income in 1830 was $3190 in 1990 international Geary–Khamis dollars, while those of most countries in Western Europe were in the range of $1500 to $2500.
These countries failed to catch up during the 1950s and 1960s because they targeted industrial countries that were too far ahead and industries that were not aligned with their own comparative advantages in the early stages of their development.

6.4 BASIC STRATEGIES FOR CATCH-UP: FOLLOWING COMPARATIVE ADVANTAGE

The New Structural Economics postulates that each country, at any specific time, possesses factor endowments of land (natural resources), labor and capital (human and physical) that represent the total available budget a country can allocate to primary, secondary and tertiary industries to produce goods and services. Relative endowment abundance is fixed at any given point in time, but can change over time. This is also true for infrastructure (Lin 2012b: 21).

This framework implies that at any given point in time the structure of a country’s factor endowments determine the relative factor prices and, therefore, the optimal industrial structure (Ju et al. 2011). The endowment structure therefore endogenously determines a country’s optimal industrial structure—that which will make it most competitive.

A country’s vision for development usually involves, in one way or another, augmenting the value of all its endowments and transforming them into diversified productive assets by investing in sectors that can produce at lower cost with comparative advantage (Figure 6.1). This way, the structure of production is concentrated in the sectors that intensively use the country’s abundant factors. This structure will generate economic surpluses and people will enjoy decent jobs and higher welfare.

Why is it desirable to transform the composition of various forms of capital and diversify away from nonrenewable natural resources? We suggest three main motivations. The first and most important is to expand the scope of job creation and help poverty reduction. In most low-income, resource-rich countries, rural land is abundant and the majority of the poor reside in rural areas. Agribusiness and light manufacturing that use agricultural products and raw materials can create millions of jobs for the rural poor and raise their income and consumption, as has happened in Cambodia, the PRC, India and Viet Nam.

The second motivation is that a country’s human capital grows by accumulating both codified and tacit knowledge for producing and exporting. According to Hausmann (cited in Mitchell 2011), ‘The essential theory ... is that countries grow based on the knowledge of making things.’ They ranked 128 countries based on their ‘productive knowledge,’ which
Development and modern industrial policy in practice includes the skills, experiences and general know-how that a population acquires when it learns how to produce and export. In their view, countries with a high score in the ‘economic complexity index’ have acquired years of knowledge in a variety of products and goods and have greater potential for growth. Therefore, diversification away from resources and into manufacturing sectors will help countries build their productive knowledge base, including not easily transferable tacit knowledge.

Under New Structural Economics, productive knowledge and capabilities are key in determining a country’s potential new sectors. But the theory also holds that the target sectors that a capabilities’ analysis may indicate for future development must be in line with a country’s endowment structure. The Growth Identification and Facilitation Framework provides a practical guide to how to identify sectors aligned with a country’s comparative advantage. This tool can help policymak-

Notes:
PRC = People’s Republic of China.
Intangible capital includes human and institutional capital.


Figure 6.1 Composition of national wealth, selected countries, 2005

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ers in developing countries identify industries with latent comparative advantage, as well as facilitate the development of the private sector (Lin and Monga 2011).

The third motivation is to reduce macroeconomic volatility due to large swings in commodity prices and to be able to sustain long-term growth, especially in resource-rich countries. Empirically, several studies have found that a higher concentration of exports is associated with greater volatility of the real exchange rate and GDP growth. In addition, a high degree of concentration and exchange rate volatility could be a channel for the spread of the resource curse.5

East Asia’s experience shows that countries can diversify their structure successfully only if they follow their comparative advantage and accumulate productive assets. This is clearly seen in the successful transformations of the PRC, Indonesia and Malaysia.

6.4.1 The PRC’s Transformation into a Manufacturing Powerhouse

The PRC was an exporter of primary products in the late 1970s and early 1980s, when its per capita income was less than one-third of the average in sub-Saharan African countries. The country was land and labor abundant but capital scarce, and its exports were concentrated in resource-intensive raw materials and primary products. Until 1984, crude oil and agricultural products accounted for over 50% of the PRC’s exports (Figure 6.2).

The PRC has since been able to transform its natural capital into produced, human and intangible capital. Economic reforms and the opening of the economy after 1978 transformed a planned system into a market-oriented economy, increased job opportunities and enabled people to enjoy the higher returns of education. The establishment of special economic zones opened the country to foreign direct investment (FDI), enabling significant transfers of technology and the accumulation of tacit knowledge through learning-by-doing and learning-by-exporting.6 Today,

5 Frankel (2010) summarizes the extensive literature on the resource curse. Evidence shows that the economic performance of developing countries is often negatively related to their natural resource wealth, which is caused by: (1) currency appreciation, which reduces the competitiveness of nonextractive exports; (2) macroeconomic volatility; (3) corruption and political conflicts over rent capture and revenue management; and (4) misuse of rents on consumption rather than investment. However, the resource curse is not the focus of this chapter.

6 Recent literature underscores the importance of tacit knowledge in economic growth. It can take the form of business behavior, routines, attitudes and networks that are only available at certain locations where specific industries exist. Because tacit knowledge exists, Hausmann and Klinger (2006) contend that face-to-face communication is the most effective form of gathering information. Information and knowledge for innovation are acquired and transmitted through learning-by-interacting.
98% of the PRC’s exports are manufactured products and the country is integrated into the world’s most important supply chains (Lin and Wang 2008).

The PRC’s transformation from a primary product exporter into a manufacturing powerhouse would not have been possible had the economy’s original endowments remained unchanged during the last three decades. With annual savings at around 40% of GDP and dramatic improvements in education, its endowments of human, physical and financial capital have increased significantly. Indeed, the composition of total assets in the national wealth accounts has changed dramatically: the share of natural capital fell from 34% in 1995 to 25% in 2005, while the shares of produced capital and intangible capital increased concomitantly.

6.4.2 East Asia’s Flying-Geese Pattern

It has been argued that several generations of ‘lead geese’ played significant roles in the rapid transformation of the East Asian economies. Between 1965 and 1990, Japan emerged as the world’s biggest exporter of manufactured goods. A second generation of economies followed in the 1970s (Hong Kong, China, the Republic of Korea, Singapore and Taipei, China). A third

Note: PRC = People’s Republic of China.

Source: Lin and Wang (2008), updated based on UN COMTRADE data.

Figure 6.2 Transformation of the PRC’s export structure, 1984–2010
Structural transformation and diversification

A generation emerged in the 1980s (Indonesia, Malaysia, the Philippines and Thailand) and a fourth in the 1990s (the PRC and Viet Nam). Chandra et al. (2013) have provided empirical evidence of the flying-geese pattern of transformation in East Asia. The structure of textile exports illustrates the pattern (Figure 6.3) (Chandra et al. 2013: 66.)

6.4.3 The PRC’s Upgrading Provides Opportunities for Low-Income Countries

The PRC has now reached a stage similar to that of western countries and Japan in the 1970s, and the Republic of Korea, Taipei, China and Singapore in the 1980s. As labor-intensive industries matured, wages increased and firms moved into more technologically sophisticated industries in accordance with the upgrading of the endowment structure. The PRC’s wages have risen rapidly, from $150 per month in 2005 to $500 per month in 2012 and to over $600 per month in coastal regions in 2013 (growing at a rate of 15% a year, plus a currency appreciation of nearly 3% a year). Increasingly, enterprises under pressure to seek low-cost locations are moving inland or ‘going global.’ The PRC has an estimated 85 million workers in manufacturing, most of...
them in labor-intensive sectors, compared with Japan’s 9.7 million in 1960 and the Republic of Korea’s 2.3 million in 1980. The upward shift of the PRC’s manufacturing toward more sophisticated, higher value-added products and tasks will open up great opportunities for labor-abundant, lower-income countries to produce the labor-intensive, light-manufacturing goods the PRC leaves behind. As a result, the PRC will not be a goose in the traditional flying-geese model, but a leading dragon, so to speak, which opens up huge opportunities for numerous lower-income countries to step into the vacuum left by its industrial upgrading (Chandra et al. 2013).

Developing countries, especially those that are labor abundant, can benefit by attracting labor-intensive enterprises that are relocating out of the PRC. In particular, in Southeast Asia, the scarcity of local entrepreneurial skills and investment capital are invariably the top two constraints for a competitive manufacturing sector. The availability of outward FDI enables them to overcome these constraints and take advantage of enterprises relocating out of the PRC and other emerging markets. Figure 6.4 shows that the PRC leads the other three BRIC countries in FDI inflows and outflows.

![Figure 6.4](image.png)

**Notes:**
PRC = People’s Republic of China, FDI = foreign direct investment.

Foreign direct investment inflows and outflows comprise capital provided (either directly or through other related enterprises) by a foreign direct investor to an FDI enterprise, or capital received by a foreign direct investor from an FDI enterprise. Foreign direct investment includes three components: equity capital, reinvested earnings and intra-company loans. Data on FDI flows are presented on a net basis (that is, capital transactions’ credits less debits between direct investors and their foreign affiliates). Hence, FDI flows with a negative sign indicate that at least one of the three components of FDI is negative and not offset by positive amounts of the remaining components. These are called reverse investment or disinvestment.

**Source:** Authors, based on UNCTAD data (accessed October 2013).

**Figure 6.4 Outward FDI from the PRC and other countries, 2000–2012**
countries (Brazil, India and the Russian Federation) in outward FDI, with the amount rising from a few million dollars to over $84 billion in 2012, and with the Russian Federation, the Republic of Korea, India and Brazil following (United Nations Conference on Trade and Development 2013). A large proportion of outward FDI has been invested in neighboring Asian countries, mostly in greenfield investments, which provides opportunities for industrial relocation and upgrading in low-wage developing countries.

6.5 TRANSFORMING ‘WHAT A COUNTRY POSSESSES’ INTO ‘WHAT IT COULD DO WELL’

Can a resource-rich, labor-abundant economy, such as Papua New Guinea, benefit from the relocation of manufacturing industries from the PRC and develop its own labor-intensive manufacturing industries? The short answer is yes. Wages are low and are the major cost of production for labor-intensive industries.

The development of labor-intensive industries in Indonesia and Thailand decades ago and in Cambodia more recently are good examples. The development of labor-intensive manufacturing industries offers not only the potential to absorb surplus labor from the rural subsistence sector, but can also pave the way for upgrading into higher-value-added industries. One example is New England in the nineteenth century, when many textile and garment industries took advantage of abundant labor there. Finland’s Nokia is another. The company started with logging (Finland is wood abundant), but successively diversified operations, first into rubber boots (labor intensive) and later into original equipment manufacture of household electronics for Philips, before venturing into mobile phones (Lin 2011).

Most likely, resource-rich but labor-scarce developing countries cannot benefit directly from the relocation of labor-intensive industries out of the PRC, as their labor costs are typically high. It is therefore critical for them to sensibly use the rents generated from the exploitation of natural resources to facilitate the diversification of the productive structure into non-resource industries (as shown in the case of Australia in Figure 6.1). Many developing countries are land and resource abundant and producers of primary products in the first stage of their development. To upgrade their industrial structure, they must first close their endowment gaps, including physical, human and institutional (intangible) capital, with advanced industrial nations. Consistent with New Structural Economics, these countries ought to follow their comparative advantage, although
this does not mean that they should specialize in what they do well (that is, resource-intensive products). Rather, their strategy should be to identify what they could do well; that is, to identify their latent comparative advantage.\footnote{An economy has latent comparative advantage in an industry if, based on the factor costs of production determined by the economy’s resource endowment structure, the industry should be competitive. However, due to high transaction costs, determined by infrastructure, logistics and other business conditions, the industry is not yet competitive in the global market.}

The next two sections examine the existing comparative advantages of several countries. They then introduce the Growth Identification and Facilitation Framework to identify the latent comparative advantage and discuss several options for industrial policy.

### 6.5.1 Making the Best of the Existing Comparative Advantage for Transformation

Throughout history, some resource-rich countries have been able to turn their natural resources into a blessing. They have done so by using their existing comparative advantage and transforming their natural-resource rents into human and physical capital and other assets. Such countries accumulated capital, upgraded their endowments, improved infrastructure and transformed their industrial structure. Subsequently income in these economies increased faster than in other labor-abundant, resource-poor countries (Lin 2011). Scandinavian countries provide one such example. They have demonstrated superior stewardship of the wealth that their natural resources generated, and shown that transparent administration of resource rents and investment in human capital and infrastructure can increase labor productivity, reduce production and transaction costs, and offset the adverse effects of the ‘Dutch disease.’ The Scandinavian experience holds valuable lessons for resource-rich developing economies.

However, in low-income countries, state capacity may be too weak to collect revenue from natural resource extraction, and institutions and regulations may not be in place to ensure that fiscal revenues are allocated to projects with the largest developmental impact. Rent seeking and corruption may also be common in this situation. There are two options in these circumstances.

First, if the government is able to collect revenues from natural-resource extraction, the country could then establish a national wealth or price stabilization fund for investment or for future use (International Monetary
Countries could also establish a five-step ‘extractive industries value chain,’ as suggested by Alba (2009) and the World Bank (2011: 122).8 Second, a country could design a transparent and environmentally sustainable resource for infrastructure so that natural resources are transformed into physical infrastructure and add to productive capacity (IMF 2011: 25). This could have a developmental impact many years ahead of that provided by the first approach. Resource-for-infrastructure strategies have become increasingly attractive for this reason, with over 35 countries adopting them in one form or another. In Ghana, the most recent example, the International Monetary Fund raised its non-concessional borrowing limit to $3.4 billion so that the country could borrow to build infrastructure and boost the manufacturing sector for job creation capacity (Barma et al. 2010: 193).

We stress that for these options to work, countries first need to identify their comparative advantages, and a standard method can be used to calculate the revealed comparative advantage (RCA) (Box 6.1). A country is said to have revealed comparative advantage in a sector if its RCA > 1. Figure 6.5 shows the number of sectors (out of a total of 97) where RCA > 1.

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BOX 6.1  THE MEASUREMENT OF COMPARATIVE ADVANTAGE

Identifying existing comparative advantage is straightforward, as several established indicators can be used. Here the analysis mainly relies on one established indicator, the revealed comparative advantage, available in the World Integrated Trade Solution database.

This is a useful concept, based on Balassa (1965), to measure whether a country has a revealed comparative advantage in a commodity that it is already exporting. It is calculated as follows:

\[
RCA_{j} = \frac{x_{ij}/X_{it}}{x_{wj}/X_{wt}}
\]

where \(x_{ij}\) and \(x_{wj}\) are the values of country \(i\)'s exports of product \(j\) and world exports of product \(j\) and where \(X_{it}\) and \(X_{wt}\) refer to the country's total exports and world total exports. Therefore, if RCA > 1, a country is said to export the product in question with revealed comparative advantage.

Source: Based on World Bank, World Integrated Trade Solutions.

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8 The natural resource management value chain consists of five steps: (1) sector organization and contract award, (2) regulation and monitoring of operations, (3) collection of taxes and royalties, (4) revenue distribution and management, and (5) sound and sustainable policies (Alba 2009).
Development and modern industrial policy in practice

Comparing across middle-income countries, the Russian Federation and resource-rich Kazakhstan have only 11 sectors with RCA > 1. Lower-income countries, such as Indonesia and Viet Nam, have more sectors with RCA > 1. The PRC is the most diversified country in the group, with 46 sectors out of 97, with RCA > 1.

6.5.2 The Growth Identification and Facilitation Framework

The Growth Identification and Facilitation Framework posits that latecomer countries are able to catch up with industrial countries if they identify a set of correct target countries and sectors consistent with the latecomer’s comparative advantage. Economists have long debated whether industrial policy, in particular ‘picking winners,’ is a good idea for developing countries, which often have weak institutional capacity and poor governance. The Growth Identification and Facilitation Framework argues that identifying the right target country (or countries) and industries with good potential for growth and competitiveness, is a precondition for successful catch-up. Why?

Notes:
PRC = People’s Republic of China, RCA = revealed comparative advantage.
The figure on top of each bar is the number of sectors with RCA > 1 (indicating that the country has a comparative advantage in that sector), out of a total of 97. They refer to 2010 or 2011.

Source: Authors, based on World Bank, World Integrated Trade Solutions, HS2 1996 code for 97 sectors.

Figure 6.5 Number of sectors with RCA > 1

for a sample of countries for 2010–11. Comparing across middle-income countries, the Russian Federation and resource-rich Kazakhstan have only 11 sectors with RCA > 1. Lower-income countries, such as Indonesia and Viet Nam, have more sectors with RCA > 1. The PRC is the most diversified country in the group, with 46 sectors out of 97, with RCA > 1.
First, governments always have limited resources to invest in hard and soft infrastructure, which are often sector specific. A developing country cannot be successful in all sectors. Successes are often found in individual sectors, such as textiles in Mauritius, apparel in Lesotho, cut flowers in Ethiopia or gorilla tourism in Rwanda. For cut flowers, airport refrigeration facilities and regular flights are required to ship them to markets overseas, which are obviously different from the port facilities for Mauritius’ textile exports. Governments must therefore choose which infrastructure to improve and where to provide these services to facilitate the private sector activities.

Second, identification is needed because industrial clustering is essential for economies of scale to materialize and for reducing costs. Specialization, agglomeration and clustering are vital for reducing transaction costs in any given industry. The government needs to provide infrastructure services in certain locations or incentives for first movers in certain sectors; otherwise, private firms may be spread too thinly over too many sectors, which would reduce the survival chances of these firms and the chances of gaining a competitive edge in the international market.

There are many examples of failures and successes in picking winners. Ireland has done both. In the 1950s, it adopted an industrial policy known as a ‘heavy state interventionist but hands-off approach,’ based on providing tax incentives, grants and subsidies to encourage investments that targeted exports, but there were few takers and Ireland remained among Western Europe’s poorest countries. In the 1980s, Ireland’s Investment Development Authority started to pick winners, focusing on electronics, pharmaceuticals, software and chemicals. It courted FDI in these industries from Germany, the UK and the US, and managed to attract nine of the world’s top ten pharmaceutical firms, and 12 of the top 15 makers of medical products. Google, Yahoo, eBay and Amazon and other information and communications technology companies also set up plants in Ireland (Lin 2012b: 153).

What, then, is the best procedure to identify the right target countries and industries? The following summarizes the six steps identified by Lin and Monga (2011), based on the Growth Identification and Facilitation Framework:

- Choose the right target country and sectors. Policymakers should select dynamically growing countries with similar endowment structures. Among these, they should select countries with per

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9 For the African success stories, see Chuhan-Pole and Angwafo (2011).
capita incomes about 100% higher (measured in purchasing power parity). They must also identify the tradable goods and services that have grown well in those countries for 15–20 years. These are likely to be new industries consistent with latent comparative advantage, as countries with similar endowments are likely to have similar comparative advantage. A fast-growing country that has produced certain goods and services for about 20 years will begin to lose its comparative advantage as wage levels rise, leaving space for countries with lower wages to enter those industries. There are therefore two sub-steps in this process: one is to choose target countries with a per capita income that is not too far ahead of the home country; the other is to identify industries in those countries consistent with the latent comparative advantage of the home country.

- **Assist domestic private firms.** If some private domestic firms are already present in those industries, they need tacit or local knowledge that lowers costs and makes them competitive (Bahar et al. 2013). Policymakers should identify the obstacles that prevent these firms from upgrading their products and the barriers that limit entry into those industries by other private firms. Policies can then be implemented to remove constraints and facilitate entry.

- **Attract global investors.** For those industries where no domestic firm is present, policymakers should try to attract FDI from some of the countries listed in the first step or from other higher-income countries that produce those goods. Such foreign investors will likely possess the general and tacit knowledge required for the design and production as well as the supply chain and distribution channels of those industries. Governments should also set up incubation programs to encourage start-ups in these industries.

- **Scale up self-discoversies.** In addition to the industries identified in the first step, governments should pay attention to spontaneous self-discovery by private enterprises and support the scaling-up of successful private innovation in new industries. Owing to rapid technological changes, many new opportunities arise—opportunities that would not have existed a decade or two before, as those industries did not exist in the rapidly growing comparator countries. Examples include mobile phones and related e-services, social media and green technologies.

10 Tacit knowledge is not easily transferable and takes different forms: business behavior and attitudes, routines, networks, etc. (Bahar et al. 2013).
• **Recognize the power of industrial parks.** In countries with poor infrastructure and an unfriendly business environment, the government can set up special economic zones or industrial parks to help overcome barriers to firm entry and foreign investment. Establishing industrial parks or zones can also facilitate the formation of industrial clusters and hence reduce production and transaction costs.

• **Provide limited incentives to the right industries.** Policymakers can compensate pioneer firms in the industries identified with time-limited tax incentives, cofinancing for investments or access to foreign exchange. This is to compensate for the externalities created by the first movers and to encourage firms to form clusters. Because the identified industries are consistent with the country’s latent comparative advantage, incentives should be limited in both time and financial cost. To prevent rent seeking and political capture, governments should avoid incentives that create monopoly rents, high tariffs or other distortions. Moreover, incentives should be linked to performance and be continuously evaluated against stated objectives (Lin 2012a).

### 6.6 THE FIRST STEP OF THE GROWTH IDENTIFICATION AND FACILITATION FRAMEWORK: AUSTRALIA AS A TARGET COUNTRY FOR KAZAKHSTAN

This section provides an example of how to apply the first step of the Growth Identification and Facilitation Framework for the case of resource-abundant and labor-scarce countries. It uses Australia as a target country for Kazakhstan. The objective of the exercise is to show how a resource-rich and labor-scarce country can identify a target country for catch-up given their similar endowment structures. It is important that in the first step the identified target country has a similar endowment structure to Kazakhstan’s, and are dynamically growing. It is likewise important to identify the tradable goods and services that the target country has successfully produced for at least 20 years.

Table 6.2 shows a group of countries that Kazakhstan could potentially choose as target (with the rationale in the ‘Remarks’ column). Of these, we think that Australia is the ideal catch-up target for Kazakhstan for three reasons. First, both countries have similar population densities, natural resource endowment, and geography. Australia, like Kazakhstan today, was isolated from large global markets in the early 1900s, when ocean
Table 6.2  *Kazakhstan’s potential targets for catch-up*

<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td></td>
<td>GDP per capita</td>
<td>% of KAZ</td>
<td>GDP per capita</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>4499</td>
<td>100</td>
<td>8699</td>
</tr>
<tr>
<td>PRC</td>
<td>1849</td>
<td>41</td>
<td>4115</td>
</tr>
<tr>
<td>Malaysia</td>
<td>9129</td>
<td>203</td>
<td>11544</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>7851</td>
<td>174</td>
<td>11853</td>
</tr>
<tr>
<td>Chile</td>
<td>9629</td>
<td>214</td>
<td>12663</td>
</tr>
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<td>Korea, Republic of</td>
<td>15761</td>
<td>350</td>
<td>22783</td>
</tr>
<tr>
<td>Australia</td>
<td>25385</td>
<td>564</td>
<td>32719</td>
</tr>
</tbody>
</table>

*Note:* GDP = gross domestic product, KAZ = Kazakhstan, PRC = People’s Republic of China.

transport was expensive. Second, Australia’s per capita income measured in GDP purchasing power parity at constant 2005 international dollars was just under 300% that of Kazakhstan in 2011. It is therefore not overly ambitious for Kazakhstan to target Australia and its industries in the next ten to 20 years. Third, Australia successfully transformed its economy structurally from a commodity base to diversified industry.

Australia’s structural transformation went through several episodes (see Chapter 11). The country rapidly industrialized in the 1920s (peaking in the 1960s) and then moved into services in the 1980s. Our focus here is mainly on the first episode. According to Robertson (2008), Maddock and McLean (1987) and Boehm (1993), Australia’s structural transformation was dramatic. At the beginning of the twentieth century, farming and mining accounted for nearly 30% of total GDP, while manufacturing accounted for only 12%. Exports were heavily concentrated in wool, which accounted for 39% of total exports, and in agriculture (25%) (Table 6.3).

The share of manufacturing in output began to increase in the 1920s, propelled by international migration and investment flows. It accelerated during World War II, peaking during 1955–60, and then started declining. The share of agriculture started falling at mid-century, with the contribution of mining first declining and then increasing (Robertson 2008: 11) (Figure 6.6).

The proportion of workers engaged in agriculture, forestry and fishing declined from 25% of the labor force in 1901 to 3.4% in 2007 (Figures 6.7 and 6.8). The share of mining has also declined dramatically, and today it accounts for just over 1% of the total labor force. In both sectors, increased mechanization contributed to the long-term trend. In contrast, the share of workers in manufacturing rose to 26% in the postwar period and then declined to 14% in 1986. This trend continued until it reached 10.3% in 2007 (Figure 6.8). It is worth noting that construction as part of the services sector remained high and stable over the years.

The Australian government’s development strategy and policies played a

Table 6.3  Export product concentration (% of total exports), Australia, selected periods

<table>
<thead>
<tr>
<th>Years</th>
<th>Wool</th>
<th>Mining</th>
<th>Agriculture</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920–25</td>
<td>39.2</td>
<td>6.6</td>
<td>25.8</td>
<td>28.4</td>
</tr>
<tr>
<td>1945–50</td>
<td>43.1</td>
<td>5.1</td>
<td>20.7</td>
<td>31.1</td>
</tr>
<tr>
<td>2003–07</td>
<td>1.7</td>
<td>45.2</td>
<td>4.9</td>
<td>48.2</td>
</tr>
</tbody>
</table>

Source: Bhattacharyya and Williamson (2009).
Development and modern industrial policy in practice

**Figure 6.6 Economic structure, Australia, 1900–1981**

**Note:** The series from 1962–63 is not consistent with earlier years because of the use of a standard industrial classification.

**Source:** Maddock and McLean (1987).

**Figure 6.7 Composition of the labor force (by decade), Australia, 1901–86**

**Note:** Agriculture includes fishing, trapping, agricultural, pastoral and forestry. Electricity and gas are included in manufacturing, 1901–21. Water supply and others are included in construction 1901–21 and 1947.

**Source:** Robertson (2008).
Structural transformation and diversification

Significant role in the country’s structural transformation during and after World War II. Some policies succeeded, but others failed. ‘To avoid the resource curse, the Commonwealth [of Australia] adopted a three-pronged program for strengthening national defense as well as promoting long-term development. The basic premise was that Australia needed to substantially increase its population, which stood at 7 million people at the end of the war. To accelerate population growth, European migrants were recruited’ (Robertson 2008: 17). The labor shortage was resolved by attracting high-quality talent and migrants, shown by the rise in manufacturing employment during 1933–61 (Figure 6.6). After 1945, growth of government investment in both public infrastructure and education was high (Table 6.4).

Australia’s manufacturing sector grew significantly from the 1930s, spurred by migration and investment flows. This was achieved under the umbrella of import replacement policies, with this sector’s development seen as the main mechanism to generate jobs—and with the added benefit that this would also reduce Australia’s strategic vulnerability in the event of another war (Robertson and Trace 1983). Import restrictions and tariffs were imposed to protect industries such as automobiles, metal processing, chemicals, textiles and clothing and footwear. The average duty level was


Figure 6.8 Composition of the labor force (annual), Australia, 1984–2007
Development and modern industrial policy in practice

40–50% during the 1930s and 1940s, but declined to 20% during the 1950s and 1960s and to 10% in the 1990s (Lloyd 2008). After liberalizing trade in the 1990s, many industries lost competitiveness and disappeared.

Public investment played an important role in Australia’s economic development. Before World War II the government and its agencies accounted for about half of all capital formation (Maddock and McLean 1987). However, two other factors contributed to Australia’s structural transformation: the increasing importance of private foreign investment, especially in mining and manufacturing in the postwar years, and major rural development schemes based on publicly provided infrastructure.

Net foreign capital inflows rose in the postwar era, amounting to 9.4% of total gross fixed capital expenditure during 1950–55 and 13.2% during 1960–70. United States direct investment was the main driver behind this growth in the 1950s. In 1955, Australia started to export coal to Japan. In the following decades, Japan became the major destination for Australia’s raw materials and agricultural products. In the 1960s, the economy started to lose competitiveness against the newly industrializing economies in Asia, and the share of the manufacturing sector declined gradually from

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**Table 6.4 Growth rate in government gross capital formation (%), Australia, selected periods**

<table>
<thead>
<tr>
<th>Years</th>
<th>Aggregate growth of GGCF</th>
<th>Post and telegraph</th>
<th>Roads</th>
<th>Railways</th>
<th>Housing</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920–25</td>
<td>4.4</td>
<td>30.4</td>
<td>13.9</td>
<td>6.2</td>
<td>−11.9</td>
<td>8.3</td>
</tr>
<tr>
<td>1925–30</td>
<td>−1.5</td>
<td>−4.8</td>
<td>4.8</td>
<td>−1.0</td>
<td>−9.5</td>
<td>−5.0</td>
</tr>
<tr>
<td>1945–50</td>
<td>22.3</td>
<td>21.6</td>
<td>13.8</td>
<td>10.3</td>
<td>40.6</td>
<td>28.7</td>
</tr>
<tr>
<td>1950–55</td>
<td>12.7</td>
<td>10.2</td>
<td>13.9</td>
<td>11.6</td>
<td>8.7</td>
<td>19.9</td>
</tr>
<tr>
<td>2000–07</td>
<td>−2.3</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Notes:

... = data not available, GGCF = government gross capital formation.
Growth rates correspond to the complete period, that is, they are not annual growth rates.

Source: Bhattacharyya and Williamson (2009), based on Barnard and Butlin (1981).
25–30% of GDP at its peak between the mid-1950s and the late 1960s (Figure 6.6) to 14% in 1986. From then on, as real wages rose, Australia lost its comparative advantage in manufacturing, particularly in labor-intensive products and started to shift into services. This sector accounted for 71.2% of GDP and 75% of employment in 2010.

Robertson (2008: 22) observes that in the new millennium:

Australia’s population is now large enough to provide a minimum economic scale of demand for many fields of manufacturing as well as for the services industries that now dominate the economy... because of the broad spread of activities undertaken here, the Australian economy is also much less vulnerable in the short to medium run to external changes... The goal of insulating the economy against exogenous shocks has therefore been achieved to a significant degree.

In sum, Australia successfully diversified and transformed through openness to the flows of productive factors, including talented labor, FDI and trade. It has transformed ‘what the country has’ (natural resources) into those factors that it was short of (human and productive capital, including tangible and intangible assets). To get there, the government: (1) consciously tried to avoid the resource curse using the three-pronged strategies referred to earlier, (2) attracted foreign talent and labor and invested in human capital, (3) allocated government investment in public infrastructure such as roads, railways and communication, as well as in rural development schemes (Table 6.4), and (4) opened the mining and manufacturing sectors to FDI.

Australia’s experience is relevant to resource-rich and labor-scarce developing countries insofar as these economies also need to open up and integrate with the global market and create conditions to attract those factors that they do not have by wisely using those they have in abundance through; for example, trade, special economic zones and talent-attracting policies. Selecting a target country is an economic and a political decision that only the home country’s policymakers can make. Finally, Kazakhstan should learn from Australia how to attract talented people and technical experts. Here, labor market policy and urban infrastructure are important.

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13 No two countries are the same. Australia’s experience has limited relevance because it had high tariff protection in the early years. When tariff protection came down, some manufacturing industries lost competitiveness. Today, although the services sector dominates the country’s economic structure, the share of mineral exports remains large, accounting for over 60% of total merchandise exports in 2007 (ABARE 2007: table 6.3).
6.7 SELECTING SECTORS: THE PRC AS AN EXAMPLE FOR LOW-INCOME ASIAN COUNTRIES

Low-income and labor-abundant countries such as Bangladesh, Cambodia, the Lao People’s Democratic Republic and Myanmar could use the PRC as a target country. The PRC is losing competitiveness in some sectors as its costs rise, although it is normal that a fast-growing country producing certain goods and services for about 20 years will begin to lose its comparative advantage, and so leave room for countries with lower wages to enter those industries.

Figure 6.9 shows the PRC’s sunset sectors, that is, sectors whose employment shares are declining and therefore offer opportunities for low-wage countries. These sectors include textiles, chemical fibers, tobacco, certain metals and general purpose machinery.

Countries that start developing comparative advantage in the PRC’s

Note: The chart shows only subsectors where employment is declining or rising more slowly than the average for the urban manufacturing sector in the PRC. Percentage change is the difference between the 2002 and 2009 values over the 2002 value.


Figure 6.9 Sunset sectors in the PRC, % change in employment, 2002–09
Structural transformation and diversification

Sunset sectors should seize this opportunity; for example, by attracting outward direct investment from the PRC and start growing the sectors. Governments can play important roles in facilitating the development of these sectors, as shown in the other five steps of the Growth Identification and Facilitation Framework (Lin 2012a).

Countries in Asia and the Pacific hardly need to be persuaded of the advantages of industrial parks; several East Asian economies have successfully developed industrial clusters through their use. Examples include the chemical industry in Singapore’s Jurong Island, the Xinzhu high-technology industrial zone in Taipei, China and several special economic zones in Suzhou and Shenzhen in the PRC. But a recent success story in Ethiopia deserves special attention (Box 6.2).

6.8 CONCLUSIONS

The emergence of large middle-income countries such as Brazil, the PRC and India in the global arena has created an unprecedented opportunity for developing countries. In particular, the PRC, after achieving rapid and dramatic structural transformation over the past 35 years, can provide ideas, tacit knowledge and experience, and development finance and investment for transformation. As real wages rise in the PRC and in other upper middle-income countries, some manufacturing jobs will be relocated, along with outward direct investment, to other developing countries (World Bank 2012; Chandra et al. 2013). This will create huge opportunities for developing countries, particularly for low-wage, labor-abundant economies and for those that are resource rich and labor abundant. The industrial upgrading of the PRC and other leading developing economies will help foster structural transformation—directly or indirectly through trade and investment—in other economies trying to catch up, but this will only happen if policymakers can tap into the potential advantages of being a latecomer and help transform their economies by following their country’s comparative advantage.

Developing countries are vastly different in their natural and factor endowments. Some are labor abundant but capital scarce; others are resource rich and labor scarce. This chapter has provided a common framework for catch-up based on the successful experiences of developed and emerging market economies, including those in East Asia. Resource-rich but labor-scarce countries with higher labor costs, such as Kazakhstan, should consider identifying a target country with an income level that is not too far ahead and is dynamically growing and upgrading, such as Australia.
A key message is that catch-up is possible only if latecomer countries choose target countries that are not too far advanced and if they identify suitable industries in line with their latent comparative advantage. This analysis uses the six steps of the Growth Identification and Facilitation Framework to help a country identify latent comparative advantage that does not yet exist. Following comparative advantage does not mean...
specializing more in those sectors in which a country is already doing well; rather, it means identifying the sectors in which it could be competitive given its endowments, but is not yet ready because of constraints and barriers. For international financial organizations, it is important not to focus on those conditions that developing countries do not have, but to transform ‘what they possess’ into ‘what they could potentially do well in.’

REFERENCES


**Websites**


7. Economic diversification: implications for Kazakhstan

Jesus Felipe and Cesar A. Hidalgo

7.1 INTRODUCTION

Over two decades since independence, upper-middle income Kazakhstan—a large, landlocked, sparsely populated but resource-rich country—remains an economy in transition. Oil production accounts for a fifth of gross domestic product (GDP) and 60% of merchandise exports. The discovery in 2000 of oil in the Caspian Sea’s Kashagan field vaulted Kazakhstan’s oil reserves to the world’s ninth largest. With production at 1.7 million barrels per day in 2010, Kazakhstan is now the region’s second largest oil producer after the Russian Federation (BP 2011), and oil is now the economy’s main driver.

Kazakhstan was hard hit by the crash in oil prices as global economic conditions worsened in late 2008. Tighter credit conditions caused by restricted access to international capital markets amid the global financial crisis also played a role in the slowdown. But the economy staged a V-shaped recovery with 7% GDP growth in 2010 on the back of improved global conditions and a revival in external demand for energy. Even so, the crisis starkly exposed the pitfalls of a growth strategy dependent on natural resources. Indeed, recent research has shown that while booms in commodity prices have a positive effect in the short run, gains are often wiped out in the long term, with output ending below where it started (Collier and Goderis 2007). This is especially true of nonagricultural commodities such as oil.

This chapter examines the importance of economic diversification as a major pillar of a country’s economic transformation, and analyzes the level of diversification of Kazakhstan’s economy and the efforts made by the government to achieve greater diversification. Policymakers are well aware that diversifying the economic structure is vital to achieve the objective of becoming a modern industrial and service economy. The chapter uses the Product Space methodology and provides policy recommendations.
7.2 KAZAKHSTAN’S INDUSTRIAL POLICY PROGRAMS: A BRIEF OVERVIEW

The government has identified the economy’s diversification as a critical factor for long-term growth and, more importantly, to become a modern industrial and service economy. Shortly after gaining independence, it launched a number of programs to achieve economic progress, social development and environmental sustainability, with the aim of turning Kazakhstan into one of the world’s 50 most competitive economies by 2030. The fundamental ideas that inspired these goals were laid out in a 1997 speech by President Nursultan Nazarbayev on the so-called Kazakhstan 2030 Strategy. His vision contained several long-term priorities: (1) national security; (2) domestic political stability; (3) economic growth based on an open market economy with a high level of foreign investment and internal savings; (4) health, education and the well-being of Kazakhstan’s citizens; (5) power resources; (6) infrastructure, in particular transport and communications; and (7) governance. This strategy was based on the experiences of economically successful countries such as Canada, the People’s Republic of China, Japan, the Republic of Korea, Malaysia, Norway, Singapore and the United States. The government established public policy priorities focusing on agriculture, forestry and wood processing, light and food industries, tourism, housing and infrastructure. The reasons for selecting these sectors were threefold. First, maximizing their social value could help ensure that the basic needs of the population were being met. Second, the country’s natural resource base, geography, favorable climate, and industrial and human resources could be tapped for further development. Third, the government sought to reduce the high shares of imported products in key sectors—including agriculture (60%), light industries (90%) and pharmaceuticals (94%), as they were negatively affecting economic development and national security. Strategy 2030 laid out the long-term path for the country’s industrial policies.

To implement Strategy 2030, the government approved in 2003 a Strategy of Industrial Innovation Development for 2003–15 to diversify and modernize the economy by creating the right conditions for producing competitive products and for export growth.1 By the early 2000s, policymakers had acknowledged that a competitive and modern industrial

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1 Strategy 2030 provides an overall vision. It was initially conceived with two ten-year plans, 2000–2009 and 2010–19, which contain practical measures to achieve the long-term goals. The first plan focused on setting the foundations for sustainable development; the second focuses on enhancing Kazakhstan’s competitiveness.
Development and modern industrial policy in practice

and service-based economy could not depend on a single sector—oil. Therefore, the Strategy of Industrial Innovation Development included specific targets for agriculture, industry, transport, social welfare, health, education and the public sector. For 2003–15, it envisioned: (1) achieving annual economic growth of not less than 8.8–9.2%; (2) ensuring the average annual growth rate of the processing industries stayed in a range of 8.0–8.4%; (3) tripling labor productivity by 2015 from 2000 levels; and (4) halving energy intensity from 2000 levels. The strategy also called for an increase in research and development (R&D) activities as a share of GDP from 0.9% in 2000 to 1.5–1.7% in 2015, and a slowdown in the reduction of the share of processing industries in GDP from 13.3% in 2000 to 12.0–12.6% in 2015. In 2012, R&D activities accounted for 0.23% of GDP and processing industries 11.4%.

The government has estimated the total cost of implementing the Strategy of Industrial Innovation Development at 139.8 billion tenge (T), equivalent to 0.5% of Kazakhstan’s GDP, with T77.3 billion to be allocated from the central budget, T2.1 billion from local budgets and T60.4 billion from private local and foreign investments.

The government also created new public institutions, known as institutes of development, to play a leading role in the implementation of Strategy 2030. These include the Development Bank of Kazakhstan, the Investment Fund of Kazakhstan and the National Innovation Fund.

The first phase of the strategy, covering 2003–05, was facilitated by an evolving regulatory framework strengthened by the passage of 30 laws to address production factors. The new institutional framework established institutes of development, socio-entrepreneurial corporations and holding companies, and also launched technology parks and economic and industrial zones. Exports of manufactured goods more than doubled between 2002 and 2005, while industrial labor productivity increased 51% between 2000 and 2005, including a 63.3% rise in manufacturing productivity.

In a 2007 address to the nation, President Nazarbayev announced a ‘win-win policy’ by which the economy would be diversified through the efforts of both foreign and domestic investment. The continuation of this policy was the establishment of the State Commission on the Modernization of the Economy of Kazakhstan in April 2012, which led to the launch of the 30 Corporate Leaders of Kazakhstan program. This aims to increase the competitiveness of non-oil sector domestic companies in international markets through public–private projects, including...

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2  To stimulate R&D, the government passed in 2012 the Law on State Support to Industrial and Innovative Activities. This obliged all subsoil users to devote 1% of their total annual revenue for R&D. State funding is expected to reach 1% of GDP by 2015.
investment projects with government support. However, the implementation of Strategy 2030 did not make much progress. First, most government policies after 1997 had to focus on recovering from the break-up of the Soviet Union and the 1998 financial crisis in the Russian Federation, which diverted attention from increasing industrial diversification. A decade later the global financial crisis hampered progress of Kazakhstan’s industrial policies. In 2006–07, although the public sector reduced its external borrowing and associated currency mismatches, Kazakhstan’s banks considerably increased their foreign exchange liabilities.\textsuperscript{3} Given the shallow base of domestic deposits and underdeveloped local financial markets, Kazakhstan’s banks borrowed excessively in international capital markets, reaching record levels in 2007 of $45.9 billion, the equivalent of 45\% of GDP.\textsuperscript{4} External borrowing by banks was used to fund aggressive credit expansion in the economy, with domestic credit surging to 59\% of GDP at the end of 2007 from 35.2\% only two years earlier. Cheap credit fuelled a real estate boom in Almaty and Astana, leading to rocketing prices in the housing market and dangerously high levels of exposure among Kazakhstan’s banks to the construction and retail sectors. By 2006, nearly one-third of bank loans were related to real estate.

In 2009–10, the government modified the implementation of the Strategy of Industrial Innovation Development because of its failure to deliver its objectives, although the government continued to emphasize the need to diversify the economy away from oil and natural resources. In 2009, it embarked on the next step in the implementation of Strategy 2030 with the Strategic Plan until 2020. This was conceived as a transition to post crisis development and sustainable economic growth through rapid industrialization and infrastructure development, with investments in the social sector to improve the quality of human capital. To implement this strategy, the government launched the State Program on the Accelerated Industrial–Innovative Development of the Republic of Kazakhstan 2010–14, which highlights seven priority sectors: (1) agriculture, (2) construction and construction materials, (3) oil and gas products and infrastructure, (4) transportation, (5) information and communication technologies, (6) tourism, and (7) health care.

\textsuperscript{3} This was the result of a significant increase in the external liabilities of the private sector; above all, from banks. The banking sector’s model of ‘external expansion’ was due to the growth of credit activity abroad, the abundance of cheap natural resources and low interest rates. During this period, the National Bank of Kazakhstan was committed to maintaining the exchange rate peg with the US dollar.

\textsuperscript{4} Average annual GDP growth in 2000–2008 was 9.4\%. High rates of economic growth led to changes in Kazakhstan’s financial system, with the gross external debt of banks rising from $1.4 billion in 2002, equivalent to 6\% of GDP, to $45.9 billion in 2007 (45\% of GDP), accounting for nearly all of the country’s external debt. By comparison, in the Russian Federation at the height of the boom in the third quarter of 2008, the banking sector’s external debt was 11.2\% of GDP.
Development and modern industrial policy in practice

(4) metallurgy and metal products, (5) chemicals and pharmaceuticals, (6) energy, and (7) transport and telecommunications infrastructure. State support to these sectors includes the provision of physical infrastructure (information and communications, energy and transport) and social infrastructure (skilled human resources), lower administrative barriers, guidelines on technical regulations and creating a more business-friendly environment to attract foreign direct investment.

It is difficult to assess the implementation and progress so far of the Strategy of Industrial Innovation Development and of the Strategic Plan until 2020. Although the government provides information regularly on manufacturing growth, share of manufacturing in GDP and labor productivity, this is not done within a systematic monitoring and evaluation framework. Furthermore, it is not clear which agency consolidates this data in a systemic way to evaluate the progress of policies under this program. The government, however, does acknowledge that only some gains in economic diversification have been achieved. The Strategic Plan identifies the core areas that will be critical for successful diversification, among them: developing the priority sectors of the economy (heavy machinery, information and communications technology, education, health care); strengthening the ‘social effectiveness’ of these sectors and investment projects in them; and creating a favorable environment for industrialization. The program identifies four sectors that the state will focus on: (1) traditional industries—natural gas, mining and metallurgy, atomic energy and the chemical industry; (2) areas of high domestic demand—machine building, pharmaceuticals, construction and building materials; (3) predominantly export-oriented sectors—agribusiness, light industry and tourism; and (4) sectors of the future—information and communications technology, biotechnology, alternative power engineering, nuclear energy and space.

The government is now expected to develop a plan for the next phase of industrialization for 2015–19. To move forward, President Nazarbayev announced Strategy 2050 in late 2012. This has the very ambitious objective of making Kazakhstan a true world leader, specifically to join the top 30 advanced countries. This includes developing pragmatic economic policies based on the principles of profitability, return on investment and competitiveness; offering full support to entrepreneurship, particularly small and medium enterprises and public–private partnerships; designing new social policies that balance social guarantees and personal responsibility; and advancing the development of a knowledge economy.  

5 Other components of Strategy 2050 announced by President Nazarbayev include a stronger ‘budget culture’ and cost savings among all government agencies, as well as the efficient utilization of unused funds. In many cases, unused construction funds will be redirected.
2050 contains important elements of a modern industrial policy as well as addressing the newer challenges that Kazakhstan faces as it approaches high-income status. The government regards this strategy as more than an extension of the Strategy 2030. However, priorities and implementation plans need to be established. It also needs to be clear who will lead Strategy 2050, and how the government will manage the numerous agencies created to oversee its implementation. To move forward with the strategy, policymakers need to consider these crucial issues.6

7.3 WHY DOES DIVERSIFICATION MATTER?

A key difference between modern and ancient economies is that the former are made of a significantly larger number of different things, many of which were not available in earlier times (Beinhocker 2006). This increase in diversification is probably the most conspicuous aspect of economic development, and a chief difference between the complex process of economic development and the aggregate process of economic growth.

During the Industrial Revolution, England’s economy did not grow by simply multiplying its ability to produce the shields and armor of medieval times. It expanded as a result of the introduction of new products and technologies. The steam engine powered locomotives, looms, pumps and even the world’s first computer, known as Babbage’s calculating machine (Gleick 2011). This increase in diversification is also true of more recent ‘growth miracles,’ such as those of Japan and the Republic of Korea. Both these countries have come to dominate markets in which they had little or no participation a few decades before entering them, such as automobiles, ships, medical equipment, industrial machinery and electronics.

The relevance of economic diversification has increased in recent decades. Prosperous economies differ from ones that are not, both in the diversity of the inputs they have available and in the diversity of the outputs they produce (Hausmann et al. 2011). These differences imply that
developed countries participate in more industries and in more markets than developing countries do, since the former can perform activities that few other countries can and which are widely demanded. In a world where new activities tend to emerge as a combination of old activities, wealth is not a consequence of having more but of having the right combinations.

Evidence illustrating the importance of diversification has been highlighted in recent work on international and regional development. This shows that the economies and employment levels of countries and regions that export a diverse set of products grow faster (Hausmann et al. 2007; Saviotti and Frenken 2008; Hidalgo and Hausmann 2009; Hausmann et al. 2011), in part because they hold a varied set of industries and, through them, a larger number of productive capabilities (Hausmann and Hidalgo 2011). A diverse set of industries and capabilities, in turn, creates inter- and intra-industry spillovers (Jacobs 1969; Frenken et al. 2007; Boschma and Iammarino 2009) that give rise to clusters of productive activities in which a firm’s competitiveness is strongly dependent on the existence of other firms in the same or similar sectors (Porter 1998).

Understanding the role of diversification in economies has been historically difficult. Why, for example, are natural resources—as in the case of Kazakhstan—so good at bringing in dollars, but so bad at kick-starting development? The lack of answers can be partly traced to a historical disregard for the physical nature of the world economy. Aggregate macroeconomic descriptions make little or no difference between capital goods such as tractors, pumps and refrigerators beyond what can be captured through the cost of their parts or through the wages and years of schooling of the workers involved in their production. Moreover, when traditional theories have attempted to incorporate the diversity of the world into their models, they have done so through extremely symmetric assumptions (as in the Dixit-Stiglitz model) in which goods are represented through a continuum that has no parallel in the real world. The failure to incorporate diversification into theories of economic growth and development is a widely recognized limitation (Krugman 2009; Lucas 1988). In recent years, however, new streams of literature are helping to improve understanding of the role of diversity by highlighting its role at the level of countries and cities.

Ultimately, countries that concentrate their production and exports in the products in which they have comparative advantage will benefit from gains from trade, and they should therefore avoid trying to produce goods beyond this optimal mix. In the Heckscher–Ohlin model of trade, the source of comparative advantage is relative factor abundance. Here, it is recognized that comparative advantage is natural and fairly static for natural resources and agricultural products, but that it can be induced and
Economic diversification: implications for Kazakhstan

is dynamic for the industrial and services sectors. Based on this theory, economists have praised the benefits of specialization and advised developing countries to follow their comparative advantage on resource allocation and efficiency grounds. This theory acknowledges that specialization entails restructuring costs (for example, unemployment), but it argues that these can be solved through compensatory policies.

There are other reasons why economic diversity is important, which go beyond the path-dependence intrinsic to development. For example, export diversification matters because it can lower volatility and instability in export earnings. Such portfolio effects can help hedge against the risk inherent in markets with uncertain returns (Bertinelli et al. 2009). In fact, economic downturns turn out to be shorter-lived in countries that are better located in the Product Space (Hausmann et al. 2006).

Another channel is the negative and a nonlinear impact of natural resources on growth through their effect on institutional quality (Sala-i-Martin and Subramanian 2003). Countries that are rich in natural resources are less likely to implement growth-enhancing reforms or to improve their investment climates (Amin and Djankov 2009). Although resource revenues make a handsome contribution to fiscal coffers, they also pose several challenges: what to do with the revenues earned (spend now or invest—the time profile of consumption); where to invest (foreign assets or domestic assets); and how to balance public and private sector actions (that is, government consumption and investment in relation to private sector consumption and investment). It is therefore important for Kazakhstan and other resource-rich countries to find the right balance between these opposing forces. On the one hand, capital is scarce and therefore returns from investment at home are likely to be higher. On the other hand, investment might be riskier and run into supply-side constraints causing the economy to overheat.

Agosin et al. (2012) have studied empirically the determinants of export diversification using a world data set that covers 1962–2000. The authors use several measures of diversification, including the Gini, Herfindal, and Theil indices. They find that: (1) trade openness induces concentration, not export diversification; (2) financial development helps countries diversify their exports; (3) real exchange rate overvaluation is negatively related with export diversification; (4) exchange rate volatility is uncorrelated with diversification; (5) capital accumulation contributes positively to export diversification; (6) remoteness reduces export diversification; and (7) improvements in terms of trade tend to concentrate exports, but this effect is lower for countries with higher levels of human capital.

Probably the strongest argument in favor of diversification is obtained by putting aside any theoretical discussions on its potential merits, and by observing the reality of the world. Despite any theoretical construct, the
reality is that developed countries display relatively low levels of export concentration, while countries with low per capita income export a very limited range of goods. In fact, except for commodity booms and other bonanzas, economic growth tends to co-occur with increased diversification. Hence, arguing whether diversification or specialization makes sense at the level of countries might be a distraction in a world where diversification appears to work strongly.

7.4 THE LIMITED DIVERSIFICATION OF KAZAKHSTAN’S EXPORT STRUCTURE

Figure 7.1 shows the level of diversification and composition of the export structures of Kazakhstan and three comparable countries with similar level of per capita income—Costa Rica, Turkey and Venezuela. The picture clearly shows that industrial diversification of oil-rich Kazakhstan and Venezuela—where petroleum accounts for three quarters of total exports—is significantly lower than in the other two countries, which have far more diversified industrial structures.

There are also some useful examples that can be used to show that lack of diversification at one point in time need not be an economic ‘death sentence’ for a country if future policies shift the economic structure. Figure 7.2 shows the export structures of Brazil in 1965 and 2010. In 1965, coffee was Brazil’s main export, accounting for 48% of total exports and 31% of the world’s coffee exports, making the country the top coffee exporter. In 2010, Brazil was still the world’s top coffee exporter, with a market share of 22%. Yet, coffee only represented 2.4% of Brazil’s exports because the economy had diversified considerably since 1965. This illustrates two things. First, had Brazil followed traditional advice and concentrated only on its area of comparative advantage (and even in the best-case scenario of being the world’s only coffee exporter), its total exports of coffee would only amount to 10% of its current total exports. Hence,

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7 It is important to note that ‘diversification’ and ‘concentration’ are not the direct opposites of each other. Consider countries A and B. Country A exports ten products, each with a global market representing 0.1% share in world trade. Country B, on the other hand, exports nine products (similar to those of country A) plus oil, which alone represents 5% of world trade. In this case, both countries are equally diversified, but B’s exports are more concentrated than those of A. This is not due to the fact that B has specialized, but simply because oil is a product with an outsized world market. A true measure of diversification should control for differences in market size; for example, by using Balassa’s Revealed Comparative Advantage or an export per capita equivalent, such as the one used in Bustos et al. (2012). If this is not done, differences may emerge solely from countries that have export baskets composed of products with different market sizes.
without diversification Brazil would not have been able to increase exports by the amount it did. And second, this shows that it is possible to diversify into new products without leaving behind traditional sectors. The lesson is that diversification does not require abandoning existing industries—or even losing much ground in them.8

Table 7.1 shows Kazakhstan’s top 15 exports (from a dataset of 1240 products) according to increases and decreases in exports by nominal value as well as change in RCA(pop) between 1995 and 2010, where RCA(pop) is the index of revealed comparative advantage, defined as

\[ RCA_{cp} = \frac{\sum_{c} exports_{c,p}/population_c}{\sum_{c} exports_{c}/population_c} \]

RCA(pop) is defined for country (c) and product (p) as the ratio between the exports per capita of country c of product p and the average exports per capita of the world in that same product. Table 7.1 indicates that Kazakhstan has increased its market share in a number of products, as measured by RCA(pop). However, most of these products are natural resources, such as minerals and metals.

Table 7.2 shows Kazakhstan’s level of diversification in each product chapter, measured by the number of products exported with RCA(pop) > 0.25 (out of a total of 1240 products).9 This table indicates that diversification almost doubled (from a very low base), from 68 to 127 products from 1995 to 2010. The largest increase was in mineral products, from 9 to 29. The table also shows that the level of diversification declined in the period reviewed. It is important to note that Kazakhstan’s diversification is well below that of other middle-income countries, such as Malaysia and Thailand (890 and 776 products exported with RCA(pop) > 0.25, respectively).

A mix of factors explains why, despite efforts to diversify the economy in 2010, Kazakhstan exported with revealed comparative advantage fewer products than in 2000. These are: (1) in general, economies well endowed with natural resources have problems diversifying their economies; (2) weak incentives to diversify in a context of high oil prices; (3) the government selected sectors and specific companies for public support instead of fostering innovation, technological upgrading and the development of new products; and (4) the country’s framework for competition was very shaky.

---

8 Note that Brazil now has a world market share in coffee of almost 25%, which is equivalent to about 2.5% of its exports; 100% of the world market would imply 10% of Brazil’s exports.

9 We chose 0.25 because this is a threshold that discriminates countries well. A smaller threshold is reached by too many countries and a significantly larger one is reached by very few. We say that country c exports with revealed comparative advantage product p, if RCA(pop) > 0.25 for product p.
Figure 7.1  Composition of exports, Kazakhstan and three comparator countries, 2010 (based on Hausmann et al., 2011)
Figure 7.1 (continued)
Brazil's Exports

48% Green & roasted coffee & coffee substitutes
7.5% Raw cotton
4.4% Worked wood of coniferous

Source: Authors, based on Hausmann et al. (2011).

Figure 7.2 Brazil’s export structure, 1965 and 2010
Brazil’s Exports

2010

$201,273,933,044

14% Not agglomerated iron ore
9.4% Crude petroleum
5.7% Soya beans
2.9% Poultry meat

Brazil’s Exports

EAST AFRICA
MIDDLE AFRICA
NORTH AFRICA
SOUTH AFRICA
WEST AFRICA
NORTH AMERICA
CARIBBEAN
CENTRAL AMERICA
SOUTH AMERICA
WEST ASIA
CENTRAL ASIA
SOUTH ASIA
SOUTH EAST ASIA
EAST ASIA
WESTERN EUROPE
SOUTHERN EUROPE
NORTHERN EUROPE
EASTERN EUROPE
AUSTRALIA & NEW ZEALAND
MELANESIA
MICRONESIA
POLYNESIA

$21,558,072,672

22% Brazil
8.4% Colombia
5.6% Germany
4.9% Switzerland
3.5% Brazil
3.3% Vietnam
3.2% Indonesia

Market Share of Coffee Exporters

2.4% Tourist and travel services
5.7% Chemical wood pulp, soda, or sulphate
1.3% Unclassified transactions

2.9% Green & roasted coffee & coffee aromatics

2.3% Soyabeans
2.3% Oilcake

Figure 7.2 (continued)
Table 7.1  Top 15 exports by nominal increase and decrease and index of revealed comparative advantage, Kazakhstan, 1995–2010

<table>
<thead>
<tr>
<th>Product name</th>
<th>HS4</th>
<th>RCA(pop)</th>
<th>Value in $ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum oils, crude</td>
<td>2709</td>
<td>0.08 7.93 44</td>
<td>44 25 100</td>
</tr>
<tr>
<td>Refined copper and copper alloys</td>
<td>7403</td>
<td>4.92 7.12 218</td>
<td>218 1909</td>
</tr>
<tr>
<td>Petroleum oils, refined</td>
<td>2710</td>
<td>0.27 0.99 67</td>
<td>67 1892</td>
</tr>
<tr>
<td>Ferroalloys</td>
<td>7202</td>
<td>4.06 22.81 102</td>
<td>102 1722</td>
</tr>
<tr>
<td>Radioactive chemical elements and radioactive isotopes</td>
<td>2844</td>
<td>1.47 31.83 23</td>
<td>23 1683</td>
</tr>
<tr>
<td>Iron ores and concentrates</td>
<td>2601</td>
<td>0.19 3.92 5</td>
<td>5 1085</td>
</tr>
<tr>
<td>Petroleum gases</td>
<td>2711</td>
<td>0.02 1.34 2</td>
<td>2 995</td>
</tr>
<tr>
<td>Wheat and meslin</td>
<td>1001</td>
<td>0.18 7.69 10</td>
<td>10 663</td>
</tr>
<tr>
<td>Gold content</td>
<td>2603</td>
<td>0.00 4.81 0</td>
<td>0 529</td>
</tr>
<tr>
<td>Unwrought zinc</td>
<td>7901</td>
<td>4.41 16.81 48</td>
<td>48 518</td>
</tr>
<tr>
<td>Coal briquettes</td>
<td>2701</td>
<td>0.39 1.19 22</td>
<td>22 413</td>
</tr>
<tr>
<td>Unwrought aluminum</td>
<td>7601</td>
<td>0.12 3.06 8</td>
<td>8 352</td>
</tr>
<tr>
<td>Flat rolled iron or non-alloy steel, coated with tin, w &gt; 600</td>
<td>7210</td>
<td>0.77 1.75 35</td>
<td>35 235</td>
</tr>
<tr>
<td>Uranium or thorium ores</td>
<td>2612</td>
<td>0.00 146.27 0</td>
<td>0 231</td>
</tr>
<tr>
<td>Sulfur</td>
<td>2503</td>
<td>0.04 31.01 0</td>
<td>0 210</td>
</tr>
</tbody>
</table>
### By nominal decrease

<table>
<thead>
<tr>
<th>Product name</th>
<th>HS4</th>
<th>RCA(pop)</th>
<th>Value in $ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool</td>
<td>5101</td>
<td>3.38</td>
<td>−2.59</td>
</tr>
<tr>
<td>Mineral or chemical fertilizers, mixed</td>
<td>3105</td>
<td>2.21</td>
<td>−1.91</td>
</tr>
<tr>
<td>Raw hides and skins of bovine or equine animals</td>
<td>4101</td>
<td>2.15</td>
<td>−1.75</td>
</tr>
<tr>
<td>Raw skins of sheep or lambs</td>
<td>4102</td>
<td>4.31</td>
<td>−3.98</td>
</tr>
<tr>
<td>Vegetable products not elsewhere specified</td>
<td>1404</td>
<td>15.79</td>
<td>−14.21</td>
</tr>
<tr>
<td>Waste or scrap aluminum</td>
<td>7602</td>
<td>1.78</td>
<td>−1.33</td>
</tr>
<tr>
<td>Prepared or preserved fish</td>
<td>1604</td>
<td>0.39</td>
<td>−0.33</td>
</tr>
<tr>
<td>Polymers of styrene, in primary forms</td>
<td>3903</td>
<td>0.15</td>
<td>−0.15</td>
</tr>
<tr>
<td>Casein</td>
<td>3501</td>
<td>0.71</td>
<td>−0.71</td>
</tr>
<tr>
<td>Nickel unwrought</td>
<td>7502</td>
<td>0.18</td>
<td>−0.18</td>
</tr>
<tr>
<td>Stranded wire, cables and similar articles of copper</td>
<td>7413</td>
<td>2.14</td>
<td>−2.13</td>
</tr>
<tr>
<td>Other metals</td>
<td>8112</td>
<td>7.37</td>
<td>−5.71</td>
</tr>
<tr>
<td>Alkali or alkaline-earth metals, rare-earth metals, scandium</td>
<td>2805</td>
<td>1.53</td>
<td>−1.53</td>
</tr>
<tr>
<td>Maize (corn) seed</td>
<td>1005</td>
<td>0.04</td>
<td>−0.04</td>
</tr>
<tr>
<td>Fluorides, fluorosilicates, fluoroaluminates</td>
<td>2826</td>
<td>0.91</td>
<td>−0.89</td>
</tr>
</tbody>
</table>

**Notes:**

HS4 = Harmonized System Commodity Code 4-digit level.
The index of revealed comparative advantage is RCA(pop), defined in the text.

**Source:** Authors.
Table 7.2  Kazakhstan’s export diversification (number of products exported with revealed comparative advantage), value in $ million, and % of total exports, selected years from 1995–2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal and animal products</td>
<td>1 product</td>
<td>3 products</td>
<td>6 products</td>
<td>7 products</td>
</tr>
<tr>
<td></td>
<td>$7 (0.53%)</td>
<td>$23 (0.22%)</td>
<td>$76 (0.31%)</td>
<td>$134 (0.32%)</td>
</tr>
<tr>
<td>Vegetable products</td>
<td>5 products</td>
<td>16 products</td>
<td>21 products</td>
<td>16 products</td>
</tr>
<tr>
<td></td>
<td>$41 (2.99%)</td>
<td>$612 (5.69%)</td>
<td>$530 (2.18%)</td>
<td>$997 (2.39%)</td>
</tr>
<tr>
<td>Foodstuffs</td>
<td>1 product</td>
<td>4 products</td>
<td>8 products</td>
<td>8 products</td>
</tr>
<tr>
<td></td>
<td>$11 (0.81%)</td>
<td>$37 (0.35%)</td>
<td>$161 (0.66%)</td>
<td>$119 (0.28%)</td>
</tr>
<tr>
<td>Mineral products</td>
<td>9 products</td>
<td>24 products</td>
<td>29 products</td>
<td>29 products</td>
</tr>
<tr>
<td></td>
<td>$164 (12.04%)</td>
<td>$5981 (55.60%)</td>
<td>$16010 (65.83%)</td>
<td>$31069 (74.47%)</td>
</tr>
<tr>
<td>Chemical and allied industries</td>
<td>15 products</td>
<td>19 products</td>
<td>20 products</td>
<td>17 products</td>
</tr>
<tr>
<td></td>
<td>$123 (9.00%)</td>
<td>$366 (3.40%)</td>
<td>$967 (3.98%)</td>
<td>$2231 (5.35%)</td>
</tr>
<tr>
<td>Plastics and rubbers</td>
<td>1 product</td>
<td>0 products</td>
<td>1 product</td>
<td>1 product</td>
</tr>
<tr>
<td></td>
<td>$7 (0.50%)</td>
<td>$7 (0.07%)</td>
<td>$27 (0.11%)</td>
<td>$37 (0.09%)</td>
</tr>
<tr>
<td>Raw hides, skins, leather and furs</td>
<td>2 products</td>
<td>3 products</td>
<td>5 products</td>
<td>5 products</td>
</tr>
<tr>
<td></td>
<td>$47 (3.43%)</td>
<td>$25 (0.23%)</td>
<td>$235 (0.97%)</td>
<td>$40 (0.10%)</td>
</tr>
<tr>
<td>Wood and wood products</td>
<td>0 products</td>
<td>1 product</td>
<td>2 products</td>
<td>1 product</td>
</tr>
<tr>
<td></td>
<td>$1 (0.11%)</td>
<td>$12 (0.11%)</td>
<td>$25 (0.10%)</td>
<td>$12 (0.03%)</td>
</tr>
<tr>
<td>Textiles</td>
<td>9 products</td>
<td>10 products</td>
<td>9 products</td>
<td>6 products</td>
</tr>
<tr>
<td></td>
<td>$120 (8.80%)</td>
<td>$78 (0.72%)</td>
<td>$219 (0.90%)</td>
<td>$126 (0.30%)</td>
</tr>
<tr>
<td>Category</td>
<td>Products</td>
<td>Revenue</td>
<td>RCA (%)</td>
<td>Products</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>Footwear and headgear</td>
<td>0</td>
<td>$0</td>
<td>0.00%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone and glass</td>
<td>2</td>
<td>$133</td>
<td>9.71%</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td>21</td>
<td>$696</td>
<td>50.98%</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery and electrical products</td>
<td>0</td>
<td>$7</td>
<td>0.54%</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>1</td>
<td>$6</td>
<td>0.42%</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>$2</td>
<td>0.14%</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>$1365</td>
<td></td>
<td>143</td>
</tr>
</tbody>
</table>

Notes:
HS2 = Harmonized System Commodity Code 2-digit level.
A product is exported with comparative advantage if its RCA (pop) > 0.25.

Source: Authors.
Kazakhstan also comes up short in terms of upgrading. Overall, it exports many products that are neither complex nor central. Complexity is a property of a product and of a country. To construct indices of both, we use information on both the diversification of countries, as defined above, and of product ubiquity, defined as the number of countries that export a product. Joint information on both generates through an algorithm an index of product complexity and an index of country or economic complexity. Centrality is a measure of the easiness to jump (that is, acquire comparative advantage in new products) from one product into all other products. The likelihood of a successful jump is higher when the products that a country already exports use capabilities that can be easily redeployed for the export of other products. We say that these products are central.

Table 7.3 classifies all products exported by Kazakhstan with revealed comparative advantage ($RCA_{\text{pop}} > 0.25$) in 1995 and 2010 into the three terciles of product complexity and centrality. The table shows that

Table 7.3  Export diversification (number of products exported with revealed comparative advantage), by complexity and centrality, Kazakhstan, 1995 and 2010

<table>
<thead>
<tr>
<th></th>
<th>Complexity</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom tercile</td>
<td>Middle tercile</td>
<td>Top tercile</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>(68 products with revealed comparative advantage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centrality</td>
<td>Bottom tercile</td>
<td>29</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Middle tercile</td>
<td>9</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Top tercile</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>(127 products with revealed comparative advantage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centrality</td>
<td>Bottom tercile</td>
<td>66</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Middle tercile</td>
<td>24</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Top tercile</td>
<td>0</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

Notes:
Complexity is a combination of diversification and ubiquity; centrality is a measure of how many other products can be co-exported.
This table shows the number of products exported by Kazakhstan with revealed comparative advantage (that is, products with $RCA_{\text{pop}} > 0.25$). The total number of products in the database used is 1240.

Source: Authors.
the country did not see a large increase in exports of the most technologically advanced sectors (those in the bottom row and in the third column). Indeed, of the 68 products exported with RCA(pop) > 0.25 in 1995, 38 (56% of total exports) were in the bottom tercile of the product complexity scale. Kazakhstan only exported four products in the top tercile. In 2010, of the 127 products exported with RCA(pop) > 0.25, 90 products (71% of total exports) were exported that belonged to the bottom tercile of the complexity scale, and only 12 products in the top tercile. This is not a sign of progression. Moreover, the level of complexity of the export basket in 2010 was significantly below that of 1995.

7.5 DIVERSIFICATION AND THE PRODUCT SPACE

In recent work, the process of diversification has been studied through the lens of the Product Space theory (see Chapter 2, Figure 2.1), a byproduct of network theory (Hidalgo et al. 2007). The Product Space is a graphical representation of all products exported in the world and the links between them. These links are probabilistic measures of whether a country that exports a product also co-exports another one (a conditional probability). Work in this area has shown that countries are more likely to diversify exports by adding goods that are related to the goods that they already export. Countries that are more diversified are likely to have more opportunities for further diversification. This represents another channel by which economic diversity can translate into prosperity, and is of relevance to Kazakhstan’s efforts at economic diversification.

To make the Product Space country specific, one needs to superimpose onto it the products that a country exports with revealed comparative advantage. To do this, we use the indicator \( \text{RCA(pop)}_{cp} = \frac{\text{exports}_{cp}/\text{population}}{\sum \text{exports}_{cp}/\sum \text{population}} \). A value of RCA(pop) of 2, for example, indicates that a country’s exports per capita of the product in question are twice the world’s exports per capita. Empirically, we set the threshold of RCA(pop) > 0.25 to determine if a country has comparative advantage in a product.\(^{10}\)

Figure 7.3 shows the Product Space of Kazakhstan and Turkey for 1995 and 2010, with the products exported with comparative advantage by

\(^{10}\) The threshold RCA(pop) > 0.25 requires that a country’s exports per capita be larger than 25% of the world’s exports per capita for the product in question. This threshold ensures that it can be determined whether a country is a significant exporter of a product. If a higher threshold (for example, RCA(pop)>1) is used, then there are many countries for which the value is zero. Empirically, RCA(pop) of 25% provides a reasonable filter.
Note: Fully saturated nodes indicate the products exported by each country with RCA > 1.

Source: Authors, based on Hausmann et al. (2011).

Figure 7.3 Export structures of Kazakhstan and Turkey in the Product Space, 1995 and 2010
Figure 7.3 (continued)
each marked with dark dots. In this visualization, each node represents a product (according to the HS4 trade classification system) and the size of the nodes represents the total world trade for that good. Fully saturated nodes indicate the set of all products that are exported with $\text{RCA}(\text{pop}) > 0.25$. Pairs of products are connected according to the probability that they are co-exported, since co-exports are more likely among pairs of products that require the same capabilities. Hence, the Product Space is a visualization that not only illustrates the mix of products that a country exports, but also potential new exports given a country’s current productive structure.

In 1995, Turkey’s productive structure was more diversified than that of Kazakhstan, implying a larger number of opportunities for future exports. During the following 15 years, these opportunities translated into new export sectors, illustrating that diversification is a self-reinforcing process. Relatively speaking, Kazakhstan’s export structure, specifically the products that it exports with revealed comparative advantage, has evolved much less.

Figure 7.3 also shows that the structure of the Product Space can be used to predict the evolution of a country’s productive structure. Here, the new exports of Kazakhstan and Turkey are products located close in the Product Space to other products that both countries used to export. This is important because it implies that the productive structure of countries not only conditions income and economic growth, but also the future evolution of the country’s product mix.

Our analysis of Kazakhstan’s export structure indicates that the economy is not diversified. One way of complementing this is by relating diversification to the level of natural resource intensity (measured by the share of exports of natural resources in total exports) and comparing Kazakhstan to countries with similar natural-resource intensity—and measuring that by the share of natural resource exports in total exports. Table 7.4 looks at countries where this share was at least 25% in 1995 and 2010. It excludes Australia, Canada, Israel and Norway—all fairly diversified developed economies—with natural resource intensities above 25%. Table 7.4 shows that in 1995 Kazakhstan’s natural resource intensity was 44.45%, broadly similar to Cameroon, Chile, Egypt, Ghana, Mauritania, Mongolia, Peru, and Trinidad and Tobago, where exports of natural resources ranged from 34% to 50% of total exports.

Table 7.5 documents resource intensity in 2010. The number of products exported with $\text{RCA}(\text{pop}) > 0.25$ is shown under the ‘diversification’ columns. Kazakhstan’s resource intensity rose from 44.45% in 1995 to 82.86%, one of the world’s highest natural resource intensities. Several countries with a resource intensity of 25–50% in 1995 increased to 50–75% in 2010. However, only Kazakhstan and Mongolia increased to more than 75%.
The average level of diversification in 2010 of all 130 countries in the data set, including those with natural-resource intensities below 25% and advanced economies, is 411 products, which is much higher than the average of all resource-rich countries in Table 7.5. Kazakhstan, with its natural-resource intensities at 82.86% and a level of diversification of 127 products, is higher than the average of its peer countries with intensities above 75% (95 products). Within this group, only Iran, Kuwait, Oman and Saudi Arabia are more diversified than Kazakhstan.

As Table 7.5 shows, with the exception of the United Arab Emirates (996 products) and Belarus (449 products), the level of diversification of all countries with a share of natural resource exports in total exports greater than 25% is below 411 products. Other than United Arab Emirates and Belarus, the most diversified economies in this group are Brazil (369 products), Chile (390 products), Indonesia (319 products) and the Russian Federation (378 products), all of which have lower natural-resource intensity than

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**Table 7.4  Natural resource intensity (% of total exports), various countries, 1995**

<table>
<thead>
<tr>
<th>Country</th>
<th>25–50%</th>
<th>50–75%</th>
<th>Above 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>28.93</td>
<td>53.82</td>
<td>77.89</td>
</tr>
<tr>
<td>Ecuador</td>
<td>33.21</td>
<td>57.36</td>
<td>78.78</td>
</tr>
<tr>
<td>Togo</td>
<td>33.46</td>
<td>59.03</td>
<td>79.07</td>
</tr>
<tr>
<td>Cameroon</td>
<td>33.97</td>
<td>69.80</td>
<td>84.64</td>
</tr>
<tr>
<td>Ghana</td>
<td>36.12</td>
<td>70.49</td>
<td>85.31</td>
</tr>
<tr>
<td>Mauritania</td>
<td>39.07</td>
<td>72.01</td>
<td>85.87</td>
</tr>
<tr>
<td>Chile</td>
<td>44.44</td>
<td>73.19</td>
<td>86.37</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>44.45</td>
<td></td>
<td>87.13</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>44.96</td>
<td></td>
<td>91.46</td>
</tr>
<tr>
<td>Peru</td>
<td>48.00</td>
<td></td>
<td>92.04</td>
</tr>
<tr>
<td>Egypt</td>
<td>49.15</td>
<td></td>
<td>93.48</td>
</tr>
<tr>
<td>Mongolia</td>
<td>49.68</td>
<td></td>
<td>94.93</td>
</tr>
</tbody>
</table>

**Note:** Figures denote resource intensity, measured by the share of natural resource exports in total exports.

**Source:** Authors.
Table 7.5  Natural resource intensity (% of total exports) and export diversification (number of products exported with revealed comparative advantage), various countries, 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>25–50% NRI</th>
<th>50–75% NRI</th>
<th>Above 75% NRI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NRI (%)</td>
<td>Diversification</td>
<td></td>
</tr>
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<td>Brazil*</td>
<td>27.66</td>
<td>369</td>
<td></td>
</tr>
<tr>
<td>Belarus*</td>
<td>28.56</td>
<td>449</td>
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<tr>
<td>Liberia</td>
<td>29.69</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>India*</td>
<td>32.49</td>
<td>169</td>
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</tr>
<tr>
<td>Senegal*</td>
<td>33.14</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>Cuba</td>
<td>33.92</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Uzbekistan*</td>
<td>34.12</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>36.18</td>
<td>319</td>
<td></td>
</tr>
<tr>
<td>Georgia*</td>
<td>36.47</td>
<td>112</td>
<td></td>
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<tr>
<td>Egypt</td>
<td>37.35</td>
<td>239</td>
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<tr>
<td>Armenia</td>
<td>37.81</td>
<td>80</td>
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</tr>
<tr>
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<td>40.23</td>
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<td>Brazil*</td>
<td>27.66</td>
<td>369</td>
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<td>Belarus*</td>
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<td>449</td>
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<tr>
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<td>India*</td>
<td>32.49</td>
<td>169</td>
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<td>Senegal*</td>
<td>33.14</td>
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<td>Cuba</td>
<td>33.92</td>
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<tr>
<td>Uzbekistan*</td>
<td>34.12</td>
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<td>Indonesia</td>
<td>36.18</td>
<td>319</td>
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<td>36.47</td>
<td>112</td>
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<td>239</td>
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<tr>
<td>Armenia</td>
<td>37.81</td>
<td>80</td>
<td></td>
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<tr>
<td>Tanzania*</td>
<td>40.23</td>
<td>80</td>
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<table>
<thead>
<tr>
<th>Country</th>
<th>NRI (%)</th>
<th>Diversification</th>
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</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>53.44</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>59.50</td>
<td>390</td>
<td></td>
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<tr>
<td>Trinidad and Tobago</td>
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<td>Zambia</td>
<td>61.60</td>
<td>84</td>
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<td>Colombia</td>
<td>61.90</td>
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<tr>
<td>Syria</td>
<td>62.11</td>
<td>134</td>
<td></td>
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<tr>
<td>Peru</td>
<td>69.15</td>
<td>248</td>
<td></td>
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<tr>
<td>Mauritania</td>
<td>69.21</td>
<td>25</td>
<td></td>
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<tr>
<td>Turkmenistan*</td>
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<td>39</td>
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<tr>
<td>Congo, Dem. Rep</td>
<td>71.43</td>
<td>14</td>
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<tr>
<td>United Arab Emirates</td>
<td>71.62</td>
<td>996</td>
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<tr>
<td>Papua New Guinea</td>
<td>72.43</td>
<td>41</td>
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<tr>
<td>Guinea</td>
<td>76.22</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Oman</td>
<td>81.11</td>
<td>315</td>
<td></td>
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<tr>
<td>Kazakhstan</td>
<td>82.86</td>
<td>127</td>
<td></td>
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<tr>
<td>Iran</td>
<td>85.61</td>
<td>203</td>
<td></td>
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<tr>
<td>Saudi Arabia</td>
<td>86.18</td>
<td>392</td>
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<tr>
<td>Gabon</td>
<td>87.02</td>
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<td></td>
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<tr>
<td>Chad*</td>
<td>88.35</td>
<td>12</td>
<td></td>
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<tr>
<td>Mongolia</td>
<td>89.26</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>89.90</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Congo, Rep. of</td>
<td>91.52</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>91.98</td>
<td>181</td>
<td></td>
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<tr>
<td>------------------------------</td>
<td>-------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>Kyrgyz Republic*</td>
<td>44.92</td>
<td>97</td>
<td>43</td>
</tr>
<tr>
<td>Myanmar*</td>
<td>46.09</td>
<td>41</td>
<td>103</td>
</tr>
<tr>
<td>Lao People’s Democratic</td>
<td>46.11</td>
<td>64</td>
<td>26</td>
</tr>
<tr>
<td>Democratic Republic*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cameroon*</td>
<td>48.16</td>
<td>45</td>
<td>378</td>
</tr>
<tr>
<td>Ghana*</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>48.16</td>
<td>45</td>
<td>74.87</td>
</tr>
</tbody>
</table>

**Notes:**

NRI = natural resource intensity.

NRI is the share of natural resource exports in total exports.

Diversification is the number of products exported with revealed comparative advantage (that is, products with RCA(pop) > 0.25).

**Source:** Authors.
Kazakhstan. If per capita income, together with per capita income squared and population (but without considering natural resource intensity), are taken into consideration, a regression analysis indicates that Kazakhstan’s level of diversification is significantly below its predicted value of 228 products. However, if natural resource intensity as well as population and per capita income are taken into account, Kazakhstan’s diversification is much closer to its predicted value of 151 products.\footnote{This is based on a cross-country regression of the level of diversification on population, GDP per capita, GDP per capita squared, and natural resource intensity (measured as the share of natural resource exports in total exports). The regression uses 2010 data for 122 countries. The estimated regression is (variables in logarithm in base 10; all of them statistically significant at the 1% level): diversification = $-2.46 + 1.74 \times \text{Income per capita} - 0.15 \times \text{Income per capita squared} + 0.13 \times \text{Population} - 0.247 \times \text{Resource intensity}$. Adj. R-squared=0.75.} With the usual caveats that this type of exercise entails, this analysis indicates that, with the current level of natural-resource intensity, Kazakhstan could reach a diversification level of 241 products if its per capita income doubled.

On the other hand, if Kazakhstan could reduce its natural-resource intensity to 50% and double its per capita income, its diversification could reach 273 products. Although this is a somewhat mechanical exercise, it does call attention to the fact that diversification will not be easy for Kazakhstan. The regression analyses suggest that policymakers should aim to achieve exports with revealed comparative advantage of about 250–300 products in the next 20 years. In general, the experience of rich and advanced countries that are well endowed with natural resources indicates that such an endowment need not be an insurmountable obstacle—provided countries use export revenues wisely.

It is also important to recognize that countries well endowed with natural resources have limits on diversification. They probably have less economic incentive to diversify in the face of a booming natural resources sector. Research by the United Nations Industrial Development Organization (2013: 74) concluded that a high natural resource endowment has a negative effect on most manufacturing industries. The effect is especially strong on industries that play a key role in deepening and sustaining industrialization from the upper middle-income stage onward, such as electrical machinery and apparatus, motor vehicles (in large countries only), and chemical industries. Thus, countries well endowed with natural resources need to manage the impact of currency appreciations as well as invest in physical and human capital, as both are necessary for a continuous shift in the manufacturing structure.

Appendix Table 7A.1 shows the natural resource products that Kazakhstan exports with comparative advantage—marked in italics. Out
of 127 products, 29 are natural resource exports, broken down into the following products: minerals (18), metals (8), stone and glass (2) and chemical and allied products (1). The other 98 products that Kazakhstan exports with comparative advantage (75% of the total) are nonnatural resources. They are distributed as follows: animal products (7), vegetable products (16), foodstuffs (8), mineral products (11), chemicals and allied products (16), plastic and rubber products (1), raw hides, skins, leather and furs (1), wood and wood products (1), textiles (6), stone and glass (4), metals (22), and machinery and electrical (1).

Given this analysis, our view is that Kazakhstan should diversify by developing products that use capabilities similar to those used by the 127 products it exports with comparative advantage. In the context of modern industrial policy, the private sector should know where the opportunities lie, and discussions with producers and exporters should reveal both what these products are and the steps needed to export them successfully. Identifying these products should serve as a guide to engage the private sector. This does not mean that Kazakhstan should focus exclusively on this set of products; it should also explore how to acquire comparative advantage in products that require more distant capabilities (and with associated higher value-added). Indeed, this will probably be necessary to achieve Strategy 2050’s objectives. Kazakhstan also needs to diversify its export destinations and upgrade its export basket. Again, it should not be difficult for the private sector to identify promising destinations, as well as products that have potential for upgrading.

Appendix Table 7A.2 shows other Asian countries that are heavy exporters of natural resources (> 25% of total exports). Most of the products they export with revealed comparative advantage are also non-natural resources (that is, very few natural resource exports account for a significant share of the exports with revealed comparative advantage).

7.6 CONCLUSIONS

Kazakhstan is a middle-income country with three important characteristics that shape its development path: it is a transition economy, a landlocked country and heavily dependent on natural resources, particularly oil. Although it is possible for a country endowed with natural resources to achieve high income per capita, it will be very difficult for Kazakhstan to become a modern industrial and service-oriented economy when its structures of production and exports are heavily biased toward oil. Furthermore, there are serious risks behind a nondiversified economic structure (for example, the instability of export earnings, the possibility of...
‘Dutch disease’ or the risk of political capture). This chapter argues that diversification lowers these risks and increases the degree of inclusiveness in the economy.

With Kazakhstan’s income per capita approaching high-income, and with the ambitious objectives set in Strategy 2030 and Strategy 2050, it is imperative that an appropriate policy framework is put in place to enable the country to catch up with the standards of income and productivity of more developed countries. It has been argued that in the latter stages of development, institutions and policies matter more than in the earlier stages (Buiter and Rahbari 2011). For this reason, Kazakhstan needs to follow a multipronged development strategy that relies on: (1) diversifying the economic base by developing products that use capabilities similar to those used by the 127 products it exports with comparative advantage, (2) optimal management of its resource revenues, (3) financial stability and macro-prudential regulations, (4) developing its human capital, (5) enhancing the quality of physical infrastructure to counteract being a landlocked country and (6) strengthening institutions.

REFERENCES


Table 7A.1  Kazakhstan's export diversification: 127 products exported with $RCA(pop) > 0.25$, 2010

<table>
<thead>
<tr>
<th>HS 4 product code</th>
<th>Product name</th>
<th>Value in $ million</th>
<th>RCA (pop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>303</td>
<td>Frozen fish excluding fillets</td>
<td>12</td>
<td>0.282</td>
</tr>
<tr>
<td>304</td>
<td>Fish fillet or meat</td>
<td>103</td>
<td>2.499</td>
</tr>
<tr>
<td>305</td>
<td>Fish flours, meals and pellets for human consumption</td>
<td>5</td>
<td>0.422</td>
</tr>
<tr>
<td>504</td>
<td>Guts of animals except fish</td>
<td>4</td>
<td>0.459</td>
</tr>
<tr>
<td>507</td>
<td>Ivory, tortoise shell, whalebone and whalebone hair, horns</td>
<td>0</td>
<td>1.267</td>
</tr>
<tr>
<td>510</td>
<td>Ambergris, civet, musk for pharmaceutical use</td>
<td>0</td>
<td>0.964</td>
</tr>
<tr>
<td>511</td>
<td>Animal products not elsewhere specified</td>
<td>3</td>
<td>0.617</td>
</tr>
<tr>
<td>703</td>
<td>Onions and shallots</td>
<td>28</td>
<td>1.906</td>
</tr>
<tr>
<td>704</td>
<td>Cabbages, cauliflower, kohlrabi, kale, broccoli</td>
<td>8</td>
<td>1.484</td>
</tr>
<tr>
<td>707</td>
<td>Cucumbers</td>
<td>1</td>
<td>0.271</td>
</tr>
<tr>
<td>807</td>
<td>Melons</td>
<td>9</td>
<td>1.268</td>
</tr>
<tr>
<td>1001</td>
<td>Wheat and meslin</td>
<td>672</td>
<td>7.868</td>
</tr>
<tr>
<td>1003</td>
<td>Barley</td>
<td>27</td>
<td>2.145</td>
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<td>1101</td>
<td>Wheat or meslin flour</td>
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<td>20.637</td>
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<td>Worked cereal groats</td>
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<td>Wheat gluten</td>
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<td>Linseed</td>
<td>18</td>
<td>11.922</td>
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<td>1205</td>
<td>Rape or colza seeds</td>
<td>10</td>
<td>0.536</td>
</tr>
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<td>Code</td>
<td>Description</td>
<td>Quantity</td>
<td>Value</td>
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<td>------</td>
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<td>----------</td>
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<tr>
<td>1206</td>
<td>Sunflower seeds</td>
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<td>0.496</td>
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<td>1301</td>
<td>Lac</td>
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<td>Vegetable products not elsewhere specified</td>
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<td>1512</td>
<td>Sunflower seed or safflower oil, crude</td>
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<tr>
<td>1517</td>
<td>Margarine, not liquid</td>
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<td><strong>Foodstuffs</strong></td>
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<td>Confectionery sugar</td>
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<td>Pasta</td>
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<td>Waters flavored or sweetened</td>
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<td>Ethyl alcohol &gt; 80% by volume</td>
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<td>2302</td>
<td>Bran, sharps (middlings) and other residues</td>
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<td>2306</td>
<td>Cotton seed oilcake</td>
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<td>Tobacco, raw</td>
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<td>2402</td>
<td>Cigars</td>
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<td>Sulfur</td>
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<td>Natural calcium phosphates</td>
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<td>Feldspar</td>
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<td>2601</td>
<td>Iron ores and concentrates</td>
<td>1090</td>
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<td>2602</td>
<td>Manganese of 47% or more by weight</td>
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<tr>
<td>2603</td>
<td>Gold content</td>
<td>529</td>
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Table 7A.1  (continued)

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<tr>
<th>HS 4 product code</th>
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<th>Value in $ million</th>
<th>RCA (pop)</th>
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<tr>
<td>2607</td>
<td>Lead ores</td>
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<tr>
<td>2608</td>
<td>Zinc ores</td>
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<td>2610</td>
<td>Chromium ore</td>
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<td>Tungsten ores</td>
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<td>2612</td>
<td>Uranium or thorium ores</td>
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<td>146.271</td>
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<td>Other ores and concentrates</td>
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<td>2618</td>
<td>Granulated slag</td>
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<td>Other slag and ash, including seaweed ash (kelp)</td>
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<tr>
<td>2701</td>
<td>Coal; briquettes</td>
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<td>1.579</td>
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<tr>
<td>2702</td>
<td>Lignite</td>
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<td>6.286</td>
</tr>
<tr>
<td>2704</td>
<td>Coke of coal, lignite or peat, retort carbon</td>
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<td>1.056</td>
</tr>
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<td>2706</td>
<td>Tar distilled from coal</td>
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<td>Pitch and pitch coke</td>
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<td>2713</td>
<td>Petroleum coke</td>
<td>19</td>
<td>0.432</td>
</tr>
<tr>
<td></td>
<td>Chemical and allied products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2804</td>
<td>Hydrogen, rare gases and other nonmetals</td>
<td>73</td>
<td>2.159</td>
</tr>
<tr>
<td>2809</td>
<td>Diphosphorus pentaoxide, phosphoric acid</td>
<td>3</td>
<td>0.269</td>
</tr>
<tr>
<td>2817</td>
<td>Zinc oxide and peroxide</td>
<td>4</td>
<td>1.435</td>
</tr>
<tr>
<td>2818</td>
<td>Artificial corundum</td>
<td>192</td>
<td>4.467</td>
</tr>
<tr>
<td>2819</td>
<td>Chromium oxides and hydroxides</td>
<td>90</td>
<td>85.169</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Quantity</td>
<td>Unit Weight</td>
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<tr>
<td>------</td>
<td>----------------------------------------------------------------------------</td>
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<td>-------------</td>
</tr>
<tr>
<td>2824</td>
<td>Lead oxides</td>
<td>2</td>
<td>4.472</td>
</tr>
<tr>
<td>2833</td>
<td>Sulfates, alums, peroxosulfates (persulfates)</td>
<td>9</td>
<td>1.240</td>
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<tr>
<td>2835</td>
<td>Phosphinates and phosphonates</td>
<td>27</td>
<td>3.092</td>
</tr>
<tr>
<td>2841</td>
<td>Salts of oxometallic or peroxometallic acids</td>
<td>54</td>
<td>15.774</td>
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<tr>
<td>2844</td>
<td>Radioactive chemical elements and radioactive isotopes</td>
<td>1706</td>
<td>33.299</td>
</tr>
<tr>
<td>2846</td>
<td>Compounds, inorganic or organic, of rare-earth metals</td>
<td>6</td>
<td>28.46</td>
</tr>
<tr>
<td>2849</td>
<td>Carbides</td>
<td>8</td>
<td>28.49</td>
</tr>
<tr>
<td>3102</td>
<td>Mineral or chemical fertilizers, nitrogenous</td>
<td>15</td>
<td>3102</td>
</tr>
<tr>
<td>3105</td>
<td>Mineral or chemical fertilizers, mixed</td>
<td>14</td>
<td>3105</td>
</tr>
<tr>
<td>3202</td>
<td>Synthetic organic tanning substances</td>
<td>2</td>
<td>1.112</td>
</tr>
<tr>
<td>3214</td>
<td>Glaziers' putty</td>
<td>4</td>
<td>0.286</td>
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<tr>
<td>3603</td>
<td>Safety or detonating fuses</td>
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<td>0.448</td>
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<tr>
<td></td>
<td><strong>Plastic and rubbers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4010</td>
<td>Conveyor or transmission belts of vulcanized rubber</td>
<td>7</td>
<td>0.535</td>
</tr>
<tr>
<td></td>
<td><strong>Raw hides, skins, leather and furs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4101</td>
<td>Raw hides and skins of bovine or equine animals</td>
<td>5</td>
<td>0.401</td>
</tr>
<tr>
<td>4102</td>
<td>Raw skins of sheep or lambs</td>
<td>1</td>
<td>0.330</td>
</tr>
<tr>
<td>4103</td>
<td>Other raw hides and skins</td>
<td>1</td>
<td>0.565</td>
</tr>
<tr>
<td>4104</td>
<td>Tanned hides and skins of bovine or equine animals</td>
<td>30</td>
<td>0.830</td>
</tr>
<tr>
<td>4105</td>
<td>Tanned skins of sheep or lambs</td>
<td>4</td>
<td>0.928</td>
</tr>
<tr>
<td></td>
<td><strong>Wood and wood products</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4906</td>
<td>Architectural, engineering, industrial plans and drawings</td>
<td>1</td>
<td>1.225</td>
</tr>
<tr>
<td></td>
<td><strong>Textiles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5101</td>
<td>Wool</td>
<td>7</td>
<td>0.792</td>
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<tr>
<td>5102</td>
<td>Animal hair</td>
<td>3</td>
<td>4.161</td>
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<tr>
<td>5201</td>
<td>Cotton raw</td>
<td>92</td>
<td>2.527</td>
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<tr>
<td>5202</td>
<td>Cotton waste</td>
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<td>0.267</td>
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Table 7A.1  (continued)

<table>
<thead>
<tr>
<th>HS 4 product code</th>
<th>Product name</th>
<th>Value in $ million</th>
<th>RCA (pop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5208</td>
<td>Woven fabrics of cotton of &gt; 85% weighing &lt; 200 g/m²</td>
<td>12</td>
<td>0.370</td>
</tr>
<tr>
<td>5802</td>
<td>Terry toweling and similar fabrics</td>
<td>0</td>
<td>0.258</td>
</tr>
<tr>
<td>Stone and glass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6806</td>
<td>Slag wool, rock wool and similar mineral wools</td>
<td>4</td>
<td>0.415</td>
</tr>
<tr>
<td>6809</td>
<td>Plaster articles</td>
<td>4</td>
<td>0.930</td>
</tr>
<tr>
<td>6814</td>
<td>Mica articles</td>
<td>1</td>
<td>1.290</td>
</tr>
<tr>
<td>7108</td>
<td>Gold</td>
<td>145</td>
<td>0.339</td>
</tr>
<tr>
<td>7106</td>
<td>Silver</td>
<td>177</td>
<td>3.655</td>
</tr>
<tr>
<td>7112</td>
<td>Scrap of precious metal</td>
<td>10</td>
<td>0.257</td>
</tr>
<tr>
<td>Metals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7202</td>
<td>Ferroalloys</td>
<td>1824</td>
<td>26.872</td>
</tr>
<tr>
<td>7204</td>
<td>Ferrous waste and scrap</td>
<td>151</td>
<td>1.386</td>
</tr>
<tr>
<td>7206</td>
<td>Iron and non-alloy steel</td>
<td>12</td>
<td>1.556</td>
</tr>
<tr>
<td>7208</td>
<td>Hot rolled iron or non-alloy steel, coil, w &gt; 600mm</td>
<td>119</td>
<td>0.883</td>
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<tr>
<td>7209</td>
<td>Cold rolled iron or non-alloy steel, coil, width &gt; 600mm</td>
<td>183</td>
<td>3.995</td>
</tr>
<tr>
<td>7210</td>
<td>Flat rolled iron or non-alloy steel, coated with tin, width &gt; 600mm</td>
<td>270</td>
<td>2.516</td>
</tr>
<tr>
<td>7304</td>
<td>Tubes, pipes and hollow profiles, seamless, of iron or steel</td>
<td>28</td>
<td>0.400</td>
</tr>
<tr>
<td>7322</td>
<td>Radiators for central heating of iron or steel</td>
<td>4</td>
<td>0.488</td>
</tr>
<tr>
<td>7324</td>
<td>Sanitary ware and parts of iron or steel</td>
<td>6</td>
<td>0.968</td>
</tr>
<tr>
<td>7325</td>
<td>Other cast articles of iron or steel</td>
<td>4</td>
<td>0.312</td>
</tr>
<tr>
<td>7401</td>
<td>Copper mattes, cement copper</td>
<td>2</td>
<td>1.063</td>
</tr>
<tr>
<td>7402</td>
<td>Unrefined copper</td>
<td>33</td>
<td>1.921</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>RCA</td>
<td>Value</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>7403</td>
<td><em>Refined copper and copper alloys</em></td>
<td>2127</td>
<td>12.042</td>
</tr>
<tr>
<td>7404</td>
<td>Copper waste and scrap</td>
<td>95</td>
<td>1.578</td>
</tr>
<tr>
<td>7405</td>
<td>Master alloys of copper</td>
<td>7</td>
<td>12.945</td>
</tr>
<tr>
<td>7408</td>
<td>Copper wire</td>
<td>207</td>
<td>4.299</td>
</tr>
<tr>
<td>7409</td>
<td>Copper plates, sheets and strip &gt; 0.15 mm</td>
<td>8</td>
<td>0.358</td>
</tr>
<tr>
<td>7601</td>
<td><em>Unwrought aluminum</em></td>
<td>360</td>
<td>3.181</td>
</tr>
<tr>
<td>7602</td>
<td>Waste or scrap, aluminum</td>
<td>12</td>
<td>0.447</td>
</tr>
<tr>
<td>7801</td>
<td><em>Lead refined unwrought</em></td>
<td>156</td>
<td>11.623</td>
</tr>
<tr>
<td>7802</td>
<td>Lead waste or scrap</td>
<td>5</td>
<td>3.850</td>
</tr>
<tr>
<td>7901</td>
<td><em>Unwrought zinc</em></td>
<td>566</td>
<td>21.225</td>
</tr>
<tr>
<td>7904</td>
<td>Zinc bars, rods, profiles and wire</td>
<td>0</td>
<td>0.728</td>
</tr>
<tr>
<td>8103</td>
<td>Tantalum</td>
<td>40</td>
<td>16.173</td>
</tr>
<tr>
<td>8104</td>
<td>Magnesium</td>
<td>4</td>
<td>0.907</td>
</tr>
<tr>
<td>8106</td>
<td>Bismuth</td>
<td>2</td>
<td>3.383</td>
</tr>
<tr>
<td>8107</td>
<td>Cadmium</td>
<td>4</td>
<td>19.825</td>
</tr>
<tr>
<td>8108</td>
<td>Titanium</td>
<td>150</td>
<td>17.272</td>
</tr>
<tr>
<td>8112</td>
<td>Other metals</td>
<td>8</td>
<td>1.663</td>
</tr>
<tr>
<td>8301</td>
<td>Padlocks of base metal</td>
<td>13</td>
<td>0.536</td>
</tr>
<tr>
<td>8482</td>
<td>Ball or roller bearings</td>
<td>27</td>
<td>0.386</td>
</tr>
</tbody>
</table>

**Notes:**
RCA(pop) is the index of revealed comparative advantage.
Products in italics are natural resources.

**Source:** Authors.
Table 7A.2 Exporters of natural resources, Kazakhstan and other Asian countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Natural resource intensity (%)</th>
<th>Diversification</th>
<th>Nonnatural resource diversification</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>32.49</td>
<td>169</td>
<td>161</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>34.12</td>
<td>67</td>
<td>59</td>
</tr>
<tr>
<td>Indonesia</td>
<td>36.18</td>
<td>317</td>
<td>300</td>
</tr>
<tr>
<td>Myanmar</td>
<td>46.09</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>82.86</td>
<td>127</td>
<td>98</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>94.42</td>
<td>73</td>
<td>65</td>
</tr>
</tbody>
</table>

Notes: Natural resource intensity is the share of natural resource exports in total exports. Diversification is the number of products exported with revealed comparative advantage (that is, products with \( \text{RCA}(\text{pop}) > 0.25 \)). Nonnatural resource diversification is the number of nonnatural resource products exported with comparative advantage.

Source: Authors.
8. Industrial diversification in the People’s Republic of China

Justin Yifu Lin, Cheryl Xiaoning Long and Xiaobo Zhang

8.1 INTRODUCTION

Until about 1980, the People’s Republic of China (PRC) was a closed, centrally planned economy. It has since become a vibrant, open, market-oriented economy that produces and exports a wide range of labor- and capital-intensive goods. Quite rightly, the PRC is regarded as the ‘world’s factory.’ At first glance, this expanding product range suggests that its economic structure has become more diversified, lending support to the findings of the influential study by Imbs and Wacziarg (2003), which argues that diversification tends to occur in the early stages of development.

Using data from the China Industrial Census 1995 and the China Economic Census 2004, this chapter investigates whether diversification has occurred in the early stages of the PRC’s development. We find, surprisingly, that industrial production has actually become increasingly specialized, with the economy becoming less diversified at both the national and regional levels during 1995–2004.

Several theories explain the relationship between economic development and industrial diversification. According to Adam Smith (1776) and George Stigler (1951), the division of labor is limited by the extent of the market. As a region or country expands its market, it tends to specialize in the production of goods in which it has comparative advantage.

Building on this insight, the Heckscher–Ohlin model predicts that when a region (or country) opens up to trade, it will produce and export products that are more intensive in their use of the resources in which the region is richly endowed. The PRC began opening up its economy in the late 1970s and, after evolving quickly, became a member of the World Trade Organization (WTO) in 2001. Applied to the PRC, the Heckscher–Ohlin model predicts that, after integrating into the global market, the country would be able to exploit its comparative advantage by specializing in and
exporting more labor-intensive manufactured products. This would make it possible for the economy as a whole to become more specialized—or in other words, less diversified.

The economic geography literature (Krugman 1991) presents a different explanation for sectoral concentration. Given positive externalities, firms may prefer to cluster, thereby creating sectoral concentration. This model also predicts rising regional agglomeration alongside economic integration (Porter 1998, 2000).

Acemoglu and Zilibotti (1997), however, argue that market expansions may present firms with more opportunity to manage risk portfolios through diversification. Therefore, ‘development goes hand in hand with the expansion of markets and with better diversification opportunities’ (Acemoglu and Zilibotti 1997: 711). This model predicts that as a country develops its economy tends to diversify.

On the empirical front, Imbs and Wacziarg (2003) find that the relationship between sectoral concentration and the level of per capita income is not monotonic, as predicted by the aforementioned theories. Instead, it follows a U-shaped pattern; that is, a country diversifies in the early stage of development before it specializes. Their study presents Gini coefficients and income per capita in the PRC revealing a trend toward diversification.¹ Their sample, however, covers only four data points, with per capita income ranging from $1261 to $1493. In the past several decades, the PRC’s per capita income increased several fold, but it is not clear from their study whether this pattern holds for a longer period.

The major difference between the findings of Imbs and Wacziarg and those presented in this chapter is that the sample we use covers a much wider income range. We also test whether the U-shaped pattern predicted by Imbs and Wacziarg (2003) between industrial diversification and regional income per capita appears in the PRC, using a panel dataset for 1995 and 2004. The results fail to uncover this pattern, indicating that the increase in sectoral concentration is across the board.

Although this chapter’s finding that specialization increases is more consistent with the prediction of the first and second theories (Ohlin 1967; Krugman 1991), the underlying mechanism seems to differ. In contrast to the Heckscher–Ohlin model prediction, the fastest employment-expanding sectors were not those that were labor intensive but those that were capital intensive during 1995–2004, when the PRC joined the WTO. Moreover, even after controlling for the clustering effect highlighted in Krugman

¹ See Figure 17 in Imbs and Wacziarg (2003).
(1991), this study still finds that employment has grown faster in more capital-intensive sectors, suggesting that other factors must be in play.

This chapter argues that the PRC has been continuously upgrading its industrial structure toward more capital-intensive sectors with latent comparative advantage. In this process of technological upgrading, firms may have reorganized production structures to better suit the country’s abundant labor and limited capital. In other words, the PRC has adopted a development strategy following its dynamic advantage instead of its static comparative advantage. Overall, the findings support the theory of dynamic comparative advantage that Rodrik (2007) and Lin (2012) propose. According to this view, developing countries should push the limits of static comparative advantage and develop their industries toward the domain of countries richer than them. Consequently, the sectors with latent comparative advantage (not necessarily the static comparative advantage) tend to grow faster, particularly if the right industrial policies are put in place.

8.2 A BRIEF OVERVIEW OF THE PRC’S DEVELOPMENT STRATEGY

The PRC faced a hostile international environment when it was established in 1949. At that time, its trade partners were limited to the former Soviet Union and other socialist countries. But in the late 1950s, after relations with the Soviet Union deteriorated, the country was forced to diversify economically to survive the trade embargos imposed against it.

Influenced by the dominant development thinking at the time, the PRC adopted a heavy-industry led development strategy (Lin et al. 1996), and placed many of its state-owned heavy industries in remote mountainous areas to avoid military attack. However, this strategy was at odds with the country’s comparative advantage at the time (a function of its large population and limited capital resources), which it sometimes used inefficiently, and because the country used its scarce capital to support some unviable industrial projects, capital–labor ratios in some sectors were very low.

One of the first reform measures in the late 1970s aimed to attract foreign direct investment. Taking advantage of cheap and abundant labor in the PRC, labor-intensive industries in Hong Kong, China; Taipei, China and elsewhere shifted production there. The PRC adopted an export-oriented development strategy by setting up special economic zones and giving tax credits to exporting firms. As a result, exports of labor-intensive manufactured goods surged.
The central government also used the country’s entry to the WTO to force state-owned enterprises to face international competition. Since then, the domestic private manufacturing sector has moved more into line with the PRC’s comparative advantage in the global market and enjoyed phenomenal growth. Exposed to fierce international competition, many state-owned enterprises were closed, privatized or revamped.

The central government continues to decentralize responsibility for local economic development to local governments, including at the provincial, prefecture, county and township levels. In 1994, tax reforms simplified tax codes and increased local fiscal incentives (Shen et al. 2012). A key feature of those reforms was central and local governments’ sharing of revenues coming from several major tax sources. For value-added tax, for example, the central–local ratio was 75:25 and 60:40 for income tax.

Local governments face hard budget constraints under fiscal decentralization, although they can retain a certain proportion of incremental revenues. However, because local governments have no monetary authority and cannot issue government bonds, they need to maintain balanced budgets. This limits their ability to subsidize or protect new industries, forcing them to focus resources on industries that are able to become competitive quickly. Thus, they tend to concentrate on facilitating the development of existing industrial clusters, often consistent with local comparative advantage.

Local government officials have a big incentive to develop the economies in their jurisdictions because their political careers depend on the performance of their regions (Li and Zhou 2005), with GDP and fiscal revenue growth being important evaluation criteria. Not surprisingly, these officials are keen to attract investment and facilitate industrial development.

Unlike many other developing countries, local government officials in the PRC can use various methods to facilitate cluster development. Because economic development involves continuous identification and overcoming binding constraints, local leaders are more knowledgeable about local conditions and are more likely than high-level government officials to come up with effective solutions—often indigenous and seemingly heterodox ones—but this is provided that they have an interest in doing so. For example, if many small and medium enterprises produce the same product, local governments may conclude that this industry has local comparative advantage and introduce policies to expand the sector. Establishing marketplaces, setting up logistics centers and improving transportation conditions are common practices. However, as markets become saturated, policy interventions often focus on upgrading quality; for instance, by setting up inspection centers to check quality, granting
preferential policies to companies that produce brand names or setting up business associations that can punish firms that produce low-quality products (Ruan and Zhang 2010).

In short, the PRC has adopted many measures to reform and to transform itself into a market economy even though it does not specifically pursue a strategy of industrial diversification. As a large country, there are significant regional differences that require active local governments to determine the most suitable industries given local comparative advantage. Consequently, different regions end up specializing in different products and, due to its vast size, the PRC as a whole is more diversified than each of its individual regions.

8.3 DATA AND MEASURES OF DIVERSIFICATION

The study presented in this chapter uses firm-level data from the 1995 industrial census and 2004 economic census. Compared with datasets used in previous studies on the PRC’s industrialization patterns (Young 2000; Bai et al. 2004; Wen 2004; Zhang and Tan 2007; Lu and Tao 2009), the datasets cover a longer time span (nine years) and more firms, and include industrial firms of all sizes. Since the data is at the firm level, it can be aggregated at any level, such as county, prefecture or province for regional aggregation. The two-, three- or four-digit industry level data can also be aggregated. For the main part of the analysis, this study uses province and the two-digit China Industry Code (CIC) as the aggregation level. For robustness, it also uses prefecture and county levels for geographic aggregation and 3- and 4-digit CIC for industrial aggregation.

Because the PRC modified its industry coding system in 2002 (switching from GB1994 to GB2002), the study matches industry codes that changed between 1994 and 2002 as follows: for industry codes that have become more disaggregated, the 1994 codes are used as the standard; and for those that have become more aggregated, the 2002 codes are used. So, the more aggregate codes are used to group and compare industries between 1995 and 2004. During the period between the two censuses (1995–2004), some counties were elevated to cities and changed their names. This study tracks these changes to match the counties throughout the time period.

We computed three measures of industrial diversification at the regional level: the concentration index, the Gini index and entropy of industries. The concentration index is the total share of gross industrial output (or of employment or of assets) contributed by the top three industries (referred to as CR3). A larger CR3 value means that an economy is more concentrated in the three leading industries and is therefore less diversified. One
Development and modern industrial policy in practice

The weakness of the CR3 index is that it captures only the top three industries, ignoring the distribution of others. To remedy this, the study also computes the Gini coefficient, which measures the distribution in output (or in employment or in assets) across industries. The larger the value, the less diversified the industry.²

Entropy is a concept derived from information theory. It is widely used as a measure of industrial diversification in the literature (Jacquemin and Berry 1979). Its algebraic definition is

$$E = \sum_{i=1}^{n} p_i \log \left( \frac{1}{p_i} \right), (8.1)$$

where $p_i$ measures industry $i$’s share in a country or region’s total output (or in employment or in assets). Again, the larger the value, the more diversified a region or economy.

A fourth measure of diversification is added, which we call ‘industrial proximity.’ It is based on the concept of product proximity proposed by Hausmann and Klinger (2006). Proximity is a measure of how close or interconnected industries and participating firms are in a given location. Hausmann and Klinger constructed a proximity matrix for all four-digit Standard International Trade Classification products in which the proximity between any two goods captures their similarity in the following sense: if the two goods need the same combination of inputs or endowments and capabilities to be produced, then there is a higher probability that a country has a comparative advantage in both, and both products are more likely to be co-exported. In other words, the proximity between each pair of goods can be computed as the probability that a country has net exports in both, averaged over all countries in the world.

Firms and industries that produce goods with a higher proximity are more likely to interact with one another in various ways, including dependence on similar inputs (be they raw materials, labor or machinery), reliance on similar technologies and research and development, and even dependence on the same supply or marketing facilities. Therefore, industries that export more proximate commodities in the Hausmann–Klinger sense are likely to be more interconnected because they have closer relationships with one another due to common usage of similar technology, labor and other production factors. A region with closely related industries can be considered less diversified.

To construct industrial proximity, we start from the product proximity

² See Long and Zhang (2011) for the computation procedure of the proximity measure, which is in turn based on Hausmann and Klinger (2006).
measure and construct a weighted average of how proximate the industries located in a certain region are to one another. By using the concordance table between the Standard International Trade Classification codes and the Standard Industry Code, we match each pair of industries with a corresponding proximity measure (often a weighted average of multiple product proximities). We then compute a weighted average of all pairs of industries located in the region, using output, assets or employment as weights. The resulting measure of industrial proximity provides information on how closely related the industries in a region are to one another. Long and Zhang (2012) provide detailed computation methods for the industrial proximity measure.

8.4 PATTERNS OF INDUSTRIAL DIVERSIFICATION

Table 8.1 shows the four industrial diversification measures at the provincial and national levels, based on output. Several features are apparent. First, the four measures selected yield consistent results. Industries became increasingly concentrated between 1995 and 2004 at both the regional and national levels. The CR3 measure indicates that among the PRC’s 31 provinces, only five (Jiangsu, Zhejiang, Anhui, Sichuan and Yunnan) became more diversified in their industrial structure during the period reviewed. The Gini coefficient and entropy measures reveal that only Sichuan’s industries have become more diversified, and according to the proximity measure, only Fujian and Chongqing have become slightly less clustered. A t-test comparing the four measures in all 31 provinces, shown in the last column of Table 8.1, rejects the null hypothesis of no trend in diversification in favor of the alternative of a trend toward decreasing diversification during the sample period. In fact, the pattern is consistent with that of states in the United States from the nineteenth to the early twentieth centuries; namely, that regional specialization increased as domestic markets integrated (Kim 1995).

Second, large regional variations exist. For instance, in 2004 the top three industries in Shandong province produced 23.9% of their total output, while the top three industries of resource-rich provinces such as Tibet, Qinghai and Xinjiang generated more than 60% of their total output.

Third, at the national level, industry in the PRC appears to be more diversified than at the regional level. The output generated from the top three industries at the national level was 21.5% in 1995 and 21% in 2004, lower than—and therefore more diversified than—Shandong, the most
Table 8.1  Industrial diversification by province, PRC, 1995 and 2004

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<td>Beijing</td>
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<td>0.627</td>
<td>0.664</td>
<td>4.313</td>
<td>4.241</td>
<td>0.206</td>
<td>0.220</td>
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<td>4.509</td>
<td>4.236</td>
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<td>0.400</td>
<td>0.565</td>
<td>0.625</td>
<td>4.609</td>
<td>4.262</td>
<td>0.213</td>
<td>0.219</td>
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<td>0.590</td>
<td>0.713</td>
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<td>3.955</td>
<td>3.481</td>
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<td>4.424</td>
<td>4.167</td>
<td>0.198</td>
<td>0.214</td>
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<td>0.386</td>
<td>0.599</td>
<td>0.640</td>
<td>4.508</td>
<td>4.310</td>
<td>0.204</td>
<td>0.205</td>
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<td>0.719</td>
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<td>0.553</td>
<td>0.589</td>
<td>4.442</td>
<td>4.379</td>
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<td>0.564</td>
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<td>4.469</td>
<td>0.211</td>
<td>0.210</td>
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<td>0.280</td>
<td>0.551</td>
<td>0.552</td>
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<td>4.592</td>
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<td>0.531</td>
<td>4.791</td>
<td>4.727</td>
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<td>0.205</td>
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<td>Henan</td>
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<td>0.541</td>
<td>0.551</td>
<td>4.694</td>
<td>4.638</td>
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<td>0.216</td>
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<td>0.544</td>
<td>0.550</td>
<td>4.659</td>
<td>4.616</td>
<td>0.201</td>
<td>0.210</td>
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<td>0.537</td>
<td>0.676</td>
<td>4.712</td>
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<td>0.573</td>
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<td>4.201</td>
<td>0.208</td>
<td>0.214</td>
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<tr>
<td>Province</td>
<td>CR3</td>
<td>CR5</td>
<td>CR6</td>
<td>CR7</td>
<td>CR8</td>
<td>CR9</td>
<td>CR10</td>
<td>CR11</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
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<tr>
<td>Hainan</td>
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<td>0.443</td>
<td>0.626</td>
<td>0.670</td>
<td>4.236</td>
<td>4.090</td>
<td>0.201</td>
<td>0.207</td>
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<td>4.615</td>
<td>0.198</td>
<td>0.202</td>
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<td>Guizhou</td>
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<td>0.426</td>
<td>0.644</td>
<td>0.698</td>
<td>4.359</td>
<td>4.029</td>
<td>0.188</td>
<td>0.196</td>
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<td>Yunnan</td>
<td>0.510</td>
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<td>0.708</td>
<td>0.728</td>
<td>3.760</td>
<td>3.877</td>
<td>0.187</td>
<td>0.197</td>
</tr>
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<td>Tibet</td>
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<td>0.614</td>
<td>0.635</td>
<td>0.734</td>
<td>3.714</td>
<td>3.285</td>
<td>0.223</td>
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<td>Shannxi</td>
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<td>0.308</td>
<td>0.563</td>
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<td>0.192</td>
</tr>
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<td>Gansu</td>
<td>0.374</td>
<td>0.490</td>
<td>0.660</td>
<td>0.733</td>
<td>4.238</td>
<td>3.890</td>
<td>0.199</td>
<td>0.205</td>
</tr>
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<td>Qinghai</td>
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<td>0.612</td>
<td>0.711</td>
<td>0.802</td>
<td>3.921</td>
<td>3.319</td>
<td>0.197</td>
<td>0.217</td>
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<td>0.666</td>
<td>0.716</td>
<td>4.167</td>
<td>4.001</td>
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<td>Xinjiang</td>
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<td>0.610</td>
<td>0.742</td>
<td>0.782</td>
<td>3.689</td>
<td>3.452</td>
<td>0.190</td>
<td>0.199</td>
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<tr>
<td>National</td>
<td>0.215</td>
<td>0.210</td>
<td>0.500</td>
<td>0.643</td>
<td>4.842</td>
<td>4.762</td>
<td>0.206</td>
<td>0.211</td>
</tr>
</tbody>
</table>

Notes:
CR3 = the total share of gross industrial output contributed by the top three industries, PRC = People’s Republic of China.

*** p < 0.01, ** p < 0.05, * p < 0.1.

diversified province (23.9%). The general pattern for the country as a whole is that the economy is more diversified than most provincial economies, and this is also shown by the Gini, entropy and proximity measures. However, taking all industries into account, the four measures indicate that the PRC’s industries have become less diversified over time.

As a robustness check, the study also computes diversification measures at the county level and uses assets as weight. The main findings remain largely the same. Figures 8.1a and 8.1b plot the density distributions of the four diversification measures in 1995 and in 2004, based on two-digit and four-digit industrial output data at the county level. The pattern of regional specialization can be clearly spotted, with those based on the CIC-two digit and CIC-four digit being consistent. The density curves for the CR3 measure (Figure 8.1a, panel A) and the Gini coefficient (Figure 8.1a, panel B) have shifted rightward, indicating a greater concentration. The

Notes:
CIC = China Industry Code, CR3 = the total share of gross industrial output contributed by the top three industries, PRC = People’s Republic of China.
Weight used is assets.


Figure 8.1a  Distributions of four measures of industrial diversification, PRC, 1995 and 2004 (CIC 2-digit level)
density curve of entropy has moved leftward, suggesting a decline in diversification (Figure 8.1a, panel C). The difference in the proximity curves between 1995 and 2004 is more subtle, but nonetheless still shows a slight increase in clustering (Figure 8.1a, panel D).

However, when using employment as the weight, no obvious trend appears between 1995 and 2004. More research is needed to understand why diversification measures based on employment generate different results from those based on output and assets. One explanation could be the effect of the reform of state-owned enterprises in the 1990s, which resulted in numerous firms being shut down or sold, forcing millions of workers out of jobs. Retrenchment may have reduced the concentration of employment in state-owned enterprises.

Using cross-country data, Imbs and Wacziarg (2003) find a U-shaped relationship between sectoral concentration and income level. Industrial
Diversification is low at low levels of income per capita. It then increases and, after reaching a certain development stage, countries specialize again. Does the same pattern hold true across the PRC’s regions?

Following the specifications in Imbs and Wacziarg (2003), our study regresses the four concentration measures on per capita GDP and its square and controls for country and year fixed effects to test the U-shaped pattern. Tables 8.2a and 8.2b show the estimation results for the four concentration measures based on the CIC-two and CIC-four digit industries. As shown in panel A in Table 8.2a, none of the coefficients of per capita GDP is statistically significant and only one out of eight coefficients for per capita GDP squared is significant. We reject the existence of a U-shaped pattern.

Since many economic variables, such as per capita GDP, follow a log-normal distribution, per capita GDP is next replaced with the natural log.

### Table 8.2a  Fixed effects regressions of sectoral concentration on income per capita and income per capita squared, PRC (CIC 2-digit level)

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Gini</th>
<th>Entropy</th>
<th>Proximity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: per capita GDP in level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per capita GDP</td>
<td>−0.012</td>
<td>0.01</td>
<td>0.044</td>
</tr>
<tr>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.06)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Per capita GDP squared (/100)</td>
<td>0.097</td>
<td>−0.039</td>
<td>−0.461</td>
</tr>
<tr>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.32)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>Fixed effect year 2004</td>
<td>0.059**</td>
<td>0.033**</td>
<td>−0.244**</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.02)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.851</td>
<td>0.816</td>
<td>0.880</td>
</tr>
<tr>
<td><strong>Panel B: per capita GDP in log</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln (per capita GDP)</td>
<td>−0.002</td>
<td>0.01</td>
<td>−0.001</td>
</tr>
<tr>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.04)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>ln (per capita GDP) squared (/100)</td>
<td>0.02</td>
<td>0.364**</td>
<td>−0.172</td>
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<tr>
<td>(0.18)</td>
<td>(0.17)</td>
<td>(0.93)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Fixed effect year 2004</td>
<td>0.058**</td>
<td>0.034**</td>
<td>−0.244**</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.02)</td>
<td>(0.00)</td>
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<tr>
<td>R-squared</td>
<td>0.851</td>
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<td>4216</td>
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</table>

**Notes:**
CIC = China Industry Code, GDP = gross domestic product.
Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Industrial diversification in the People's Republic of China

Table 8.2b  Fixed effects regressions of sectoral concentration on income per capita and income per capita squared, PRC (CIC 4-digit level)

<table>
<thead>
<tr>
<th></th>
<th>Concentration</th>
<th>Gini</th>
<th>Entropy</th>
<th>Proximity</th>
</tr>
</thead>
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<tr>
<td>Panel A: per capita GDP in level</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Per capita GDP</td>
<td>−0.011</td>
<td>0.014</td>
<td>0.116</td>
<td>0.005</td>
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<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.07)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Per capita GDP squared (/100)</td>
<td>0.107</td>
<td>−0.066</td>
<td>−0.969**</td>
<td>−0.001</td>
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<tr>
<td></td>
<td>(0.07)</td>
<td>(0.05)</td>
<td>(0.42)</td>
<td>(0.02)</td>
</tr>
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<td>Fixed effect year 2004</td>
<td>0.059**</td>
<td>0.035**</td>
<td>−0.256**</td>
<td>0.009**</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.02)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.865</td>
<td>0.831</td>
<td>0.901</td>
<td>0.736</td>
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<tr>
<td>Panel B: per capita GDP in log</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln (per capita GDP)</td>
<td>0.002</td>
<td>0.012**</td>
<td>0.021</td>
<td>0.005**</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.06)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>ln (per capita GDP) squared (/100)</td>
<td>0.18</td>
<td>0.331**</td>
<td>−0.56</td>
<td>0.051</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td>(0.16)</td>
<td>(1.46)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Fixed effect year 2004</td>
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<td>0.035**</td>
<td>−0.257**</td>
<td>0.009**</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.02)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.864</td>
<td>0.824</td>
<td>0.899</td>
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</tr>
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<td>Observations</td>
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<td>4319</td>
<td>4244</td>
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</table>

Notes:
CIC = China Industry Code, GDP = gross domestic product.
Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.


of per capita GDP to check the robustness of the above results. Panel B indicates that there are only two significant coefficients. The one for per capita GDP squared in the regression of the Gini coefficient is significantly positive. Yet per capita GDP is also positive, which does not indicate an initial decline in specialization. The positive coefficient of per capita GDP in the last column for the proximity measure also contradicts the U-shaped relationship uncovered in cross-country regressions. When the concentration measures based on the CIC-four digit are used, the estimations shown in panel B of Tables 8.2a and 8.2b yield similar results; the only difference is that per capita GDP becomes statistically significant.

In summary, no matter whether we use the level or the log of per capita GDP, and whether the concentration measures are computed based on the CIC-two or CIC-four digit, the results do not exhibit a U-shaped pattern between sectoral concentration and income across regions. The positive and
significant coefficient of the dummy for 2004 in all the regressions confirms the trend of increasing specialization over time. It is likely that national policies, such as accession to the WTO and fiscal reform, may play a greater role in determining the degree of industrial diversification than income level.

8.5 WHICH INDUSTRIES HAVE GROWN FASTER?

Given that industry in the PRC has become increasingly concentrated, which industries have experienced the most rapid growth? Table 8.3 shows that in 1995 the spinning industry, smelting and pressing of ferrous metals, and chemical materials and products top the list in output at the national level. By 2004, electricity, steam and thermal power production

<table>
<thead>
<tr>
<th>Year</th>
<th>Output</th>
<th>Employment</th>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1 Spinning industry</td>
<td>Nonmetallic mineral products</td>
<td>Electricity, steam, thermal power production, and supply</td>
</tr>
<tr>
<td></td>
<td>2 Smelting and pressing of ferrous metals</td>
<td>Chemical materials and products</td>
<td>Smelting and pressing of ferrous metals</td>
</tr>
<tr>
<td></td>
<td>3 Chemical materials and products</td>
<td>Manufacture of electrical machinery and apparatus</td>
<td>Spinning industry</td>
</tr>
<tr>
<td>2004</td>
<td>1 Smelting and pressing of ferrous metals</td>
<td>Nonmetallic mineral products</td>
<td>Electricity, steam, thermal power production and supply</td>
</tr>
<tr>
<td></td>
<td>2 Electricity, steam, thermal power production and supply</td>
<td>Spinning industry</td>
<td>Smelting and pressing of ferrous metals</td>
</tr>
<tr>
<td></td>
<td>3 Traffic equipment</td>
<td>Coal mining and dressing</td>
<td>Traffic equipment</td>
</tr>
</tbody>
</table>

Note: PRC = People’s Republic of China.

and supply, and traffic equipment had replaced spinning and smelting and pressuring of ferrous metals in the top three. None of them are typical labor-intensive industries.

In terms of employment, the nonmetallic mineral products industry ranked highest in both 1995 and 2004. Interestingly, in second place, the manufacturing of electrical machinery and apparatus, which is largely labor intensive, slipped off the list in 2004. Coal mining and dressing, which is generally regarded as capital intensive, climbed to the top three in 2004. If, instead, we use assets as a measure, the top two industries—electricity, steam and thermal power production and supply, and smelting and pressing of ferrous metals—remain in the top three in both years. However, the more capital-intensive traffic equipment industry has replaced the more labor-intensive spinning industry. Thus, it appears that the capital-intensive industries experienced more pronounced growth.

To further check if the PRC’s industries have become more capital intensive over time, Figure 8.2 plots the density curves of the capital-intensity index—computed as the capital–labor ratio—at the CIC four-digit

Note: PRC = People’s Republic of China.


Figure 8.2 Density curves of capital-intensity index, PRC, 1995-2004
level in 1995 and 2004. The horizontal axis plots the degree of capital intensity and the vertical axis shows the proportion of industries corresponding to each point of capital intensity. The curve’s rightward shift suggests a trend toward increasing capital intensity over time at the industry level.

Given the conventional belief that the PRC has comparative advantage in labor-intensive manufacturing industries, one should expect more rapid growth in these industries after the economy opened up. Yet, this study finds that the fast-growing industries are largely the capital intensive ones. To help explain this, the following regression examines the impact of capital intensity on industrial growth:

\[
\log \left( \frac{Y_{it}}{Y_{i(t-1)}} \right) = \alpha + \beta_1 \log \left( \frac{Y_{i(t-1)}}{Y_{i(t-1)}} \right) + \beta_2 C_i + \sum g_i X_i + \epsilon, \quad (8.2)
\]

where \( i \) indexes the industries and \( t \) and \( t - 1 \) refer to 2004 and 1995, respectively. \( Y \) is a diversification measure in terms of output, employment or assets. \( C_i \) stands for an industry’s capital intensity, with the same definition as in Figures 8.1a and 8.1b. \( X \) is a set of other control variables. \( \epsilon \) is the random error term. The coefficient \( \beta_2 \) shows the effect of an industry’s capital intensity on its output growth, employment or assets from 1995 to 2004. The sample has a total of 341 CIC four-digit industries.

Table 8.4a presents estimation results of three outcome variables—output growth, employment and assets, using the CIC four-digit industries at the national level as observations. In the first three regressions, only the initial value of the dependent variable (in logarithmic form) and the capital intensity variable are included. The coefficient of the capital intensity variable is only significantly positive in the second regression on employment. This suggests that capital-intensive industries have hired workers at a faster pace than labor-intensive ones. Since the analysis includes only two variables, there is likely a problem of omitted-variable bias in the regression. For example, the capital intensity variable may capture an industry’s growth potential. Omitting it would result in estimation bias. In regressions 4–6, the analysis adds another regressor—the growth potential of the United States. This variable is taken from Fisman and Love (2007). After it is included, the main result still holds. Once again, the capital intensity variable is only significant in the employment regression.

Given the PRC’s vast geographic area, enterprises in the same industry may not necessarily concentrate in the same area. Table 8.4b repeats the exercises in Table 8.4a by expanding the sample to industries at the provincial level. As shown in the first three columns, the capital intensity variable is only statistically significant in the second regression on employment growth. The estimations at the county level are also conducted, with similar results.
Table 8.4a  Regressions of output growth, employment growth and asset growth at the national level by industrial sector, PRC, 1995–2005 (CIC 2-digit level)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output</td>
<td>Employment</td>
<td>Assets</td>
<td>Output</td>
<td>Employment</td>
<td>Assets</td>
</tr>
<tr>
<td>Initial value (log)</td>
<td>-0.187***</td>
<td>-0.317***</td>
<td>-0.177***</td>
<td>-0.187***</td>
<td>-0.317***</td>
<td>-0.178***</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.028)</td>
<td>(0.025)</td>
<td>(0.026)</td>
<td>(0.028)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>-0.008</td>
<td>0.194**</td>
<td>-0.081</td>
<td>0.027</td>
<td>0.213**</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.082)</td>
<td>(0.087)</td>
<td>(0.079)</td>
<td>(0.094)</td>
<td>(0.101)</td>
<td>(0.091)</td>
</tr>
<tr>
<td>Growth potentials</td>
<td></td>
<td></td>
<td></td>
<td>1.685</td>
<td>0.955</td>
<td>4.334*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.289)</td>
<td>(2.471)</td>
<td>(2.207)</td>
</tr>
<tr>
<td>Observations</td>
<td>341</td>
<td>341</td>
<td>341</td>
<td>341</td>
<td>341</td>
<td>341</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.136</td>
<td>0.278</td>
<td>0.135</td>
<td>0.137</td>
<td>0.278</td>
<td>0.145</td>
</tr>
</tbody>
</table>

Notes:
The capital intensity variable, defined as the share of real capital stock to total value-added in 1980 in the United States, is drawn from Ciccone and Rapaioannou (2009).
Standard errors are in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1.

Table 8.4b  Regressions of output growth, employment growth and asset growth at the provincial level by industrial sector, PRC, 1995–2005 (CIC 4-digit level)

<table>
<thead>
<tr>
<th></th>
<th>Column (1)</th>
<th>Column (2)</th>
<th>Column (3)</th>
<th>Column (4)</th>
<th>Column (5)</th>
<th>Column (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output</td>
<td>Employment</td>
<td>Assets</td>
<td>Output</td>
<td>Employment</td>
<td>Assets</td>
</tr>
<tr>
<td>Initial value (log)</td>
<td>$-0.248^{***}$</td>
<td>$-0.413^{***}$</td>
<td>$-0.261^{***}$</td>
<td>$-0.170^{***}$</td>
<td>$-0.367^{***}$</td>
<td>$-0.202^{***}$</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>0.091</td>
<td>0.187**</td>
<td>0.099</td>
<td>0.043</td>
<td>0.160***</td>
<td>0.057</td>
</tr>
<tr>
<td>Growth potentials</td>
<td>$-3.035$</td>
<td>$-3.055$</td>
<td>0.0399</td>
<td>$-2.369^{**}$</td>
<td>$-2.917^{***}$</td>
<td>0.469</td>
</tr>
<tr>
<td>Proximity</td>
<td>28.96***</td>
<td>12.76**</td>
<td>22.10***</td>
<td>28.96***</td>
<td>12.76**</td>
<td>22.10***</td>
</tr>
<tr>
<td>Observations</td>
<td>8062</td>
<td>7827</td>
<td>8115</td>
<td>8063</td>
<td>7827</td>
<td>8115</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.157</td>
<td>0.309</td>
<td>0.158</td>
<td>0.061</td>
<td>0.252</td>
<td>0.078</td>
</tr>
</tbody>
</table>

Notes:
CIC = China Industry Code, PRC = People’s Republic of China. The capital intensity variable, defined as the share of real capital stock to total value added in 1980 in the United States, is drawn from Ciccone and Rapaioannou (2009). The proximity measure corresponding to the columns of output, employment, and asset are weighted by output, employment and asset. Standard errors are in parentheses. $^{***}$ p < 0.01, $^{**}$ p < 0.05, $^*$ p < 0.1.

Production technologies in capital-intensive industries in countries such as the United States most likely do not operate the same way as in the PRC. But, because of the availability of cheap labor, a capital-intensive production structure can be reconfigured to adapt to the PRC’s context and, in this way, employ more labor. Clustering is one way to lower the capital requirement to start a business by dividing an integrated production process into many incremental steps (Ruan and Zhang 2009; Long and Zhang 2011).

To capture the impact of clustering on the three outcome variables, this analysis includes a clustering measure—the proximity index—in regressions 4–6. The variable is positive and statistically significant in all regressions. Indeed, clustering facilitates output, employment and asset growth. This lends some support to Krugman’s agglomeration theory and Hausmann and Klinger’s (2006) Product Space theory (that is, areas with denser product space tend to grow faster). Comparing regression 5, which includes the proximity measure, with regression 3, the coefficient of capital intensity remains significantly positive, although smaller. This suggests that clustering has, to some extent, reduced the capital requirement in seemingly capital-intensive industries. But clustering alone cannot explain the general observed pattern.

Overall, capital intensity has increased in industries in the PRC. These have generated employment at a faster pace than labor-intensive ones, which are normally regarded as those in which the country has comparative advantage. Instead, it seems that a dynamic comparative advantage strategy has been adopted to target those capital-intensive industries with greater potential in employment growth. This finding echoes Rodrik’s observation that

if countries like China and India . . . have done so well, it is not primarily because their labor-endowment advantage gave them the ability to compete in labor-intensive industries. It is because they were able to quickly diversify into more sophisticated, technically demanding activities that supported higher rates of economic growth. (Rodrik 2007: 11).

8.6 CONCLUSIONS

In just over three decades, the PRC has rapidly industrialized. In contrast to the trend in other developing countries toward increasing diversification in the early stage of development, decreasing diversification has marked the PRC’s industrialization. The expansion of markets and the fact that local governments have a big incentive to promote industrial development are likely driving the trend toward specialization. However, the rate
of employment growth in capital-intensive sectors has outpaced that of labor-intensive sectors. This suggests that capital-intensive industries have retooled their structure of production to accommodate more labor, in line with the PRC’s low capital–labor ratio. Overall, capital-intensive industries, in aligning with their latent comparative advantages, have witnessed faster employment growth.

Because of its vast size and despite the rising degree of regional and national specialization, the PRC’s economy as a whole is still quite diversified even though the government has not deliberately pursued an industrial diversification strategy. Instead, the observed patterns of specialization are largely the result of the general development strategy of reform and opening up. Here, a note of caution is warranted for small, developing countries with abundant natural resources. For these economies, integration with the international economy may result in a high level of specialization at the national level. Therefore, fluctuations in resource prices in international markets may pose a systemic risk to the domestic economy by affecting fiscal revenues and exchange rates. When facing volatile exchange rates, it would be difficult for these countries to develop export-oriented manufacturing sectors, but without a viable manufacturing sector, diversification is out of the question. Because of the large differences in size and resource endowment, the PRC’s experience in industrial diversification—and the lessons it offers—may not be so relevant to these economies.

ACKNOWLEDGMENTS

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REFERENCES


9. Do as I say, or as I do? US innovation and industrial policy since the 1980s

Matthew R. Keller and Fred Block

9.1 INTRODUCTION

Considerable scholarship since the early 1980s has characterized the innovative dynamism of the United States (US) as the result of its embrace of markets, or of its prototypically ‘liberal market economy’ (Hall and Soskice 2001). In these views, markets serve as the central mechanism of economic coordination, while government helps create an ‘innovation environment’ by setting and enforcing the basic rules of the market, such as intellectual property protection, and correcting market failures through investments including public goods such as education, basic research and infrastructure.

Under such a framework, innovative dynamism is typically maximized when private firms are insulated from government ‘interference’ and industrial policies are minimal or nonexistent. In parallel, since the 1980s, the dominant political rhetoric in the US has emphasized the economic dynamism and efficiency of markets, while the state is deemed a drag on growth and productivity. These ideas are manifested in doctrines known as neoliberalism or the Washington Consensus, which have valorized market mechanisms as the key to generating economic dynamism and solving a host of social problems. This market fundamentalism has become so politically powerful that even the term ‘industrial policy’ has become a virtual taboo in recent US political discourse.¹

¹ Even the relatively more progressive Obama administration has shied away from the term, as reflected in recent policy documents that make a sharp distinction between ‘innovation’ and ‘industrial’ policy, insisting the former is necessary, while the latter should be avoided. See, for instance, recent reports by the President’s Council of Advisors on Science and Technology (2011) and the Department of Commerce, Government of the United States (2012).
This chapter argues that such views are misleading, as they obscure key sources of US economic dynamism since the 1980s. Despite the dominance of free-market rhetoric, government agencies and policies have played a critical role in fostering innovation and competitiveness in the US. The sharp divergence between the discourse and the actual institutional and developmental path has persisted, in part, because the model of government action did not conform to the centralized models of industrial policy that dominated academic and policy debates in the 1980s and 1990s. Rather, the US developmental approach is sharply decentralized, with an alphabet soup of loosely coordinated, occasionally overlapping agencies and policies supporting economic dynamism. Table 9A.1 in the appendix to this chapter provides a summary of the industrial policy instruments in the US.

Although decentralized approaches have multiple roles (and drawbacks), US policy structures have been particularly effective in correcting ‘network failures’ (Schrank and Whitford 2011; Whitford and Schrank 2011) endemic to the decentralized or fragmented production regimes that have increasingly dominated both US and global production since the late 1970s. It can further be argued that the basic structure of the US developmental model resembles in many respects the ‘developmental network states’ (Ó Riain 2004; Breznitz 2007) associated with the rapid growth of high-technology industries in Ireland; Israel; Taipei, China; and elsewhere (although the US model is larger and more complex). But because much of this decentralized state apparatus has been largely ‘hidden’ from public view (Block 2008; Mettler 2011; Berger 2013), the US government’s complex roles in the economy have only occasionally entered into mainstream public and political debates.

9.2 LIMITS TO THE US AS A COMPARATIVE INDUSTRIAL MODEL

Before discussing key elements of the US approach to industrial policy, it is important to note both the limits of using the country as a comparative model and the reasons why it is nevertheless useful to understand its structure and operations. On the first point, three main difficulties should

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2 The terms ‘fragmented’, ‘decentralized’ or ‘disintegrated’ production, refer to an environment in which multiple independent parties contribute to the production of a final good or service. For instance, Apple’s iPads are designed in the US but assembled in the People’s Republic of China, with components, subcomponents and software provided by various firms or third parties.
be mentioned. First, the US is quite possibly the world’s most complex economy. It supports a vast array of industrial sectors, operates through a thicket of government agencies and policy regulations that differ across industries and at subnational levels, and it is home to a strikingly diverse set of actors involved in industrial networks. These include: government agencies, private venture capitalists and angel investors; large financial institutions; university and government research laboratories; and robust populations of firms ranging from the very small to the extremely large. This diverse, decentralized economic and policy structure forms an essential pillar of innovative dynamism that is unlikely to be replicated in developing contexts.

Second, the scale of government spending dwarfs that of most developed nations, and certainly developing ones. For instance, in the 2010 fiscal year, the ‘base’ budget for the Department of Defense alone was about $530 billion and the National Institutes of Health—the civilian agency with the largest research and development budget—had expenditures of $31 billion. Even the modestly funded (by US standards) Small Business Innovation Research (SBIR) program, which strongly contributes to enhancing entrepreneurial dynamism (Keller and Block 2013), dispenses some $2 billion annually.

The gap in research and development spending between the US and global competitors has been closing in recent years (National Science Board 2012: ch. 4), allocations are nevertheless far larger and more variegated than any developing nation can afford. Moreover, these fiscal outlays parallel broader advantages in resources and human capital that are difficult to replicate. As Crow and Bozeman (1998) noted in the late 1990s, the federally supported Los Alamos National Laboratory alone employed ‘more doctoral-level physicists than can be found in all but a few nations.’

Third, caution should be exercised in comparing or drawing lessons from systems which have divergent political systems, industrial bases and institutional cultures. That said, it is important to understand the core of the US model of development precisely because it is one of the world’s most dynamic in generating innovative technologies, and because the US plays a powerful role in influencing global development strategies. Moreover, in seeking to emulate the dynamism of US-led technology sectors, such as pharmaceuticals and information technologies, some nations have recently adopted market-centric reforms that are quite likely

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3 This does not include $162 billion directed to campaigns in Afghanistan and Iraq. Budgetary data from the Office of Management and Budget.
4 Data from the National Institutes of Health Office of Budget.
to be counterproductive because they rest on distorted views of US innovative dynamism.

Addressing the main misunderstandings of the model is therefore important. Although institutional systems cannot be replicated or transplanted, recent research suggests that certain programmatic and organizational elements similar to those characteristic of the US model can be found in both relatively advanced nations (Ó Riain 2004; Breznitz 2007) and in a number of developing ones (Appelbaum et al. 2011; Breznitz and Murphree 2011; Negoita and Block 2012) that have experienced substantial growth over the last several decades. Ensuring that those core elements are appropriately elaborated and contextualized is critical.

9.3 HOW SHOULD THE US MODEL BE UNDERSTOOD?

Scholars and politicians alike have commonly characterized the US as market-centric. Such views typically acknowledge that during and after World War II, the government worked closely with large corporations to develop and support key industries, particularly those with close ties to military purposes or Cold War objectives.

The common narrative is that the industrial policy debates of the 1980s were resolved in favor of market-centric positions (such as Graham 1992), and the state began a process—initiated under the Carter administration and then magnified under the Reagan administration—of deregulation, weakening organized labor and retrenching welfare state policies. In effect, this led to an increasing insulation of private firms from government.5 Hence, in Hall and Soskice's (2001) oft-cited work on the 'varieties of capitalism,' the US is characterized as the prototypical liberal market economy in which competitive market relations are the central means of economic coordination.6 In this view, private firms operate relatively free from government involvement, arm’s-length transactions predominate, labor

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5 For an overview, see Mizruchi (2010).

6 These attributes are contrasted to ‘coordinated market economies,’ such as Germany, where the state is more involved in economic activities. In coordinated market economies, horizontal and nonmarket forms of coordination among firms as well as between firms and government agencies are greater, unions are stronger, social safety nets more generous and inequalities relatively lower. Hall and Soskice (2001: 8) describe horizontal and nonmarket forms of coordination among firms as having 'more extensive relational or incomplete contracting, network monitoring based on the exchange of private information inside networks, and more reliance on collaborative, as opposed to competitive, relationships to build the competencies of the firm.'
markets are fluid and inequalities are comparatively high. Moreover, from this perspective it is typically argued that the market-centricity of liberal market economies—including their greater flexibility, freedom from centralized controls and larger rewards—provide stronger grounds for dynamism and the development of ‘radical’ innovations.

There is some truth in these views. The US does have comparatively flexible labor markets, it is marked by large pay and income inequalities, and has a less generous safety net than most developed nations (Esping-Andersen 1990). Furthermore, there are clearly areas in the economy where the government has either retrenched its role or declined to restrain certain types of business activities, as in the financial industry for products such as derivatives and asset-backed securities (Campbell 2010).

But views that emphasize market competition as the primary source of US industrial and economic dynamism typically downplay the increasingly collaborative or network character of key industries (Powell et al. 2005; Hage 2012), as well as the collaborative underpinnings of innovative regions like Silicon Valley and Boston’s Route 128 (Saxenian 1994). Such views also fail to capture the critical role of the government in both creating and supporting these innovative and industrial networks—and hence, elide or understate the government’s role in spurring innovative and industrial dynamism (Block and Keller 2011; Keller and Block 2013; Mazzucato 2013). The government has been deeply involved in industrial and innovation policies since the 1980s, and has played more than a caretaker role (that is, it has done much more than simply maintaining a basic set of rules under which the market functions).

Government influence is particularly clear in rapidly changing, highly uncertain fields such as biotechnology and pharmaceutical development. Here, it has been well-documented that, over the past two decades, the largest firms have suffered a so-called innovation deficit (Drews and Ryser 1996; Angell 2004). These firms have not been able to generate a steady stream of innovative products from their own research laboratories. Innovative, big-selling drugs have instead frequently emerged from small, innovative firms, often seeded by government research funds, and government or university laboratories, which are also supported by federal and state funding. For instance, Vallas et al. (2011) show that 13 of the 15 blockbuster drugs marketed by US-based firms in 2006 (earning more than $1 billion in sales) received ‘significant’ federal support for their development and approval processes.

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7 A range of critiques of the distinction between liberal and coordinated markets has emerged, including Hancke et al. (2007) and Allen (2004). For a recent empirical test, see Schneider and Paunescu (2012).
This does not mean, of course, that the market positions of the largest pharmaceutical firms have been eroded. They are still enormously profitable; indeed, large firms remain central to the networks of innovators in the field (Roijakkers and Hagedorn 2006) and they are often the parties that ultimately bring new drugs to market. In some cases they do so by digging into their deep pockets to acquire small innovative firms or license their technologies, and often the resources and experience of large firms have been critical to shepherding drugs through lengthy clinical trials and approval processes. But it has frequently been government support that has directly or indirectly led to breakthroughs generating innovative products.8

Even beyond nurturing new ideas and providing support to innovative technologists and firms, government policies have also been critical to the continued profitability of large pharmaceutical firms in at least two key ways. First, the government has extended patent protections over many years, effectively providing firms extended windows of monopolistic control over drugs they have developed or acquired. The government has similarly supported a 20-year protection for intellectual property for pharmaceuticals under the World Trade Organization’s Treaty Regarding Trade-Related Aspects of Intellectual Property Rights, thereby insulating firms from competition in international markets for extended periods.9 Second, the large pharmaceutical firms have effectively lobbied the government to allow them discretion in setting prices under patent protection. Providing monopolistic control alongside price-setting power has no justification in economic theory, but these policies have boosted firms’ profits and insulated them from market competition.

There are two lessons to emphasize here: (1) government programs and funding have provided critical support for small- and medium-sized firms and the public and university laboratories that have been central to drug discovery and development processes over the past several decades; and (2) even large firms have reinforced or entrenched their positions through interactions with the state. These firms are not entirely subject to—nor did they arise from—free-market competition (Fligstein 1996; Crouch 2011).

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8 For a broader review of the effects of public funding on the pharmaceutical industry, see Cockburn and Henderson (2001).

9.4 GOVERNMENT’S INCREASING ROLE IN INNOVATION DEVELOPMENT

Although the pharmaceutical industry is only one example, substantial evidence suggests that the roles of government in spurring innovative dynamism cut across a variety of industrial sectors (Block and Keller 2011). A study of three decades of winners of the R&D 100—a yearly competition organized by R&D Magazine to determine the 100 best new commercial innovations—provides clear evidence of the expanded role of government since the 1980s. In the 1970s, industrial firms acting alone won many awards. But by 2006, 77 of the 88 award-winning technologies developed in the US had received public support through collaborations with public agencies or direct federal funding for the technologies that won the award (Block and Keller 2009).

Mirroring the trend in pharmaceuticals, the pattern in these awards also shows a dramatic shift away from large firms as the predominant winners, which was the case in the 1970s, toward smaller technology firms and public agencies, such as government laboratories, universities or spin-offs from these entities. In the 2000s, interorganizational collaborations won roughly two-thirds of the innovation awards, supporting recent findings that suggest that technological innovations have increasingly emerged from collaborative endeavors in which different actors combine their unique or specialized skills (Hargadon 2003; Lester and Piore 2004; Hage 2012). Public sector institutions and direct government financial support were central to these collaborations.

The government’s role in these networks is not limited to funding. It has been engaged in a range of decentralized programs and policies that nurture technology development through mechanisms such as standards setting, road mapping, certification and signaling, as well as additional measures that build trust and open opportunities for collaboration among otherwise dispersed and often disconnected actors (Block 2008; MacNeil 2012; Keller and Block 2013). The key point is that the structure of the US innovation system is not well captured by the idea that markets acting in isolation from government have supported economic dynamism. Government policies and programs have provided critical support for the small- and medium-sized firms that have increasingly undergirded technology development since the 1980s, and have bolstered the market position.
of many large firms. These interventions have been misdiagnosed, in part, because the nature of the role of government is quite different from the centralized, bureaucratic strategies that nations frequently pursued in the 1970s and 1980s as they sought to catch up to more developed economies (Amsden 2001; Johnson 1982).

9.5 CORRECTING MARKET AND NETWORK FAILURES

For much of the last generation, US policy discourse has centered on the role of government in correcting market failures—the idea that if certain discrete fields of market activity are left free from oversight or intervention, socially optimal or efficient outcomes will not be obtained. Under the market-failure conceptualization, government’s role is essentially to fill gaps in otherwise well-functioning market systems, whereby policies and programs can address areas that market mechanisms tend to neglect, such as infrastructure, education or basic research. In these fields, market actors are likely to underinvest because private returns are difficult to capture for any one firm or actor. But after providing public goods, control over their efficient utilization is, in theory, returned to private actors whose use of them is disciplined by market competition. Government may support basic research, but applied research and commercialization are generally left to the private sector.

Market failure is certainly a meaningful and useful conceptualization in some cases. But one of the main difficulties with its meaning is that it essentially sees government and private firms as separate entities; that is, government performs its role but then hands over the outcomes of its services to the private sector.

The problem is that this is not, typically, how innovative and industrial dynamism have been fostered or organized. Over the last generation

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12 Additional examples of large firms supported by government funding or policies include obvious cases such as large defense contractors, but also banking and finance (Campbell 2010; Block and Keller 2014), the auto industry (Guthrie and Slocum 2010), and the health care, student loan and insurance industries (Mettler 2011).

13 On dimensions of market failure, see Crouch (2011); on its political framework, see Crow and Bozeman (1998: 28–9).

14 The concept of market failure can be used to support narrow or broad interventions. As Hausmann et al. (2008: 1–2) put it: ‘On the one side, we have advocates who point to the magnitude of the observed or presumed market failures and call for robust interventions in response. On the other, we have the skeptics who point to the near-impossibility of precisely locating the imperfections in question and to the likelihood that rent-seeking firms can and will take the government for a ride.’
the lines between basic and applied research have become increasingly blurred (Stokes 1997) and networks of specialists, often working across the public–private divide, have become ever more central to innovative and industrial dynamics (Powell 1998; Hargadon 2003; Lester and Piore 2004; Hage 2012). In a wide array of technological and industrial arenas, advances have been achieved not entirely through arm’s-length, competitive transactions, but through mutual learning processes. These have been fostered by well-managed collaborations between specialists, who combine complementary skills or bodies of knowledge, as well as between designers, producers and end-users.

This blurring of boundaries has been paralleled by changes in the ways private firms pursue innovation. Over the last generation, a range of trends has ‘moved corporations toward a vertically disintegrated network model that was widely adopted in both manufacturing and service’ (Davis 2011: xii). Firms now outsource a variety of functions once provided within the firm’s own boundaries. Research and development and manufacturing are particularly prone to outsourcing or downsizing precisely because developing innovative products or services is inherently unpredictable and cannot be reliably built into the short-term calculations and predictable shareholder returns that increasingly dominate corporate strategies (Lazonick and O’Sullivan 2000: Davis 2011).

However, the network or collaborative form of organization that has moved to the fore of innovation and production regimes has weaknesses of its own; principal among them is the ability of firms to continually evaluate the trustworthiness and competence of partners necessary for effective collaborative production (Schrank and Whitford 2011; Whitford and Schrank 2011). Specialized or small firms rarely have the capacities to thoroughly investigate supply chain options, and even large or well-resourced ones are typically unable to continually monitor all relevant collaborators and technical fields, or to set industry standards around which dispersed parties organize their innovative efforts. This is precisely where the US government has often been effective. Through a host of programs and policies, it has addressed market failures as well as a variety of network failures endemic to decentralized production regimes in which organizationally dispersed parties are involved in developing and producing goods and services.

Understanding why the US government has been able to effectively address these collaborative failings requires a brief description of key policy and programmatic innovations that have shifted its role in the US innovation system. The transformation has been gradual and fostered by the ‘layering’ (Streeck and Thelen 2005) of a series of institutional and policy innovations that have developed over a long period.
World War II, the government took a much stronger role in supporting military research and development and, later, in funding basic research for scientific discovery (Mowery and Rosenberg 1998). Some of those initial policy pillars remained in place, but the system evolved in ways that pushed federal agencies toward increasing support for a range of innovation and industrial supports that go far beyond basic research.

9.6 FOUR CRITICAL POLICY DIRECTIONS

Although a detailed review of these adaptations is beyond the scope of this chapter, four primary policy innovations helped shift the direction of the US innovation system. These are diverse and decentralized, but connected by their evolving roles as organizational adaptations that fostered technological dynamism—and, when effective, they corrected both market and network failures.

9.6.1 The DARPA Model and its Diffusion

The first critical policy direction was the government’s initiation in 1958 of the Defense Advanced Research Projects Agency (DARPA) in response to the Soviet launch of Sputnik. Caught by surprise, the government intended DARPA to both foresee and generate ‘beyond the horizon’ technologies with the potential to radically alter technological trajectories. The Defense Advanced Research Projects Agency was crucial to advancements in an array of technologies, including lasers, robotics, chip fabrication and the precursor to the Internet.

The Defense Advanced Research Projects Agency’s mode of operation in pursuing its goals was critical. Rather than work through arm’s-length transactions or tight, bureaucratic relations with large, established defense contractors, it fostered competition and collaboration by drawing on an emergent culture of small, high-technology startups in locations such as Silicon Valley, as well as on university researchers engaged in novel research projects. Among these groups, DARPA’s quite modest but targeted funding often made a substantial difference in seeding new projects. The Defense Advanced Research Projects Agency was also structured in ways that allowed it to quickly and flexibly move money to promising projects, and pull support for those that did not reach targets.

The Defense Advanced Research Projects Agency’s program officers played a skillful role in fostering collaborations between star scientists and other experts who may have otherwise been reluctant to share data or information, as well as in fostering input and resources from larger firms
that did not want to be left behind if and when path-breaking technologies emerged from DARPA’s networks. In some cases, DARPA sought to expand the networks of technological experts working on technological barriers or problems; for example, in their major role in establishing computer science departments in US universities in the 1960s (Block 2008, 2011).

Moreover, DARPA’s own organizational design fostered social learning and adaptation to changing institutional contexts (Fuchs 2010, 2011). Its ‘connected-science model of innovation’ (Bonvillian 2009) fostered ongoing social learning among key but, often, otherwise disconnected principals. Also, it effectively merged public policy and resources with private sector developments and resources to spur innovative dynamism. In doing so, it was not primarily correcting market failures, but playing a decisive role in forging innovation networks and expanding technology horizons, and connecting the dots between disparate or distrustful parties who had complementary information and skills.

Over the following decades, elements of DARPA’s model diffused through an array of government agencies working on technology development. The most recent manifestation is the Department of Energy’s Advanced Research Projects Agency–Energy program designed to foster path-breaking alternative energy technologies.

9.6.2 National Research Laboratories

A second critical policy direction was the government’s decision to continue funding a system of national laboratories that were initially designed to develop nuclear weapons. Although the laboratories had broadened research beyond nuclear technologies for several decades, they were given strong incentives to intensify their focus on technologies with commercial potential in the aftermath of the Cold War.

The Stevenson–Wydler Act of 1980 encouraged technology transfer activities at the laboratories as well as direct collaboration with universities, state and local governments and private firms. Subsequently, the labs developed a series of mechanisms that brought their scientists into closer contact with commercial markets, including cooperative research and development agreements with private industry, work-for-others

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15 Bonvillian (2009) summarizes 12 key organizational elements of DARPA, including: a small, flexible and nonhierarchical structure; relative autonomy from bureaucratic impediments; a world-class technical staff and program managers; work managed through teams and networks and operating on a project-based challenge model; and an acknowledgment and acceptance of some degree of failure given the technical complexity of its projects.
agreements in which the laboratories perform contract research and development for private firms, and programs designed to provide entrepreneurial lab scientists with incentives to pursue commercial ventures (Markusen and Oden 1996; Schrank 2011). Literally thousands of public–private collaborative projects have been pursued using cooperative research and development and work-for-others agreements.\(^\text{16}\) They have allowed private firms to take advantage of the substantial expertise and specialized equipment of the laboratories while, in parallel, laboratory scientists have been encouraged to translate ideas into commercially relevant technologies.

Successes and failures have marked these programs,\(^\text{17}\) but there is evidence suggesting they have been quite effective in the aggregate (Crow and Bozeman 1998; Jaffe and Lerner 2001). It is worth noting that laboratories are increasingly prominent winners of or collaborators within the R&D 100 awards. Key discoveries have occurred in areas as varied as solar photovoltaics, wind turbines, computer technologies and advanced battery research.

### 9.6.3 Public–Private Partnerships

Starting in the 1970s, growing international competitiveness, coupled with the energy crisis and inflationary pressures, gave rise to broader experimentation with public–private partnerships to boost competitiveness and economic growth. From the Nixon administration onward, policymakers recognized the significant capacity of universities and public research facilities to contribute to technological and innovative dynamism (Hurt 2011; Berman 2012).

Arguably, the centerpiece of these efforts was the Bayh–Dole Act of 1980, which allowed universities to patent research developed with federal funding.\(^\text{18}\) But this was only one in a series of policies that stimulated public–private engagement. In 1978, the National Science Foundation launched its University–Industry Cooperative Research Centers program, which brought together experts from industry and the academy to develop solutions to shared problems. In 1984, a similarly designed program

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\(^\text{16}\) To provide a sense of scale, in 2008, the Department of Energy engaged in 626 cooperative research and development agreements, and 1674 work-for-others agreements with private firms (Government Accountability Office 2009).

\(^\text{17}\) Even the transfer of the labs to the newly created Department of Energy in the 1970s was characterized by what Crow and Bozeman (1998, 63) describe as a process that combined several ‘muddled, ill-defined missions’ that mixed defense, energy and environmental issues.

\(^\text{18}\) The effects of the Bayh–Dole Act have been extensively debated, including in Mowery et al. (2004).
authorized the creation of Engineering Research Centers to foster public–private collaboration to overcome technological barriers. In 1982, the SBIR program was initiated. It sets aside a small percentage of federal research and development spending for small innovative firms. In 1988, the Advanced Technology Program (recently reconstituted as the Technology Innovation Program) was launched to provide federal matching grants for private firms trying to commercialize promising technologies. In the same year, the Manufacturing Extension Program began providing expertise to manufacturers using advanced technologies.\textsuperscript{19}

In the following years, the government engaged in a range of endeavors designed to foster industrial collaborations in specific fields including semiconductors and advanced batteries (Keller and Negoita 2013), and employed a more general set of mechanisms for cooperative R&D (see Schacht 2012).

\textbf{9.6.4 Demand-Side Measures}

The Federal government has long used its procurement power as a mechanism to stimulate technology development, particularly through the military (Mowery 2009). At various times a series of incentives designed to stimulate private sector demand has complemented that power. For instance, the 1978 Energy Act included tax credits for investments in alternative energy technologies that later contributed to the California wind boom of the 1980s.\textsuperscript{20} In the same year, clarifications to the Employment Retirement Income Security Act opened the door for pension funds to invest in venture capital funds, enabling greater circulation of capital to innovative technology firms and the expansion of the venture capital sector. A number of subsequent legislative pushes sought to open flows of private resources to research and development, with mixed results.\textsuperscript{21}

Collectively, these programs and policies have forged a developmental apparatus in which there are ‘an array of US industrial programs aimed at creating networks and overcoming network failures, using not

\textsuperscript{19} These examples only touch on legislative efforts in the 1970s and 1980s. See Block (2008).

\textsuperscript{20} These specific incentives were revoked in the 1980s. They are indicative of the broader use of tax credits or financial incentives used to foster industrial activities. These incentives were organized in a largely decentralized fashion; for instance, an investigative series by the \textit{New York Times} in 2012 suggested that there were more than 1800 programs providing some $80.4 billion in annual subsidies from state and local governments alone (Story 2012).

\textsuperscript{21} For instance, tax credits for investments in research and development, reforms to liability, and antitrust and intellectual property laws. For a general overview, see Schacht (2010).
just subsidies, protection and regulations (“hard” measures) but also advice, persuasion and threat backed by the authority of the government (“soft” measures)’ (Wade 2012: 230). Trends suggest such measures have not declined in recent years and were, arguably, intensified in programs emerging from the $787 billion American Reinvestment and Recovery Act passed in the wake of the 2008 financial crisis. Among other so-called stimulus programs, a range of decentralized initiatives pushed green technology development.

An example from the advanced battery sector programs reveals the basic contours of the multiple strands of intersecting policies that were pursued at that time. Although US researchers have made many breakthrough discoveries in this field, the production of advanced batteries shifted to Asia (Keller and Negoita 2013). To galvanize the industry domestically, the Department of Energy faced the dual challenge of developing novel technologies that would advance the sector while simultaneously creating domestic capacity for manufacturing that would provide jobs and stimulate the connections between research and development and production that are widely regarded as critical to technology development (Florida and Kenney 1992; Alic 2011).

In pursuing these goals, programmatic efforts moved along four main and intersecting fronts. First, a series of research and development awards were issued for both longer-term, potentially platform-altering technologies through the Advanced Research Projects Agency–Energy program and for technologies closer to market readiness through a range of programs, including the SBIR program, a series of Energy Frontier Research Centers (mid-sized collaborative centers designed to bring together university and government researchers with industry), and a new Batteries and Energy Storage Innovation Hub (a large collaborative center designed to overcome shorter-term technical and market barriers).

Second, testing and evaluation centers were established, allowing universities and private firms to share data on technical leads and dead ends. Third, the Department of Energy deployed several demand-side measures to extract these technologies out of the lab and put them in the field. Tax credits for alternative energy development provided incentives to firms to establish manufacturing capacity and to open opportunities for

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22 For instance, the Center for Electrical Energy Storage, headquartered at the Argonne National Laboratory. From 2009 onward, 46 Energy Frontier Research Centers were each funded on five-year contracts, at annual levels between $2 million and $5 million.

23 This is one of a small number of hubs funded under the American Reinvestment and Recovery Act for five years at about $20 million a year.
deployment. Similarly, loan programs for alternative energy technologies were used to support the construction of advanced manufacturing facilities so that technologies close to market readiness could quickly be put into production. Fourth, funds were expended to develop infrastructure that would reassure consumers about the value of purchases that used these technologies. For instance, the Department of Energy allocated funds to establish a network of charging facilities for the all-electric vehicles that would ostensibly integrate the newly developed, domestically manufactured advanced batteries.

These efforts combined supply- and demand-side measures designed to not only generate novel technology ideas, but also to try to ensure that new technologies would move directly to domestic production facilities and, in turn, find receptive consumer bases. While few of these policies are novel on their own, taking a combined, cross-stage approach to supporting manufacturing and deployment is largely new, and it responds to a signal weakness of prior US policies that have strongly supported research, but failed to support domestic manufacturing and deployment (Knight 2011).

The elements described above are not exhaustive. In fact, there is a bewildering array of policy directives, agencies and programs and subprograms pursuing technological and industrial development at the national, state and local levels of government. However, these examples are meant to shed light on several key aspects of the overall system for spurring industrial and innovative dynamism.

The system, as one example, is strikingly decentralized. Some programs were intended as complementary, but the system is perhaps better viewed as involving the layering of different policies and programs. The result has been a complex and decentralized policy apparatus with a cornucopia of

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24 The tax credits were authorized under Section 1603 of the American Reinvestment and Recovery Act. For a summary and early analysis of the program’s impact, see http://www.nrel.gov/docs/fy12osti/52739.pdf (accessed 2013).
25 The Advanced Technology Vehicle Manufacturing, 1703, and 1705 loan programs were established under the administration of George W. Bush, but were only funded and used following the passage of the American Reinvestment and Recovery Act. For an overview, see: https://lpo.energy.gov/ (accessed 2013).
27 In parallel, the Department of Defense has committed to expend substantial procurement power in greening its operations to avoid longer-term dependence upon, for instance, fossil fuels emanating from foreign sources.
28 For instance, the SBIR program was envisioned, in part, as a source of funding to university and government scientists who were newly empowered by the Bayh-Dole and Stevenson-Wydler acts to initiate their own ventures.
agencies working on innovation and industrial policy. To take another example, a study for the National Institute for Standards and Technology (National Institute of Standards and Technology 2011) counted 103 programs implemented by 17 different agencies providing assistance to small manufacturing firms.\(^\text{29}\)

Another aspect is that not all programs have succeeded. Indeed, the large- and small-scale failures in US policies and programs are well documented (Lerner 2009). However, the diverse and decentralized nature of the system has meant that failures have not necessarily compromised the system, since there are often other programs pursuing related objectives or supporting alternative technologies. Indeed, some of the largest and most visible technology programs and agencies have either failed or been subject to political attacks (Negoeita 2011), while smaller, less-visible agencies have had a major impact (Keller and Block 2013; for a comparative perspective, see Breznitz and Ornston 2013). Nevertheless, the decentralized developmental policies typically pursued in the US have distinct weaknesses (Sabel and Saxenian 2008; Block and Keller 2009; Ó Riain 2011) that are difficult to address in the US political context (Berger 2013).

Perhaps surprisingly, despite the breadth and complexity of the US developmental apparatus, the market failure paradigm remains the standard paradigm for discussions on civilian technology and industrial development policies. While the framing has in some respects been politically useful, it has often masked the complexity of US policies and programs (Berman 2013), and thus contributed to what Block (2008) terms the hidden character of the US developmental state.

### 9.7 EVALUATING RISK IN A DECENTRALIZED SYSTEM

Assessing the effects, efficiency and cost-effectiveness of government support for innovation and industry are long-running challenges. In the US, evaluation is particularly difficult because of the diversity and decentralization of the support system. Even when advanced metrics are brought to bear, they are typically better attuned to measuring single or a small number of similar programs rather than a diversified, overlapping system. Furthermore, the decentralization and diverse objectives of different parts of the developmental apparatus mean there is no single

\(^\text{29}\) The report nevertheless suggests these programs are limited and fail to provide sufficient capital to the sector.
US innovation and industrial policy since the 1980s

mode of operation or ‘magic bullet’ among agencies for operationalizing effective risk or monitoring systems. Indeed, in programs like DARPA with long-term horizons, or in basic-research oriented programs in which outcomes are highly uncertain, some degree of failure is expected—and can be a valuable learning tool that informs future projects. Programs with shorter-term horizons or specified targets employ different risk calculations and measurement tools. Degrees of acceptable risk and the metrics to measure programs thus depend upon programmatic goals and modes of operation.

Despite programmatic diversity, several broad contours of the overarching system are observable. In general terms, it is characterized by multiple levels of checks and balances and multiple potential loci for review. At the lowest level, of course, are the systems the programs employ themselves. Generally speaking, programs rely heavily on technical and expert reviews in their evaluation processes. But, consistent with the decentralization of the system, evaluators and modes of evaluation differ depending upon the scope and focus of the program. The National Institutes of Health, the National Science Foundation and the SBIR program typically rely on peer review as a central mechanism of evaluation. DARPA’s program does not necessarily rely upon peer review in many cases, but employs—and regularly rotates—well-established experts embedded in key scientific fields. Programs like SBIR that work with smaller firms have developed multiple mechanisms not just to award funds to promising projects, but also to support the organizational sustainability of partner organizations, including voluntary organizational development programs and operations that foster connections between supported firms, private financiers, and large government contractors or government procurement agencies (Keller and Block 2013). The Central Intelligence Agency’s public venture capital fund, In-Q-Tel, is an example of a program that partly manages risks by working within networks of sophisticated private investors and technology experts to whom the agency is directly linked by its use of venture analysts and experienced private investors as staff (Keller 2011). In this and similar programs, procedures are carefully designed and pass through multiple layers of internal and external review prior to and after program initiation.

Most successful programs also avoid over-centralizing authority in the hands of single or small clusters of decision makers or locking in a singular technology strategy or pathway for extended periods. If participants are sufficiently diverse and highly qualified, reliance on peer review tends to decentralize decision making. Also, while agencies like DARPA provide decision makers with greater managerial authority, even here key officials are regularly rotated through the agency, partly to
Development and modern industrial policy in practice

avoid bureaucratization and programmatic stagnation. Collectively, these decentralized strategies, pursued by many agencies working in occasionally overlapping technological domains, allow a wide range of technology ideas and directions to receive relatively impartial evaluations and expert feedback. They typically escape dependence on single suppliers or ideas, and they avoid overreliance on single or a small cadre of personnel inside bureaucracies that have permanent or sole authority to make decisions. While these strategies do not eliminate risk, they diffuse it across many different projects and technological directions.

At a broader level, individual government agencies and programs are nested within a federal system in which there is constant competition over limited funding, and in which the executive branch and Congress exert strong influence over ongoing budgetary allocations, as well as over general programmatic evaluation criteria. Congress and the executive branch each has its own apparatus for evaluating the efficacy of programs, and legislation authorizing or reauthorizing programs frequently contains additional statutory requirements for review. Moreover, particularly since the passage of the 1993 Government Performance and Results Act under the Clinton administration, there have been efforts to tighten or refine more general or framework metrics that enhance transparency and enable tools for general oversight and cross-agency comparison. Meanwhile, discretion in establishing field-specific and program-appropriate evaluation criteria is typically maintained at the agency or program level.

This overarching approach has drawbacks. Multiple levels of evaluation by actors with different interests can result in overzealous or politically motivated review processes (Negoita 2011). The US arguably takes decentralization to an unproductive extreme as reflected. For example, the administration of the SBIR, which is delegated to individual participating agencies, went more than two decades without maintaining a relatively inclusive, centralized data repository that would allow cross-program data sharing. But when these practices work well, they resemble, in broad terms, what Sabel and Simon (2011) characterize as ‘experimentalist’ regimes. These combine decentralization, the establishment of broad framework goals with local autonomy to meet them, and regular reporting and review by peers and superiors. In principle, such practices ‘are

30 The Office of Management and Budget and the Government Accountability Office are central evaluation instruments for the executive and Congress, respectively.
31 These systems have varied under different administrations, and their results are vigorously debated. Key initiatives include the George W. Bush administration’s Program Assessment Rating Tool and the Obama administration’s Responsible Government Initiative.
designed to achieve local adaptation and aggregate learning by combining discretion with duties to report and explain, and by pooling information’ (Sabel and Simon 2011: 78).

It would be incorrect to suggest that the US system was deliberately designed this way, or that it closely approximates an ideal typical version. Rather, the system is a patchwork. Evaluation terms and criteria—and efforts to apply them—vary across and sometimes within programs and agencies. Some programs are allowed or compelled to be more transparent and accountable than others. As Sabel and Simon (2011) point out, even if the attributes of this regime are theoretically compatible with positive outcomes such as continual social learning, few rigorous studies have measured its efficacy in practice. Articulating the resemblance to this type of decentralized, learning-centered approach is intended to provide a general framework for understanding the way that risk is addressed and how such systems might be enhanced.

9.8 CONCLUSIONS

Scholars have made it increasingly clear that there are few, if any, one-size-fits-all innovation and industrial policies. Governments must be sensitive to their own institutional strengths and indigenous capacities, and continually seek out, choose and nurture areas in which they may be able to establish comparative advantage in increasingly global markets and globalized production chains (Biggart and Guillen 1999; Rodrik 2007; Chang 2010). While a number of nations have successfully deployed more centralized strategies to support industries attempting to catch up to their counterparts in developed nations, policies that help a nation to join or remain at the cutting edge of high-technology development are less well understood, and have often emerged in fits and starts from the layering of policies and agency operations.

Innovation and industrial policies are, in sum, complex, and the effects of individual policies are often difficult to analytically distinguish since they work within innovation systems with, likewise, highly complex, interwoven parts. In addition, developments within a particular national context are intertwined with both local capabilities (Sen 1985) and the dynamics of a global economic environment that national governments typically have no control over. Countries must develop their own policy trajectories through a careful analysis of strengths, weaknesses, and opportunities.

This analysis of the US case follows a stream of recent research that suggests that the US has been engaged in ‘industrial policy’ despite the
prevalence of free-market rhetoric, and because it has often been of a softer, decentralized variety, it has often fallen below the radar or been incompletely accounted for by policy analysts, academics and politicians. We suggest that the ability of US programs to correct network failures—in addition to the more conventional attention to market failures—has been a critical element of their successes. Although not documented here, it appears this feature is not unique among nations that have been able to galvanize technology-intensive industries (Ó Riain 2004, 2011; Breznitz 2007; Breznitz and Ornston 2013; Keller and Negoita 2013). Effective state policies for developmental networks are not of a single type and do not provide a one-size-fits-all blueprint. But operated well, their decentralized character can allow many more ideas to bubble up—a necessity in an era of fast-paced technological change.

REFERENCES


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## APPENDIX

**Table 9A.1  Industrial policy instruments in the US**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Description</th>
<th>Outcome</th>
</tr>
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<tbody>
<tr>
<td>Fiscal incentives</td>
<td>Tax credits and incentives for various types of activities such as research and development. These are offered at the federal level, as well as through a patchwork of incentives at the state and local levels. In addition, patent laws aim to balance rewards to inventors with access to relevant knowledge. See section 9.6 and footnotes 21 and 22</td>
<td>Because state and local incentives are organized in a largely uncoordinated and decentralized fashion, some have succeeded and others have failed. At the federal level, there is ongoing debate about the impact and appropriate size and scope of programs like federal research and development credits. Patent laws are also a subject of vigorous, ongoing debate.</td>
</tr>
<tr>
<td>Investment attraction programs</td>
<td>Diverse and decentralized programs, typically handled at the state and local levels, including efforts to generate regional or local industrial or technological clusters</td>
<td>These programs have a mixed record of success, but generally, since the 1980s, state and local governments have had relatively constrained resources for developmental efforts. For a detailed overview of a range of programs in the green energy sector relevant to this and several other categories, see Hess (2012)</td>
</tr>
<tr>
<td>Training policies</td>
<td>An array of decentralized programs, including the Manufacturing Extension Program which provides consultation to small manufacturers; specific federal programs that provide organizational support and/or seek to connect technologists with collaborators or complementary parties (for example, the Small</td>
<td>With many disparate programs at the federal, state and local levels, the results are mixed. See section 9.6</td>
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<tr>
<td>Business Innovation Research program); in some instances programs to support job training or retraining in targeted fields</td>
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<tr>
<td>Infrastructure support</td>
<td>Federal, state, and local governments regularly provide investments in infrastructure projects</td>
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<tr>
<td>Trade measures</td>
<td>The US participates in multiple international and regional trade agreements. Government procurement has also been usefully deployed in some cases as a mechanism for trade policy (Weiss and Thurbon 2006)</td>
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<tr>
<td>Public procurement</td>
<td>The Department of Defense, in particular, has historically used its substantial procurement powers to nurture an array of industries. See section 9.6.4</td>
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<tr>
<td>Financial mechanisms (loans, risk-sharing)</td>
<td>Both established programs and occasional temporary authorizations. An array of decentralized programs invest in technologies and/or early stage firms, ranging from grant and loan programs to public venture capital initiatives (see Block and Keller 2011)</td>
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<tr>
<td>Typical concerns in recent years have emphasized that the US has not adequately invested in its infrastructure. These concerns range from aging physical infrastructure (such as roads, bridges, railways) and to infrastructure for the adoption and use of advanced technologies (such as access to high-speed Internet)</td>
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<tr>
<td>Effects of trade agreements typically differ by industrial sector. For general overviews of key issues and agreements, as viewed by the US Congressional Research Service, see Villareal and Fergusson (2014) and Fergusson (2011)</td>
<td></td>
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<tr>
<td>Successful in supporting multiple industrial fields, though there is ongoing debate concerning the costs and benefits of procurement strategies. For a broad comparative view, see Lember et al. (2014)</td>
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<tr>
<td>Most long-running programs have been subject to official and independent analysis. Conclusions differ by program, but many are seen as relatively successful, and some have served as models for other national development programs. Although preliminary analyses are available, many of</td>
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Table 9A.1  (continued)

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<tr>
<th>Instrument</th>
<th>Description</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Financial mechanisms (loans, risk-sharing)</td>
<td>After the financial crisis, a series of programs provided financial support for firms in targeted industries, including cash grants in lieu of tax credits for certain types of production, as well as loans for alternative energy projects</td>
<td>the alternative energy programs the American Recovery and Reinvestment Act 2009 supports are aimed at longer-term technology horizons and outcomes that are difficult to evaluate in the short run</td>
</tr>
<tr>
<td>Industrial restructuring schemes</td>
<td>After the recent financial crisis, the federal government took a stake in several major automakers and financial institutions. These were framed as short-term, emergency measures</td>
<td>The effects of these programs will likely be debated for decades. In the short term, they saved many jobs at the firms in question and their domestic suppliers</td>
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Source: Authors.
10. The Republic of Korea’s financial support for small and medium-sized enterprises and venture businesses

Jung-moh Chang

10.1 INTRODUCTION

Financial policies to enhance industrial performance are vital for small- and medium-sized enterprises (SMEs), which are a key source of dynamism, innovation and flexibility in both industrialized and developing countries. Small- and medium-sized enterprises are responsible for most net job creation in the member countries of the Organisation for Economic Co-operation and Development. Yet, without adequate access to external funds for investment, SMEs will have difficulty raising investment per worker, essential for improving productivity and wages. The difficulties SMEs face in accessing finance during their early and later stages of development are not easy to overcome. To improve access, many governments have developed financial policies and programs for supporting innovative businesses—and this is particularly important for restoring sustainable, long-term economic growth after recessions and financial crises.

This chapter examines the Republic of Korea’s experience in providing a supportive financial architecture to the country’s traditional and innovative SMEs. With a focus on the latter, it looks closely at trends in the sector’s development during 1997–2012, which covers both the Asian and global financial crises, during which the nature of SME financing changed substantially.

Since the early 1990s, policymakers, entrepreneurs and analysts have drawn attention to the limitations of the Republic of Korea’s economic model. The mechanism of resource allocation the government used to wield discretionary power over the market was indeed effective when the economy was rapidly expanding, but the 1997–98 Asian financial
Development and modern industrial policy in practice

The crisis exposed the limitations of discretionary resource allocation and underscored the urgent need for economic reform. The old policy frameworks (and institutions) that had led the country in its early high-growth era became bottlenecks for sustained growth in a changing economic environment.

In response, the government launched a national campaign to make the transition to an advanced, knowledge-based economy in which domestic innovation would thrive, and to enhance overall productivity and sustain growth (Suh and Chen 2007; Mahlich and Pascha 2012). To this end, the creation of a robust and growing industrial base became a priority policy, an aim which included nurturing SMEs as growth entities—rather than treating them as weak entities.

Not all types of SMEs are suitable as growth drivers. Small- and medium-sized enterprises operate in different sectors, have varying management styles and are clearly not all the same. Even so, they can be broadly classified into stability-oriented and growth-oriented enterprises. The former are typically firms that provide self-employment or are family businesses; these are primarily aimed at providing minimum or moderate needs with no real aim of growing. The latter are innovative SMEs or venture businesses (start-up companies that develop a service or product in a particular market segment with the expectation of financial gain). These are small but fast-growing firms exploring opportunities with new technologies and ideas. Innovative SMEs are now a driving force for economic and social stability in the Republic of Korea owing to their quantitative impact on the economy and their contribution to job creation. They foster a competitive business environment and are helping expand the country’s industrial base. They help revitalize rural economies and are pivotal in promoting trade among regions of a country for more geographically balanced growth.

Accessing adequate finance is a serious challenge for innovative enterprises, which need a range of financing vehicles to progress through the business life cycle. A number of macroeconomic, institutional and regulatory rigidities still bias the Republic of Korea’s banking system against lending to SMEs. Yet, as in most countries, commercial banks are the main source of external finance for these enterprises.

The Republic of Korea’s banks are increasingly adopting strategies to reduce risks when they lend to SMEs. They are investing considerable resources to overcome information asymmetry problems by using credit scoring models and other sophisticated techniques to identify businesses likely to survive and expand (and which are therefore worth developing a long-term relationship with).

Despite this, financing problems remain acute (Kang 2007). This
has justified heavy government intervention to provide funding for the SME sector through a venture capital fund, securitization and the launch in July 2013 of the Korea New Exchange (KONEX), a bourse exclusively for SMEs that are not yet listed on the main stock markets but aspire to be listed soon. The government has actively created and implemented financial support mechanisms for innovative SMEs precisely because market mechanisms are not promoting their creation and growth.

Various policies that can foster new ventures have been tried, such as venture certification, benefits for ventures, nurturing stock markets and venture capital, expanding government finance for venture investment and other start-up promotion policies that have attracted talented individuals, and the number of venture businesses has increased significantly. But even good policies often have their weaknesses. Some argue that even though the government’s financing programs have been effective in creating more innovative SMEs and more jobs through their growth, it has been too heavily involved, crowding out the private sector.

10.2 SMES IN THE REPUBLIC OF KOREA TODAY

The Republic of Korea defines an SME as a firm with fewer than 299 employees. The sector is a major economic contributor, particularly to exports and employment, and the vast majority of the country’s roughly 3 million enterprises are SMEs (Table 10.1). Even so, their impact on the economy declined during 2005–12, when the SME share of total exports fell from 32.39% to 18.78%.

The traditional perception of SMEs in the Republic of Korea is that they are weak and in need of support. In the past, SMEs grew steadily as subcontractors of large enterprises, owing to their relatively low wages and market protection. But SMEs have engaged in little technological upgrading and have not improved competitiveness much. As a result, most of them operate in the low-technology segments of industrial production—a weak foundation for technical training and technology development. The Small and Medium Business Administration (SMBA) has developed numerous policies in the areas of financing, marketing, technology and the promotion of business start-ups to address this handicap, doing so in coordination with the Small and Medium Business Corporation (SBC). The SBC primarily facilitates investment and loans from start-up and promotion funds, and provides credit guarantees. The Korea Finance Corporation also performs a similar role in providing
Table 10.1  SMEs: number of firms, employment, and exports, the Republic of Korea, 2005–2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Firms (in thousands)</th>
<th>SMEs Firms (%)</th>
<th>Total Employment (in thousands)</th>
<th>SMEs Employment (%)</th>
<th>Total Exports (in $ billion)</th>
<th>SMEs Exports (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2867</td>
<td>2863</td>
<td>11902</td>
<td>10449</td>
<td>284.4</td>
<td>92.1</td>
</tr>
<tr>
<td>2006</td>
<td>2940</td>
<td>2936</td>
<td>12234</td>
<td>10678</td>
<td>325.5</td>
<td>103.7</td>
</tr>
<tr>
<td>2007</td>
<td>3049</td>
<td>3047</td>
<td>12613</td>
<td>11149</td>
<td>371.5</td>
<td>113.5</td>
</tr>
<tr>
<td>2008</td>
<td>3047</td>
<td>3044</td>
<td>13070</td>
<td>11467</td>
<td>422</td>
<td>130.5</td>
</tr>
<tr>
<td>2009</td>
<td>3069</td>
<td>3066</td>
<td>13398</td>
<td>11751</td>
<td>363.5</td>
<td>76.8</td>
</tr>
<tr>
<td>2010</td>
<td>3125</td>
<td>3122</td>
<td>14135</td>
<td>12262</td>
<td>466.4</td>
<td>98.6</td>
</tr>
<tr>
<td>2011</td>
<td>3235</td>
<td>3232</td>
<td>14534</td>
<td>12627</td>
<td>555.2</td>
<td>101.6</td>
</tr>
<tr>
<td>2012</td>
<td>3354</td>
<td>3351</td>
<td>14891</td>
<td>13059</td>
<td>547.8</td>
<td>102.9</td>
</tr>
</tbody>
</table>

Note: SME = small- and medium-sized enterprises.

The Republic of Korea’s financial support for SMEs

on-lending programs. In addition, the Bank of Korea (central bank) coordinates with the SMBA and the SBC in implementing the aggregate credit ceiling system.1

10.3 SMES IN MANUFACTURING

Table 10.2 shows the share of SMEs in various manufacturing subsectors under the Korea Standard Industrial Classification system of 24 subsectors. Small- and medium-sized enterprises make up the large majority of establishments, 73.4% of employees, 43.5% of the value of shipments, 45.2% of total value added and 47.7% of tangible assets. Except in tobacco products, where SMEs account for 75.0% of SMEs, there are no significant differences in the other subsectors in the share of the number of SMEs. These account for 96.2% of the total for coke and refined petroleum products, for 96.9% in computer and communication equipment, and at least 97% of the total in the other subsectors. However, there are significant differences in other indicators. For example, the SME share of manufacturing employment ranges from 22.6% for coke and refined petroleum products to 100.0% for tanning and dressing of leather.

Another useful way of classifying SMEs is into firms that are strictly SME oriented and those that are large and enterprise oriented, based on their shares in indicators such as the number of workers, gross output, value added and tangible assets. Table 10.3 shows that wages and salaries in SMEs are 53.5% of those in large enterprises, although there is wide variation across subsectors. For example, wages in SMEs in tobacco products are 94.2% of those in large firms.

10.4 COMMERCIAL BANK LENDING AND POLICIES FOR FINANCING SMES

Most SMEs depend on bank loans for more than 70% of total funding. While bank loans have steadily increased, financing from the capital market has fallen because SMEs often fail to acquire investment grade credit ratings that satisfy investor demands. Table 10.4 shows the financing

---

1 The Korea Finance Corporation is a government-owned nonbanking financial institution. It supports SMEs with financial services, including indirect financing through intermediary lending institutions under its on-lending scheme. In addition, it provides loans, securities investments and guarantees, and foreign capital borrowing; it securitizes credit risk; and deals with issues regarding policy finance bonds and other securities.
### Table 10.2  Share of SMEs in selected indicators, manufacturing subsectors (percentage), the Republic of Korea, 2012

<table>
<thead>
<tr>
<th>Sectoral classification</th>
<th>Number of establishments</th>
<th>Number of workers</th>
<th>Wages and salaries</th>
<th>Value of shipments</th>
<th>Value added</th>
<th>Tangible assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing total</td>
<td>98.94</td>
<td>73.39</td>
<td>59.60</td>
<td>43.53</td>
<td>45.20</td>
<td>47.69</td>
</tr>
<tr>
<td>Food products</td>
<td>99.14</td>
<td>88.83</td>
<td>85.37</td>
<td>85.99</td>
<td>82.60</td>
<td>86.76</td>
</tr>
<tr>
<td>Beverages</td>
<td>97.20</td>
<td>82.19</td>
<td>75.46</td>
<td>74.84</td>
<td>69.89</td>
<td>62.06</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>75.00</td>
<td>26.42</td>
<td>25.29</td>
<td>13.92</td>
<td>10.22</td>
<td>27.80</td>
</tr>
<tr>
<td>Textiles</td>
<td>99.84</td>
<td>96.79</td>
<td>95.44</td>
<td>94.07</td>
<td>94.73</td>
<td>96.23</td>
</tr>
<tr>
<td>Sewn wearing apparel and fur articles</td>
<td>99.53</td>
<td>91.20</td>
<td>83.04</td>
<td>76.37</td>
<td>73.88</td>
<td>66.02</td>
</tr>
<tr>
<td>Tanning and dressing of leather</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Wood and products of wood and cork (except furniture)</td>
<td>99.87</td>
<td>83.19</td>
<td>79.80</td>
<td>76.92</td>
<td>75.45</td>
<td>62.78</td>
</tr>
<tr>
<td>Pulp, paper and paper products</td>
<td>99.31</td>
<td>90.87</td>
<td>84.51</td>
<td>80.07</td>
<td>79.17</td>
<td>73.97</td>
</tr>
<tr>
<td>Publishing, printing and reproduction</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Coke, refined petroleum products</td>
<td>96.18</td>
<td>22.57</td>
<td>12.45</td>
<td>3.98</td>
<td>4.64</td>
<td>3.08</td>
</tr>
<tr>
<td>Chemicals and chemical products</td>
<td>98.05</td>
<td>73.40</td>
<td>64.18</td>
<td>46.24</td>
<td>45.07</td>
<td>51.13</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>97.66</td>
<td>81.84</td>
<td>79.43</td>
<td>74.86</td>
<td>70.51</td>
<td>72.46</td>
</tr>
<tr>
<td>Industry Type</td>
<td>2009</td>
<td>2010</td>
<td>2011</td>
<td>2012</td>
<td>2013</td>
<td>2014</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Rubber and plastics products</td>
<td>99.24</td>
<td>84.12</td>
<td>77.19</td>
<td>74.81</td>
<td>71.37</td>
<td>73.96</td>
</tr>
<tr>
<td>Nonmetallic mineral products</td>
<td>99.04</td>
<td>82.85</td>
<td>76.06</td>
<td>71.47</td>
<td>64.74</td>
<td>57.06</td>
</tr>
<tr>
<td>Basic metals</td>
<td>98.53</td>
<td>68.45</td>
<td>54.10</td>
<td>37.51</td>
<td>41.54</td>
<td>32.69</td>
</tr>
<tr>
<td>Fabricated metal products (except machinery and equipment)</td>
<td>99.57</td>
<td>90.54</td>
<td>86.81</td>
<td>78.55</td>
<td>71.07</td>
<td>82.56</td>
</tr>
<tr>
<td>Computer and communication equipment</td>
<td>96.85</td>
<td>39.25</td>
<td>26.01</td>
<td>17.06</td>
<td>13.03</td>
<td>15.01</td>
</tr>
<tr>
<td>Medical, precision and optical instrument</td>
<td>99.43</td>
<td>91.49</td>
<td>89.86</td>
<td>89.07</td>
<td>91.77</td>
<td>91.58</td>
</tr>
<tr>
<td>Electrical machinery and apparatus</td>
<td>98.78</td>
<td>78.38</td>
<td>66.31</td>
<td>61.44</td>
<td>59.63</td>
<td>61.36</td>
</tr>
<tr>
<td>Manufacture of other machinery</td>
<td>99.27</td>
<td>85.78</td>
<td>79.31</td>
<td>69.97</td>
<td>73.70</td>
<td>78.59</td>
</tr>
<tr>
<td>Motor vehicles and trailers manufacture</td>
<td>97.34</td>
<td>58.06</td>
<td>38.85</td>
<td>34.33</td>
<td>36.74</td>
<td>41.69</td>
</tr>
<tr>
<td>Other transport equipment</td>
<td>97.95</td>
<td>50.42</td>
<td>34.86</td>
<td>15.07</td>
<td>25.27</td>
<td>19.81</td>
</tr>
<tr>
<td>Furniture and articles</td>
<td>99.36</td>
<td>83.15</td>
<td>73.68</td>
<td>66.83</td>
<td>73.27</td>
<td>78.50</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>99.90</td>
<td>95.70</td>
<td>94.73</td>
<td>94.62</td>
<td>93.03</td>
<td>96.64</td>
</tr>
</tbody>
</table>

**Note:** SME = small- and medium-sized enterprises.

**Source:** KOSTAT Economic Statistics Bureau (2013).
### Table 10.3  Per capita indices of SMEs by manufacturing subsector (percentage of large enterprises), the Republic of Korea, 2012

<table>
<thead>
<tr>
<th>Sectoral classification</th>
<th>Wages and salaries</th>
<th>Gross output</th>
<th>Value added</th>
<th>Tangible assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing total</td>
<td>53.49</td>
<td>27.95</td>
<td>29.91</td>
<td>33.06</td>
</tr>
<tr>
<td>Food products</td>
<td>73.36</td>
<td>77.13</td>
<td>60.51</td>
<td>82.39</td>
</tr>
<tr>
<td>Beverages</td>
<td>66.62</td>
<td>64.46</td>
<td>50.29</td>
<td>35.44</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>94.24</td>
<td>45.01</td>
<td>31.71</td>
<td>107.24</td>
</tr>
<tr>
<td>Textiles</td>
<td>69.48</td>
<td>52.69</td>
<td>59.72</td>
<td>84.73</td>
</tr>
<tr>
<td>Sewn wearing apparel and fur articles</td>
<td>47.23</td>
<td>31.19</td>
<td>27.29</td>
<td>18.75</td>
</tr>
<tr>
<td>Tanning and dressing of leather</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Wood and products of wood and cork (except furniture)</td>
<td>79.79</td>
<td>67.34</td>
<td>62.10</td>
<td>34.08</td>
</tr>
<tr>
<td>Pulp, paper and paper products</td>
<td>54.82</td>
<td>40.37</td>
<td>38.17</td>
<td>28.55</td>
</tr>
<tr>
<td>Publishing, printing and reproduction</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Coke, refined petroleum products</td>
<td>48.78</td>
<td>14.20</td>
<td>16.68</td>
<td>10.90</td>
</tr>
<tr>
<td>Chemicals and chemical products</td>
<td>64.92</td>
<td>31.16</td>
<td>29.73</td>
<td>37.91</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>85.73</td>
<td>66.09</td>
<td>53.06</td>
<td>58.40</td>
</tr>
<tr>
<td>Rubber and plastics products</td>
<td>63.88</td>
<td>56.07</td>
<td>47.05</td>
<td>53.63</td>
</tr>
<tr>
<td>Nonmetallic mineral products</td>
<td>65.76</td>
<td>51.87</td>
<td>38.01</td>
<td>27.51</td>
</tr>
<tr>
<td>Basic metals</td>
<td>54.32</td>
<td>27.66</td>
<td>32.74</td>
<td>22.38</td>
</tr>
<tr>
<td>Fabricated metal products (except machinery and equipment)</td>
<td>68.73</td>
<td>38.25</td>
<td>25.67</td>
<td>49.45</td>
</tr>
<tr>
<td>Computer and communication equipment</td>
<td>54.40</td>
<td>31.84</td>
<td>23.18</td>
<td>27.34</td>
</tr>
<tr>
<td>Medical, precision and optical instrument</td>
<td>82.37</td>
<td>75.76</td>
<td>103.72</td>
<td>101.15</td>
</tr>
<tr>
<td>Electrical machinery and apparatus</td>
<td>54.29</td>
<td>43.95</td>
<td>40.74</td>
<td>43.80</td>
</tr>
<tr>
<td>Manufacture of other machinery</td>
<td>63.56</td>
<td>38.63</td>
<td>46.46</td>
<td>60.88</td>
</tr>
<tr>
<td>Motor vehicles and trailers manufacture</td>
<td>45.89</td>
<td>37.76</td>
<td>41.94</td>
<td>51.64</td>
</tr>
<tr>
<td>Other transport equipment</td>
<td>52.62</td>
<td>17.45%</td>
<td>33.25</td>
<td>24.29</td>
</tr>
<tr>
<td>Furniture and articles</td>
<td>56.71</td>
<td>40.82</td>
<td>55.54</td>
<td>73.97</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>80.80</td>
<td>78.96</td>
<td>59.94</td>
<td>129.06</td>
</tr>
</tbody>
</table>

*Note:* n.a. = the share of SMEs is virtually 100%.

## Table 10.4  Bank financing for SMEs and entrepreneurs, the Republic of Korea, 2007–11

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Units</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>Wo, trillion</td>
<td>369.00</td>
<td>422.00</td>
<td>443.00</td>
<td>441.00</td>
<td>455.00</td>
</tr>
<tr>
<td>Loans, SMEs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business loans, SMEs</td>
<td>% of total business loans</td>
<td>86.80</td>
<td>82.60</td>
<td>83.50</td>
<td>81.50</td>
<td>77.70</td>
</tr>
<tr>
<td>Short-term loans, SMEs</td>
<td>Wo, trillion</td>
<td>319.00</td>
<td>375.00</td>
<td>373.00</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Long-term loans, SMEs</td>
<td>Wo, trillion</td>
<td>106.00</td>
<td>136.00</td>
<td>158.00</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Total short and long-term loans, SMEs</td>
<td>Wo, trillion</td>
<td>425.00</td>
<td>511.00</td>
<td>531.00</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Short-term loans, SMEs</td>
<td>% of total SME loans</td>
<td>86.40</td>
<td>88.80</td>
<td>84.20</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Government guaranteed loans, SMEs</td>
<td>Wo, trillion</td>
<td>39.70</td>
<td>42.90</td>
<td>56.30</td>
<td>56.10</td>
<td>55.46</td>
</tr>
<tr>
<td>Government guaranteed loans, SMEs</td>
<td>% of total SME loans</td>
<td>10.80</td>
<td>10.20</td>
<td>12.70</td>
<td>12.70</td>
<td>12.20</td>
</tr>
<tr>
<td>Direct government loans, SMEs</td>
<td>Wo, trillion</td>
<td>2.50</td>
<td>2.60</td>
<td>4.80</td>
<td>3.10</td>
<td>3.00</td>
</tr>
<tr>
<td>Loans authorized, SMEs</td>
<td>Wo, trillion</td>
<td>2.72</td>
<td>3.20</td>
<td>5.82</td>
<td>3.42</td>
<td>3.35</td>
</tr>
<tr>
<td>Loans requested, SMEs</td>
<td>Wo, trillion</td>
<td>4.65</td>
<td>6.06</td>
<td>9.82</td>
<td>6.66</td>
<td>5.93</td>
</tr>
<tr>
<td>Ratio of loans authorized to requested,</td>
<td>%</td>
<td>58.50</td>
<td>52.80</td>
<td>59.30</td>
<td>51.30</td>
<td>56.60</td>
</tr>
<tr>
<td>Nonperforming loans, SMEs</td>
<td>Wo, trillion</td>
<td>3.45</td>
<td>7.71</td>
<td>6.85</td>
<td>10.00</td>
<td>7.90</td>
</tr>
<tr>
<td>Nonperforming loans, SMEs</td>
<td>% of SME business loans</td>
<td>0.90</td>
<td>1.80</td>
<td>1.50</td>
<td>2.30</td>
<td>1.70</td>
</tr>
<tr>
<td>Average interest rate</td>
<td>%</td>
<td>6.95</td>
<td>7.08</td>
<td>7.20</td>
<td>7.37</td>
<td>7.49</td>
</tr>
<tr>
<td>Interest rate spread</td>
<td>%</td>
<td>0.76</td>
<td>0.79</td>
<td>0.56</td>
<td>0.54</td>
<td>0.55</td>
</tr>
</tbody>
</table>
Table 10.4  (continued)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Units</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venture and growth capital</td>
<td>Won, trillion</td>
<td>992.00</td>
<td>725.00</td>
<td>867.00</td>
<td>1091.00</td>
<td>1261.00</td>
</tr>
<tr>
<td>Venture and growth capital</td>
<td>Year-on-year growth, %</td>
<td>. . .</td>
<td>−26.90</td>
<td>19.70</td>
<td>25.80</td>
<td>15.60</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payment delays, SMEs</td>
<td>Number of days past due</td>
<td>11.00</td>
<td>12.10</td>
<td>9.90</td>
<td>12.10</td>
<td>11.70</td>
</tr>
<tr>
<td></td>
<td>date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bankruptcies, total</td>
<td>Number</td>
<td>2294.00</td>
<td>2735.00</td>
<td>1998.00</td>
<td>1570.00</td>
<td>1359.00</td>
</tr>
<tr>
<td>Bankruptcies, total</td>
<td>Year-on-year growth, %</td>
<td>. . .</td>
<td>19.2</td>
<td>−26.9</td>
<td>−21.4</td>
<td>−13.4</td>
</tr>
</tbody>
</table>

Notes:
... = data not available, SME = small- and medium-sized enterprise.
The US dollar traded at about W1065.5 on 6 January 2014.

Source: Korea Federation of Small and Medium Business (2014).
The Republic of Korea’s financial support for SMEs

sources for SMEs and entrepreneurs during 2007–11, when the share of business loans to SMEs declined from 86.8% to 77.7%, due probably to increasingly conservative bank lending policies. Indeed, lending to SMEs over this period shows a distinct preference for sector blue chips and for loans backed by mortgages and credit guarantees. However, financing bottlenecks stifle innovative SMEs that have competitive technologies and growth potential but weak financial structures.

An SME financing policy began to take shape in the 1960s and 1970s when the government started helping these firms, which were mainly doing business in the domestic market. During the 1970s and 1980s, to prevent monopolization, the government protected SMEs from large enterprises. The Asian financial crisis resulted in a shift to a more open and innovation-led economic structure requiring new strategies to build a separate financing support system for innovative SMEs. After the crisis, large firms shied away from loans, to buttress their financial positions, and banks looked instead to households and blue-chip SMEs to expand their loan portfolios. In 2005, the government, concerned with the possibility of a real estate bubble, imposed restrictions on household lending, which boosted the SME loans from 258 trillion won (W) in that year to W444 trillion in 2009. Today, the main tools of policy financing for SMEs are capital loans, on-lending and aggregate ceiling lending, the scale of which has increased significantly since the 2008 global economic crisis.

The key supporters of SME financing are the SBC, the Bank of Korea and the Korea Finance Corporation (Figure 10.1). These institutions provide SMEs with stable financing sources for capital expenses and minimize financial damage from noneconomic external shocks such as natural disasters or spikes in raw material prices.

The SBC’s policy-fund loans to SMEs consist of low-interest funds over three to eight years. The SBC revised its corporate evaluation system and now focuses on the technological and business viability of SMEs, including their future marketability and growth potential (rather than on their current financial status). The SBC has also strengthened its functions for solving market failures, such as funds for start-up periods.

The SBC offers both direct and proxy loans. For the former, it performs all related loan procedures: receipt of loan applications, loan examination and post-loan management. For proxy loans, it conducts the preliminary loan examination (commercial banks do the final loan examination) and

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2 The credit guarantee program, analyzed later in this chapter, is designed to support viable technologically innovative enterprises with growth potential, despite relatively weak collateral and low credit ratings, and nontraditional SMEs.
loans and post-loan management. In 2009, 46.3% of SBC loans to SMEs (about W2.2 trillion) were direct and 53.6% proxy (W2.6 trillion). In 2010, the SBC’s total loan support budget for SMEs totaled W3.14 trillion, with W16.50 trillion outstanding at June 2013. Its loan program is deemed to have created more than 39,000 new jobs in 2009, equivalent to 3.21 new jobs per company or 0.77 new jobs per W100 million. Its targets for 2010 were 44,500 new jobs for an average of 3.64 jobs per company and a 0.88 job creation effect.

Policies for financing SMEs using on-lending are designed with the objective to increase SME access to credit. On-lending refers to funds recorded as a deposit in a supporting financial institution, but with the original lending bank and the contractual borrower (the supporting financial institution) agreeing that the loan proceeds will be made available to third-party SMEs. Under this program, the Korea Finance Corporation sets guidelines for the SMEs targeted for support and supplies on-lending funds to financing institutions. The financing institutions then examine applicant SMEs and decide whether to provide loans and the interest rate.
Korea Finance Corporation also provides credit and liquidation underwriting to ease the risk to financing institutions.

The Bank of Korea ensures systematic support to SMEs under two key programs: the aggregate credit ceiling system and the mandatory minimum SME loan ratio system. Under the first, it allocates funds to 17 commercial banks after determining aggregate credit ceilings every quarter based on the loans these banks provided to SMEs. Under the second, it encourages lending banks to provide SMEs with loans above an established ratio. The ratio is 45% for commercial banks, 60% for provincial banks and 35% for the domestic branches of foreign banks. Banks failing to achieve these ratios are penalized when the Bank of Korea allocates aggregate credit ceilings.

The central bank applies lower than prevailing market interest rates to its aggregate credit ceiling loans to achieve its policy goals, which include the expansion of SME lending and balanced regional development. For example, the rate was lowered from 3.5% per year in August 2008 to 1.75% in December 2008 and 1.25% in February 2009. In July 2007, the aggregate credit ceiling support was W6.5 trillion but, in response to the economic crisis, the central bank sharply increased the ceiling to W10 trillion in March 2009. In addition to these Bank of Korea programs, SMBA support facilitates SME access to financing (such as SME bond issuance).

10.5 THE ROLE OF INNOVATIVE SMES IN THE KNOWLEDGE ECONOMY

Small- and medium-sized enterprises often drive local economies through the formation of SME clusters—a group of SMEs forming a supply chain with complementary production processes and sales. Small- and medium-sized enterprises clusters can stimulate competition, enhance production efficiency and quality, help start-up businesses and increase access to external economic agents, such as raw material suppliers, skilled workers, trade partners and financial institutions.

While innovative SMEs account for a very small share of SMEs in any country, they are nevertheless of strategic importance because they generate significant employment and are vehicles for introducing cutting-edge technologies into the economy. However, innovative SMEs commonly face onerous conditions in accessing finance. Because of information asymmetries, excessive collateral and guarantee requirements are imposed on innovative SME borrowers. Furthermore, movables and accounts receivable are often not regarded as collateral in their case. To improve
this situation, innovative financing instruments that do not require real estate as collateral and third party guarantees should be developed.

Appropriate funding instruments for SMEs vary depending on their stage of development; that is, from start-up until they become mature firms. Besides bank financing, nonbank financial institutions, venture capital and capital markets should also be used as financing vehicles. Creating an alternative financial infrastructure can be an effective way for SMEs to mitigate the impact of external shocks such as financial crises. It is also important to diversify funding instruments for growth-oriented SMEs based upon their needs.

There are essentially two types of innovative SMEs: those that identify an emerging market niche and those in avant-garde high-technology and ‘new economy’ industries. Both share some features, such as low capital–labor ratios, high responsiveness to market conditions and obstacles to accessing conventional bank financing. All offer similar economic advantages for growth and development, including employment creation, the promotion of an entrepreneurial class, the creation of a more skilled labor force and economic dynamism. But differences can be pronounced, which makes certain alternative sources of financing suitable for some SMEs but not for others.

10.5.1 Market-Niche Finding SMEs

This type of SME discovers unexploited market niches in domestic and world markets and moves in quickly to capitalize on them. The dynamic nature of operations often dictates the small size of such SMEs, as they shift from one focus to another as competitors fill market niches and new niches are identified.

Microfinance and other traditional forms of credit are not suitable for this type of SME. Loan officers are accustomed to evaluating projects based on past experience in a given area of business and on the performance of comparable competitors, neither of which are possible in a new market niche. Moreover, monitoring costs in dynamic areas are very high, and the type of group lending and agent-monitoring prescribed for microfinance is inapplicable.

This situation leads to fundamental problems. Because banks are reluctant to lend to them, there tends to be an excessive reliance on the entrepreneur’s own wealth or on informal financing channels to start or grow a business, such as family and friends.

Firms with low credit risk but without good business plans, meanwhile, pose a different problem, which can give rise to two sources of market distortion. First, this sort of entrepreneur will not necessarily be talented or
capable, but merely have an appropriate initial level of wealth. Second, the ability of mediocre entrepreneurs to leverage their initial capital through access to conventional loans artificially amplifies the risk of niche-finding SMEs, thus compounding the initial agency problems. To enable the best entrepreneurial talents to participate in this SME niche and maximize economic efficiency, suitable financing alternatives are needed.

10.5.2 Avant-Garde SMEs

Avant-garde SMEs are typically highly skilled risk takers. While lack of economies of scale dictates the small size of traditional SMEs, dynamism and quick shifts in emphasis dictate the small size of the niche market of this type of SME, as well as its risk. Indeed, avant-garde SMEs take substantial risks because of the potentially significant economies of scale in the niches they operate. The avant-garde entrepreneur risks a substantial portion of capital and therefore attempts to sink as little as possible in the initial investment before increasing the size of the enterprise.

Niche-finding and avant-garde SMEs share some of the same features, such as no track record, which makes dependence on conventional funding sources impossible. Avant-garde SMEs tend to invest in fixed capital with multiple uses, such as vehicles and real estate. Such forms of capital are easy to finance through lease contracts and the financing risk can be largely reduced by the lease contractor’s ability to inspect the leased capital goods periodically, which can be seized in a default. In these firms, however, the capital investment is often in the form of human capital, such as a software firm or Internet-based commerce, or unconventional forms of capital such as a manufacturing prototype of a new machine. These are difficult to inspect and virtually impossible to seize in a default. Moreover, loan and lease officers in conventional financing institutions need substantial amounts of human capital to determine the feasibility and probabilities of the success and failure of an avant-garde SME.

Given these limitations, financial institutions catering to this niche must have substantial information on the specific sector in which the SME is venturing and must rely on equity-based financing, since monitoring is virtually impossible and the capital in which funds are invested is difficult to recover if such an action is needed. Sound knowledge of the relevant industry minimizes the initial cost of assessing the probability of success, and equity investments allow funding agencies to share in the potential capitalization on economies of scale. Ideally, the institution that funds these SMEs should consider a large number of potential investments in a specific sector and diversify the high risks of each by placing them in a large number of relatively small enterprises. This is the model of venture
capital financing, which is credited for the high-technology based ‘new economy’ now spreading through much of the industrial world.

10.6 THE LEGAL DEFINITION OF AN INNOVATIVE SME

In the Republic of Korea, the number of innovative SMEs is growing through ceaseless technological development and the cooperation of industry, academia and research institutes. Through certification, the SMBA divides these SMEs into three types: venture company, Inno-biz and management-innovative business or Main-biz. A company can belong to more than one of these at the same time. The following outlines the main features of the certification requirements.

Venture company. The SMBA designates a qualified venture-type company based on the Special Measures on the Promotion of Venture Companies, enacted in 1997. Venture businesses are expected to bring high profits but are high risk. Table 10.5 shows the criteria for venture company certification.

Inno-biz certification. This is given on the basis of how technologically competitive a firm is according to an assessment based on the Organisation for Economic Co-operation and Development’s Oslo Manual. To apply for certification, a company must have been in business for over three years and provide a preliminary assessment for certification through self-evaluation. Firms are assessed on four criteria—innovation, commercialization, management capability and technology achievements. To be certified, firms need to score at least 650 points out of a possible 1000.

Main-biz certification. The SMBA provides this on the basis of an assessment of management innovation capacity. Main-biz is designed to foster SME innovation in marketing, management and quality according to a system also based on the Oslo Manual. Main-biz assessment indices include: leadership; sustainable innovation; human resource management; business, production, service, customer and market-oriented processes; production facility status; measurement analysis; and knowledge and information management.

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3 The Oslo Manual is a guide for data collection and interpretation of technological innovation at the level of the firm.
The Republic of Korea’s financial support for SMEs

Once a business obtains certification in one of the three types, it gets priority status for government financing support. The required issued capital is reduced to a minimum of W5 million (the standard is over W50 million), and innovative SMEs get priority in applying for patents, and receive special benefits in the screening process when applying for listing on the Korean Securities Dealers Automated Quotations (KOSDAQ).4 For example, the minimum amount of capital required for innovative SMEs is W1.5 billion, half the requirement for other companies, and employees get tax breaks on their stock options. The government also allows academics and members of research institutes to take leave of absence to work for start-ups. The number of SMEs with Inno-biz certification has grown rapidly due to technological developments and cooperation between industry, academia and research institutes, rising from 3454 firms in 2005 to 11526 in 2007 and to 15772 in 2009.

The government is also expanding its export-based initiative for innovative SMEs, usually reserved for large firms. In 2010, the Korea Export and Import Bank launched its 300 Hidden Champions program in which

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4 KOSDAQ is a trading board of the Korea Exchange established in 1996. It is benchmarked from NASDAQ in the United States. As of 4 January 2014, KOSDAQ listed 1009 companies.

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### Table 10.5 Criteria for venture company certification, the Republic of Korea

<table>
<thead>
<tr>
<th>Criteria</th>
<th>First phase</th>
<th>Second phase</th>
</tr>
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<tbody>
<tr>
<td>Investment by venture capital</td>
<td>Venture capital holds a minimum of 10% equity stake and is maintained for a minimum of six months</td>
<td></td>
</tr>
<tr>
<td>Investment in research and development (R&amp;D)</td>
<td>Evaluation of technology and management innovation</td>
<td>Minimum of W50 million in annual R&amp;D expenses and 5–10% of revenue depending on the industry. Good evaluation for business from venture evaluation in the following areas: patent, technology transferred from public institution and technology developed with government investment</td>
</tr>
<tr>
<td>Commercialization of new technology</td>
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</table>

**Note:** W = Korean won.

**Source:** Government of the Republic of Korea (2014).
it provides SMEs with a support package for financing, technology, networking and international marketing strategy.

### 10.7 ENHANCING ACCESS TO FINANCE FOR INNOVATIVE SMES

Figure 10.2 shows the types of financial markets that innovative SMEs in the Republic of Korea have access to. The defining feature of the support system to SMEs is the significant level of government engagement as a fund provider and facilitator, across practically all areas of the financial market. In the loan market, government-sponsored agents provide credit guarantees and direct or indirect policy loans to eligible SMEs. When innovative SMEs receive trade credit from other buying corporations, these bills are insured mostly by public credit insurance. Even in equity markets, the government and public pension funds participate in venture capital funds with private investors. The following sections provide a

<table>
<thead>
<tr>
<th>Policymakers</th>
<th>Legal framework</th>
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<tbody>
<tr>
<td>Small and Medium Business Administration</td>
<td>Act on SMEs</td>
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</table>

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<thead>
<tr>
<th>Bank loan</th>
<th>Credit guarantee</th>
<th>Capital market</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-lending</td>
<td>Direct loan</td>
<td></td>
</tr>
<tr>
<td>• Korea Finance Corporation</td>
<td>• Industrial Bank of Korea</td>
<td></td>
</tr>
<tr>
<td>• Korea Development Bank</td>
<td>• Korea Credit Guarantee Fund</td>
<td></td>
</tr>
<tr>
<td>• Commercial banks</td>
<td>• Korea Technology Finance Corporation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Regional Credit Guarantee Fund</td>
<td></td>
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<table>
<thead>
<tr>
<th>Financial institution</th>
<th>Financing tools and exit routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Korea Venture</td>
<td>• Equity</td>
</tr>
<tr>
<td>Investment Corp. (F</td>
<td>• CB, BW</td>
</tr>
<tr>
<td>und of Funds)</td>
<td>• ABS</td>
</tr>
<tr>
<td>• Venture capital</td>
<td>• M&amp;A, SPAC</td>
</tr>
<tr>
<td>• Private Equity Fund</td>
<td>• KOSDAQ</td>
</tr>
<tr>
<td>• Securities firms</td>
<td>• Freeboard</td>
</tr>
<tr>
<td>• National pension</td>
<td>• Secondary fund</td>
</tr>
<tr>
<td>fund</td>
<td></td>
</tr>
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</table>

**Note:** ABS = asset-backed securities, BW = bond with warrant, CB = collateralized bond, KOSDAQ = Korean Securities Dealers Automated Quotations, M&A = mergers and acquisitions, SME = small- and medium-sized enterprise, SPAC = special purpose acquisition company.

**Source:** Kim (2010).

**Figure 10.2** How the financial system supports innovative SMEs, the Republic of Korea
more detailed overview of how the country’s institutions provide financial assistance to innovative SMEs.

10.7.1 Risk Capital for Innovative SMEs

To be effective in any sector, a financing modality must suit the sector’s challenges for the availability of information, monitoring and the distribution of risks and rewards. In a competitive market, suppliers of finance have powerful incentives to overcome barriers to SME finance. In most countries, banks regard SME finance as attractive and have developed effective monitoring techniques.

Whether a country experiences a financing gap or not will ultimately depend on whether the business environment is sufficiently robust to enable borrowers and lenders to interact with each other with confidence. Given instances of market failure in the financing process for innovative SMEs, many countries have developed programs to provide equity investments to these firms.

It is during the early phase of the life of a company, when an entrepreneur first seeks outside financing, that many analysts and policymakers perceive a market failure or financing gap for new and risky enterprises, and recommend official intervention to aid investment. Surveys of potential entrepreneurs often indicate that lack of financing is a barrier to enterprise formation. However, many potential investors report a scarcity of investment-ready proposals. To some degree, the difference in perceptions reflects the different views of entrepreneurs and financiers. Some entrepreneurs, especially in technology-related fields, may have a strong technical background, but lack the business acumen to turn ideas into marketable products. Entrepreneurs, for their part, may have unrealistic expectations about the possibility of sharing risks and rewards with outside investors, such as whether they can retain control of their companies.

Communication channels between entrepreneurs and investors are a critical part of the venture capital industry infrastructure. Studies have shown that a lack of awareness among small firms of the alternative financing options is a factor depressing demand for venture capital—an information gap that has to be bridged. On the one hand, potential investors need information about potential new projects. On the other, entrepreneurs need information about potential financing sources and transparency requirements, and acceptable contracts to induce investor participation.

National and local authorities can play a useful indirect role in encouraging private initiatives at the local level. They can do this, for example, by contributing to the development of incubators that help provide
infrastructure and on-site advice and information on venture capital suppliers. Similarly, they can lock in some of the benefits of existing geographical clusters. A key feature of such clusters is the information networks that bring together ‘business angels,’ venture capitalists, professional firms (including lawyers and accountants), entrepreneurs and business schools. Government participation can come either directly through equity participation in venture capital firms or through joint venture capital funds with a private party, known as hybrid funds.

The Republic of Korea has developed a range of instruments, including venture capital and credit guarantee schemes, for innovative SMEs. These are also well adapted to financing traditional or slow-growing SMEs. Once new SMEs have attained a viable size and a positive cash flow, they can use a fairly standard range of financial products, such as bank loans, asset-related finance and government programs.

By contrast, the goal in providing finance to innovative SMEs is to follow a continuum that starts with informal finance, progresses through various phases of formal finance and culminates in entry into formal capital markets. In this process, finance often acts as a catalyst in developing and commercializing emerging technology and shortening product development cycles. A reality is that innovative SMEs often require funding for the period during which they are not generating sufficient revenues to cover expenses. However, even when innovative SMEs begin to generate revenue, the need to reinvest heavily in the company means they will have negative cash flow for prolonged periods. Thus, risk capital usually assumes that a project will require multiple rounds of outside fund injections. Fund providers often use the prospect of future equity injections as a monitoring tool.

In developing the market for risk capital, it is important to have a complete range of financing vehicles. After the initial funding which, as noted earlier, often comes from family and friends, these enterprises may then obtain funding from seed capital funds and informal equity investments such as business angels before moving on to formal venture capital. The entire process culminates when the firm ‘exits’ as a mature company through an initial public offering or a trade sale.

10.7.2 Credit Guarantee Programs for SMEs

Credit guarantee support provides guarantees for SMEs that have difficulty obtaining loans from commercial banks due to a lack of collateral. The implementing agencies of these programs are the Korea Credit Guarantee Fund (KODIT), the Korea Technology Finance Corporation (KOTEC) and the Korea Federation of Regional Credit Guarantee
The Republic of Korea's financial support for SMEs

Funds. All are public financial institutions that serve SMEs operating in different categories. The Korea Credit Guarantee Fund supports nontechnology-oriented SMEs, essentially, start-up firms, exporting firms and green-growth firms. The Korea Technology Finance Corporation serves technology-oriented SMEs such as venture firms, those with Inno-biz certification and technology-oriented green-growth firms. The Korea Federation of Regional Credit Guarantee Funds supports self-managed and unregistered micro businesses.

Since 1976, the government has provided a public credit guarantee program to SMEs ineligible for bank loans due to a lack of collateral. The program gives SMEs access to bank borrowing based on KODIT and KOTEC guarantees, and aims to resolve the information asymmetry problem between suppliers and SMEs (in the sense that a public risk-sharing mechanism bridges the financing gap stemming from the lack of a credit evaluation system). In practice, the credit guarantee program has often been extended to subsidize SMEs to lower their financing costs (sometimes below the risk-free interest rate), and it has become one of the most popular forms of public financial support for SMEs.

In addition to KODIT and KOTEC, there are 16 credit guarantee foundations (CGFs), which have played a role in supporting the local and macro economies during downturns. Table 10.6 gives an overview of the target groups and the guarantee levels of these three institutions.

Credit guarantee programs are the dominant financing mechanism for innovative SMEs. Total finance for SMEs under these schemes in 2009 was W11.9 trillion, with technology-based guarantees accounting for 65%.

Table 10.6  Credit guarantee institutions: target groups and guarantee levels, the Republic of Korea

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Target group</td>
<td>General SMEs</td>
<td>Technology-oriented SMEs and ventures</td>
<td>Small and micro businesses</td>
</tr>
<tr>
<td>Guarantee outstanding maximum guarantee</td>
<td>W38.4 trillion</td>
<td>W17.2 trillion</td>
<td>W13.6 trillion</td>
</tr>
<tr>
<td>Maximum guarantee</td>
<td>W3000 million</td>
<td>W3000 million</td>
<td>W800 million</td>
</tr>
</tbody>
</table>

Note: CGF = credit guarantee foundations, KODIT = Korea Credit Guarantee Fund, KOTEC = Korea Technology Finance Corporation, W = Korean won.

Source: Lee (2012).
Development and modern industrial policy in practice

of the total and policy loans for only 16%. Research and development grants typically come from venture investments; they accounted for 12% of the total financing for credit guarantee programs in 2009.

For general SME financing, the government uses credit guarantees, policy loans, grants and venture capital investment. Credit guarantees are the largest source, supplying W51 trillion in 2009, compared with W3.1 trillion for policy loans and W1.25 trillion for venture capital investments.

10.7.3 An Overview of the Three Main Credit Guarantee Programs

Korea Credit Guarantee Fund
The Korea Credit Guarantee Fund provides comprehensive support for general SMEs, with 11 types of general credit guarantees and guarantees under a primary collateralized bond obligation program. It also operates credit information management, guarantee-combined investment, credit insurance, management consulting and infrastructure credit guarantee services. Since its foundation in 1976, KODIT has accumulated and managed its own credit information data collected during credit investigations. In 1992, it successfully launched a credit information service called CRETOP, the largest database of credit information on SMEs in the Republic of Korea. With this service, enterprises and financial institutions can get credit information on their trading partners and clients.

To obtain a credit guarantee from KODIT, applicants go through a series of procedures, starting with a visit or Internet consultation. The Korea Credit Guarantee Fund then conducts a credit investigation, sets the guarantee amount for approved applicants and issues a letter of credit guarantee to a lending bank. The entire process takes three to nine working days.

The Korea Credit Guarantee Fund’s fee system is closely tied to the credit rating of the applicant, with the basic rate ranging from 0.5% to 2.0% per year of the guaranteed amount. This is based on the applicant’s credit rating. The final fee is decided by adding or subtracting a certain rate to the basic fee, which depends on the applicant’s situation and the type of guarantee product. For a large company, it adds an additional 0.5% per year to the final fee rate.

The Korea Credit Guarantee Fund’s credit guarantee procedure uses two methods. Under the direct method—the most common, accounting for 97% of guarantees in 2005—KODIT undertakes the entire approval

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5 In the Republic of Korea, all business entities are eligible for credit guarantee, except hotels and condominiums, high-end restaurants, financial services and real estate agencies.
process. Under the indirect method, it entrusts banks with all operations, including credit investigation and the issuance of letters of credit guarantees. There are two types: the general indirect guarantee uses trustee contracts with participating banks—there are 13 of them—to provide credit guarantees of up to W100 million; and the special indirect guarantee program is open only to the Industrial Bank of Korea, which is allowed to extend credit guarantees to cooperatives.

Research institutes have tried to estimate the benefits of KODIT’s credit guarantee programs on the economy (Park 2006). The Korea Institute of Public Finance estimates, using an input–output analysis, that production induced by KODIT’s credit guarantees totaled W1.3 trillion in 2005, with the ratio of induced production to guarantee provision at 4.39%. That is, for every W100 guarantee provision they induced an additional W4.39 of production, these results indicating that credit guarantee institutions should focus on industrial sectors with large production inducements. In 2005, credit guarantees created W600 billion in induced production.

**Korea Technology Finance Corporation**

The Korea Technology Finance Corporation specializes in comprehensive services to innovative SMEs and venture enterprises. Its main activity is to provide guarantees for technology-oriented industries to undertake technology appraisals and provide technological and management support. Through the Technology Credit Guarantee System, KOTEC provides more than 80% of the total amount guaranteed to companies developing or applying new technologies.

It operates a highly developed appraisal system called the Kibo Technology Rating System, patented in the Republic of Korea in 2007, and granted an international patent in Singapore in 2008 (O’Donnell 2012). The system’s overall aim is to identify and support technology-oriented SMEs with strong business prospects, but which would not qualify for loans under a normal credit analysis because of low collateral. The indicators used to assess a firm’s performance and the weights given to each indicator are key aspects of the rating system. The indicators have been refined and reduced over the years, and an ongoing effort aims to make more of them quantitative and objective.

**Credit Guarantee Funds**

As noted, 16 CGFs in cities and provinces serve small and micro businesses that lack substantial collateral. Their major activities are credit surveys, management of credit information and basic assets, and the provision of management training. Credit guarantee funds provide six types of credit guarantees, including for bank loans and loans of nonbank
financial institutions, both of which accounted for 99.7% of the guarantees outstanding in 2011. Credit guarantee funds provide full coverage, applied to guarantee amounts of up to W20 million, and partial coverage for higher amounts.

The Korea Federation of Credit Guarantee Foundations was established in 2000 to develop CGFs and is the country's only re-guarantee organization. The re-guarantee system allows CGFs to recover part of their losses when small and micro businesses default, thus strengthening the capacity of the entire scheme.

In 2010, the Korea Federation of Credit Guarantee Foundations and the CGFs established a system to manage their credit risk, which is measured and monitored monthly using a value-at-risk system. In developing the system, they chose a loan-pool methodology so that risks reflecting correlations among assets and business cycles could be considered simultaneously. The 20 pools are split into industry sectors (retail and wholesale, services, restaurants and hotels, and manufacturing) and guarantee types. The guarantee types include general guarantees, special guarantees, special guarantees for low ratings and a so-called Sunshine Loan Guarantee.6 Under the overall system, credit risks are measured using 18 classifications: the 16 CGF guarantees and the federation’s re-guarantees and individual guarantees. Additionally, the system allows the measuring of CGF credit risk by whether the re-guarantee effect is applied.

10.8 VENTURE CAPITAL INVESTMENT

Venture capital firms in the Republic of Korea are corporations. Their shareholders pay capital and employ managers and venture capitalists who invest the paid-in capital. Venture capital firms also raise funds outside, meaning they have two sources of capital pools to invest: their own funds, composed of paid-in capital and debt, and outside funds from limited-partner investors.

The venture capital industry boomed during 1998–2000, when 98 new venture capital firms were established and 281 outside funds organized. Three factors contributed to this growth: it coincided with the information technology boom that began in 1997; the government was trying to develop the venture capital industry; and the establishment of KOSDAQ in 1996 as a window for initial public offerings (Kim 2008). When the

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6 The Sunshine Loan is a microfinance measure for low-income households with low credit. Loans are granted to help start-up businesses and defray operational costs and for emergency needs.
technology bubble burst around 2000, so did the venture capital boom and many small-sized venture capital firms closed. New investment remains low.

A main trend in the venture capital industry these days is the development of outside funds (Baygan 2003). In 2000, inside funds totaled W4.6 trillion and accounted for almost 70% of the total venture capital raised, while outside funds totaled just W2.1 trillion. Since then, however, inside funds have shrunk and outside funds increased rapidly. By 2005, outside funds totaled W4.8 trillion, accounting for over 70% of the total venture capital raised. The rising trend for outside funds in the fund-raising stage is also happening in the investment stage. While the amount of new investment from inside funds rapidly decreased, new investment from outside funds has steadily increased, accounting for 83.8% of new investment in 2005. Reflecting the trend in new investment, the share of total investment accounted for by outside funds doubled in the period.

10.8.1 Characteristics of the Venture Capital Industry

The government plays a significant role in raising outside funds. This reflects the early stage of development of the Republic of Korea’s venture capital industry. The government provided the largest commitment to outside funds during 2001–05, providing on average of 27.1% of the committed capital to each outside fund, followed by corporations and venture capital firms. This structure of fund raising contrasts with that of the United States (US), where major investors in the venture capital market are private and public pension funds, financial and insurance companies, endowments and foundations. These represent at least 80% of the venture capital raised. The US government only supports the fund-raising of public venture capital firms.

The short life span of outside funds—typically around five years—is another defining feature of the venture capital industry. Of 630 funds established during 1989–2007, 76.3% (480) had a life span of five years and 102 of seven years or more. Almost 90% of the funds established during 2000–2003 had a five-year life span. This compares with the typical life span of US venture capital funds of ten years or more.

Exit mechanisms—the recovery strategy venture capitalists use—are another noticeable difference between the Republic of Korea and the US. While mergers and acquisitions are the dominant exit mechanism in the US, they only account for around 5% of total exits in the Republic of Korea, which shows how underdeveloped the country’s mergers and acquisitions market is. Instead, the overwhelming majority of venture investment exits are initial public offerings through KOSDAQ.
The short life spans of outside funds and venture investments exits have important implications for the age of invested firms. It generally takes more than seven years for a newly established venture firm to offer its stock to the public in the Republic of Korea. Because of this, venture capital firms that decide to recover their investments within three or four years prefer to concentrate their investments on expansion-focused companies that are over three years old.

During the venture boom of 1998–2000, this structural constraint was not a problem because the time it took for a new venture company to go public was much shorter than it is now. After 2000, however, the venture boom evaporated and the interval for an initial public offering increased, resulting in a greater focus on venture investments geared toward expansion or later-stage companies. In 2001, these firms accounted for only 24.6% of new venture investment, but they rose to 55% by 2005. In the same period, the proportion of new investment in early-stage firms promptly decreased from 54.4% to 15.8%.

10.8.2 The Fund of Funds

The government created the Fund of Funds in 2005 to promote the establishment of investment funds for SMEs and venture businesses. Its investment resources totaled W1 trillion. In contrast to the previous system to promote investment funds for these businesses, whereby the government directly chose recipient companies and determined the amount of funds they received, the Fund of Funds allows fund managers to evaluate, select and distribute capital to a number of investment funds. The Fund of Funds’ advantages over the previous system are as follows:

- It operates more efficiently and is more profitable. However, the Fund of Funds is not completely independent of government influence. Fund managers can be asked to allocate resources to sub-funds to support a particular government policy, as opposed to following conventional business benchmarks for selecting beneficiaries.
- Government support ensures that the Fund of Funds is still able to finance the venture capital market even when the economy is in recession so that it can play a role in revitalizing the market.

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7 Owing to government support, private investors were also trying to invest in young venture businesses, resulting in the investment of W2 trillion in 2000. In 2001, the number of venture firms exceeded 10,000. In 2002, the KOSDAQ market almost collapsed and many venture businesses faced a liquidity crisis.
The venture capital market is more transparent because of its high standards and prudent management applied in the selection of projects invested in sub-funds.

The Fund of Funds is a stable investment source to venture firms, especially during economic downturns when private investors tend to invest in safer securities.

As the seed money for investment funds in the private sector, the Fund of Funds has undoubtedly contributed to the promotion of the venture capital market. It is operated by professional fund managers to reduce investment risks, and aims to accomplish both public objectives and profitability. Its system gives priority to associations that invest in sectors in which the possibility of market failure is high.

10.9 FUNDING FOR RESEARCH AND DEVELOPMENT

Small- and medium-sized enterprises can access an array of programs for funding R&D. Funding exclusively for SMEs comes mainly through the SMBA, which had an R&D support budget of W605 billion in 2011. This was divided into direct support for companies (W444 billion) and industrial education support (W161 billion). The direct support is divided into 11 subprograms, of which the Technology Innovation Development program is the largest, accounting for 44% of total budget support, followed by the Growth Technology program (20%) and the Product Development with Option to Purchase program (11%) (Ahn 2009).

10.9.1 Technology Innovation Development Program

This is one of the main innovation support programs for SMEs, and is designed to foster technological innovation by providing funds to SMEs capable of their own product development. Under the program, 75% of a project’s cost can be funded. Once a project is deemed successful after its final evaluation, program beneficiaries must pay back, in installments over a five-year period, 30% of the costs as technology fees. An online management information system was set up in 2005 to handle the applications and operations of the Technology Innovation Development programs to overcome the physical limitations of the different agencies and locations involved in running them. Since its launch, the number of programs has expanded from one field in 2005 to 17 in 2008. The operations the system can handle have also expanded.
10.9.2 Growth Technology Program

This aims to raise the effectiveness of R&D investment by selecting research areas and industries ripe for development. During 2009–13, the selected areas were green technologies, technologies that could serve as new engines of growth and knowledge services. There are also measures to increase private R&D funding for innovative SMEs under this program. Large companies are encouraged to set up or participate in R&D investment pool funds, which invest in SME R&D. Increases in R&D funding attract tax incentives. Newly established innovative SMEs can receive tax refunds on R&D spending and labor development costs. Other tax incentives encourage R&D investment and retention of skilled personnel. To distribute R&D funds more strategically, the government seeks out innovative firms that can become globally competitive and helps them enter foreign markets.

10.9.3 Product Development with Option to Purchase Program

This program brings together purchasers of a technology or of a new product, such as public organizations and large private companies, SME suppliers of such technology and the technology development funding agencies (such as the SMBA). The government, through the SMBA, helps fund the technology or product development of an SME, and also assists large companies that do not want to invest the required R&D. It guarantees for an agreed period the purchase by a large company of the outcome of the SME’s development. The commitment to purchase the outcome is temporary in the sense that if the SME does not deliver the outcome during the agreed period, the large company will not be obliged to purchase it. The initial step in the Product Development with Option to Purchase program requires the purchasing organization to specify its requirements for a new technology or product. Under the program, R&D support can cover all activities associated with commercialization up to preproduction.

However, the system was open to abuse as firms received the funds in advance. In 2007, a new payment system, called the Research and Development Points System, was introduced to address the potential misuse of the up-front payment system. Under the system, SMEs get the funds only when they specify their use. An important feature is that once a request for payment is made all the processes are carried out in real time and online to avoid delays or lengthy approval, and recording every transaction in real time allows expenditure to be easily tracked and monitored.
10.10 SECURITIZATION

Heavy reliance on commercial banks for funding has been very costly for SMEs. For example, bank restructuring after the Asian financial crisis caused widespread bankruptcies, including many SMEs. Banks also tend to cut credit to SMEs during crises, but it is during these times that funds are most needed. In response to these unfavorable conditions, the SBC developed programs to facilitate alternative funding sources for SMEs.

These involve various primary-market collateralized bond obligation schemes, coupled with a credit guarantee mechanism. They could serve as an example for future SME funding in other countries. Securitization involves repackaging assets that generate cash flow. Its attraction is that it separates the assets from the credit profile of the original company that owned them. Since 1998, the SBC has developed diverse structures for primary-market collateralized bond obligations. The program for these instruments centers on a credit enhancement scheme that issues collateralized bond obligations in senior tranche based on the underlying assets securitized with corporate bonds; that is, it uses securitization to create funds for financing.

Table 10.7 shows the diverse structures of primary-market collateralized bond obligation programs developed during 1999–2004. There are two notable variants of these structures. The first uses credit guarantees from either the Korea Credit Guarantee Fund or the Korea Technology Credit Guarantee Fund. Without guarantees, the amount of senior bonds that can be issued with triple-A ratings ranges between 40% and 70% of the

Table 10.7 Primary collateralized bond obligation programs, the Republic of Korea, 1999–2004

<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
<th>Amount (billion)</th>
<th>Number of companies</th>
<th>Credit grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st SME securitization</td>
<td>1999 Dec.</td>
<td>W72.0</td>
<td>23</td>
<td>BB</td>
</tr>
<tr>
<td>2nd SME securitization</td>
<td>2001 Jan.</td>
<td>W160.0</td>
<td>52</td>
<td>BB-</td>
</tr>
<tr>
<td>KOROmas Fund</td>
<td>2001 Dec.</td>
<td>$0.34</td>
<td>59</td>
<td>BB-</td>
</tr>
<tr>
<td>3rd SME securitization</td>
<td>2002 Sep.</td>
<td>W81.5</td>
<td>42</td>
<td>B</td>
</tr>
<tr>
<td>CORO Voltin Fund</td>
<td>2002 Nov.</td>
<td>$0.35</td>
<td>111</td>
<td>B</td>
</tr>
<tr>
<td>4th SME securitization</td>
<td>2003 May</td>
<td>W98.0</td>
<td>41</td>
<td>B</td>
</tr>
<tr>
<td>5th SME securitization</td>
<td>2004 Feb.</td>
<td>W94.4</td>
<td>38</td>
<td>B+</td>
</tr>
<tr>
<td>Yen CBO securitization</td>
<td>2004 Sep.</td>
<td>¥10.0</td>
<td>40</td>
<td>B+</td>
</tr>
</tbody>
</table>


Source: Kim (2009).
Development and modern industrial policy in practice

value of the underlying asset, depending on the average credit quality of
the pools. With a credit guarantee, however, the amount issued of the
same senior tranche can be up to 93–97% of the value of the underlying
assets. Thus, credit guarantees can maximize the funding efficiency of the
primary collateralized bond obligation program. Furthermore, institu-
tional investors are more likely to buy collateralized bond obligations that
have the credit ratings of guaranteed bonds, which are more stable than
those without guarantee.

The second variant is the receivable-backed collateralized loan obliga-
tion structure tried in the third and fourth collateralized bond obligation
program in 2002 and 2003. In the standard structure, the underlying assets
are straight corporate bonds issued by SMEs in the pool. However, in the
collateralized loan obligation structure, underlying assets are asset-based
loans made by originating banks. This structuring is necessary in order to
address the problems in obtaining loans faced by small companies with
healthy future revenue streams from sales to big companies, but with
poor credit owing to a lack of collateral. To address this problem, the
SBC created the receivable-backed collateralized loan obligation, whereby
SMEs sell future receivables to a trust in a contractual agreement and the
certificates of the trust are given to the SBC as collateral to the loan made
to the SMEs.

10.11 KOREA NEW EXCHANGE

Venture capital companies need to retrieve their funds so they can make
profits and additional investments, which is why exit options for venture
capitalists are so important. Essentially, as touched on earlier, the two
exit options are mergers and acquisitions and initial public offerings. The
government is trying to revitalize the mergers and acquisitions market by
upgrading the information network to make intermediary support lead
to substantial matching arrangements. This will help venture capitalists
retrieve their investments since the rate of investment retrieval through
mergers and acquisitions in the Republic of Korea is only 7.1%, compared
with 89.2% in the US.

The government has tried to streamline and simplify the process and
requirements for listing in the market for initial public offerings, especially
for venture businesses. To this end, in 2003, it launched a new stock market
only for venture businesses called KONEX to facilitate direct financing
of venture start-ups and SMEs through the capital market. It provides
investors with new investment opportunities by listing SMEs—typically
those under 10 years old—with high growth potential. The exchange aims
The Republic of Korea’s financial support for SMEs

It takes 14.3 years on average for a firm from start-up to list on the secondary technology-heavy KOSDAQ. Institutional investors or individuals with a minimum deposit of W300 million can trade on KONEX; the minimum transaction is 100 shares. Of 24 companies listed on KONEX, seven are in medical equipment manufacturing or biotechnology, four in semiconductors and three in software.

10.12 CONCLUSIONS

This chapter has examined the financing constraints that traditional and innovative SMEs face in the Republic of Korea, and how the government is addressing them. Innovative SMEs are more flexible and apt to adjust to new environments. However, poor access to financing has been a severe obstacle to growth and expansion, and active government policies are necessary because commercial banks and private investors are somewhat reluctant to provide funds. The government has introduced numerous policies to encourage those institutions to increase funding with lower risk. In particular, credit guarantee programs and the creation of a public venture fund have lowered the risk of investments in innovative SMEs. No single way exists to support and strengthen SME competitiveness in a globalized world, but the Republic of Korea’s case is a good example for developing countries.

REFERENCES*


* The Asian Development Bank recognizes Korea and South Korea by the name Republic of Korea.


11. Industrial policy: the Australian experience

William Francis Mitchell

11.1 INTRODUCTION

Australia’s development demonstrates that it is possible for a small and open economy heavily reliant on primary commodity exports—and initially without a strong and diversified industrial base—to achieve high per capita income with the right mix of domestic and external policies. The country’s wealth of experience in industrial policy—particularly in building and dismantling tariff protection and direct skills formation—offers important insights into designing policy to promote economic diversification and international competitiveness.

The state has played a central role in Australia’s industrial progress. Successive governments have recognized that the state has to be responsible for regulations that may limit market activity in the interests of economic stability, such as promoting competition through regulation. A comprehensive tariff protection regime initially helped the manufacturing sector become internationally competitive. But as the sizable downsides of protection have become clearer to decision makers, industrial policy has shifted to promoting productivity, enhancing competitiveness and providing incentives for industry to restructure to meet emerging domestic and global challenges.

The state in Australia is also a very significant employer. This was especially so when national policy was calibrated toward full employment from 1945 to the mid-1970s, an era when the government undertook large-scale public infrastructure projects to provide electricity and irrigation to spur industrial development. More recently, information technology has led this effort, notably the ongoing National Broadband Network scheme. An enduring legacy of Australia’s early industrial development is the state’s strong commitment to direct skills formation through education, training and apprenticeships.

This chapter examines these developments and issues, as well as the decision to float the Australian dollar in 1983 and how this became crucial
for insulating the economy from sometimes dramatic fluctuations in commodity prices. Floating the currency was not only a landmark event in the country’s economic and industrial development, but one that still, over three decades on, holds important lessons for economies with similar characteristics and challenges. Table 11A.1 in the appendix to this chapter provides a summary of industrial policy instruments in Australia.

11.2 OVERVIEW OF THE AUSTRALIAN ECONOMY

Australia’s income per capita is among the world’s highest, with gross domestic product (GDP) per capita of $65,477 in 2011 (in US dollars at current prices), according to International Monetary Fund data. The average in member countries of the Organisation for Economic Co-operation and Development (OECD) was $47,049 in that year (Figure 11.1).

Figure 11.2 shows Australia’s annual real GDP growth from 1901 to
Industrial policy: the Australian experience

Prior to World War II, macroeconomic policy tools were not well understood and the economy experienced severe swings. From 1945 to the mid-1970s, the country enjoyed what might be called an era of full employment, marked by a willingness of successive governments to maintain levels of aggregate demand to ensure the economy created enough jobs. This commitment went as far as requiring the federal government to play a major role as an employer in its own right. Accordingly, the government used a range of fiscal and monetary measures to stabilize the economy in the face of fluctuations in private sector spending.

Economic activity was also less volatile in this period which, arguably, promoted more certainty in the investment climate and led to dynamic efficiency gains in training and skills development. Since the oil shocks in the late 1970s, Australia’s trend GDP growth rate has fallen and the unemployment rate has risen, as governments have moved away from aggregate demand-side management.

Table 11.1 shows the changing composition of final output between

Note: GDP = gross domestic product.


Figure 11.2 Real GDP growth, Australia, 1901–2011

2011. Prior to World War II, macroeconomic policy tools were not well understood and the economy experienced severe swings. From 1945 to the mid-1970s, the country enjoyed what might be called an era of full employment, marked by a willingness of successive governments to maintain levels of aggregate demand to ensure the economy created enough jobs. This commitment went as far as requiring the federal government to play a major role as an employer in its own right. Accordingly, the government used a range of fiscal and monetary measures to stabilize the economy in the face of fluctuations in private sector spending.

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Table 11.1 shows the changing composition of final output between
Table 11.1  Expenditure shares (percentage of real GDP), Australia, selected periods

<table>
<thead>
<tr>
<th>Year</th>
<th>Public consumption</th>
<th>Household consumption</th>
<th>Total consumption</th>
<th>Private dwelling investment</th>
<th>Private investment</th>
<th>Public investment</th>
<th>Total investment</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>7.4</td>
<td>73.0</td>
<td>. .</td>
<td>2.8</td>
<td>4.3</td>
<td>7.7</td>
<td>. .</td>
<td>22.5</td>
<td>17.4</td>
</tr>
<tr>
<td>1910</td>
<td>6.7</td>
<td>70.4</td>
<td>. .</td>
<td>3.6</td>
<td>4.6</td>
<td>8.2</td>
<td>. .</td>
<td>20.6</td>
<td>16.9</td>
</tr>
<tr>
<td>1920</td>
<td>8.0</td>
<td>66.8</td>
<td>. .</td>
<td>2.4</td>
<td>5.1</td>
<td>7.1</td>
<td>. .</td>
<td>15.0</td>
<td>14.6</td>
</tr>
<tr>
<td>1930</td>
<td>8.1</td>
<td>70.8</td>
<td>. .</td>
<td>2.0</td>
<td>3.0</td>
<td>7.7</td>
<td>. .</td>
<td>20.1</td>
<td>10.6</td>
</tr>
<tr>
<td>1940</td>
<td>28.4</td>
<td>54.5</td>
<td>. .</td>
<td>2.3</td>
<td>4.4</td>
<td>4.8</td>
<td>. .</td>
<td>18.5</td>
<td>13.5</td>
</tr>
<tr>
<td>1950s</td>
<td>15.1</td>
<td>52.8</td>
<td>66.2</td>
<td>5.7</td>
<td>11.2</td>
<td>5.1</td>
<td>16.0</td>
<td>9.8</td>
<td>6.6</td>
</tr>
<tr>
<td>1960s</td>
<td>15.5</td>
<td>52.2</td>
<td>66.2</td>
<td>5.9</td>
<td>12.3</td>
<td>5.6</td>
<td>18.0</td>
<td>10.2</td>
<td>7.6</td>
</tr>
<tr>
<td>1970s</td>
<td>17.1</td>
<td>52.4</td>
<td>68.1</td>
<td>6.7</td>
<td>12.2</td>
<td>5.3</td>
<td>17.6</td>
<td>12.2</td>
<td>8.2</td>
</tr>
<tr>
<td>1980s</td>
<td>18.5</td>
<td>53.0</td>
<td>71.2</td>
<td>6.7</td>
<td>14.8</td>
<td>5.2</td>
<td>20.1</td>
<td>14.0</td>
<td>9.5</td>
</tr>
<tr>
<td>1990s</td>
<td>18.5</td>
<td>52.3</td>
<td>70.7</td>
<td>6.2</td>
<td>15.7</td>
<td>4.3</td>
<td>20.0</td>
<td>20.6</td>
<td>12.7</td>
</tr>
<tr>
<td>2000s</td>
<td>17.5</td>
<td>52.9</td>
<td>70.5</td>
<td>6.2</td>
<td>20.4</td>
<td>4.5</td>
<td>24.9</td>
<td>23.1</td>
<td>18.8</td>
</tr>
<tr>
<td>2010-</td>
<td>17.8</td>
<td>53.9</td>
<td>71.7</td>
<td>5.7</td>
<td>22.3</td>
<td>6.6</td>
<td>28.9</td>
<td>23.2</td>
<td>24.2</td>
</tr>
</tbody>
</table>

Notes:
... = data not available, GDP = gross domestic product.
Data from the 1950s onward are averages for the decade. The data for the 1950s are for the last two quarters of 1959 only because this data commenced in the third quarter of 1959. Data for 1900 to 1940 are the values as at the year shown.

expenditure categories since 1900. In the early days of ‘nation building,’ public investment was around double the proportion of private investment and household consumption was dominant. A smaller percentage of output was also devoted to house construction than in later years. As the economy developed, public consumption rose, reflecting the increased provision of services, such as education and healthcare, while private consumption dropped in percentage terms. Private investment grew in importance and the economy became considerably more open, with early expenditure in infrastructure development supporting private activity.

The Australian economy, despite its high per capita income, lacks a strong manufacturing sector. Figure 11.3 shows the share of manufacturing employment in total employment for OECD nations in 2006, with Australia placing third from bottom, just ahead of the United Kingdom and the United States (US).

Figure 11.4 shows the share of manufacturing in total value added for OECD nations in 2006. Australia, again, is close to the bottom. In the early twentieth century, employment in manufacturing grew within a highly protected environment, justified by the so-called infant-industry
Development and modern industrial policy in practice

Argument. Manufacturing began to decline in the 1970s, partly as a result of increased competition from the emerging economies in Asia and partly because successive governments reduced protection levels.

Table 11.2 compares employment in industry in Australia in November 1984 with February 2012. While manufacturing remains a large employer, it has been in decline for many years and overtaken by several services sectors. Over a period when overall employment grew 73.5 percent, employment in manufacturing and agriculture declined, but grew significantly in the professional and services sectors and mining.

Lloyd (2007) created a long-term time series for rates of tariff protection for various products. The need for distinct products that resisted classification changes determined the choice of products. Figure 11.5 shows the rate of tariff protection for passenger vehicles and blankets from 1901 to 2004.

Was the decline in manufacturing employment due to exposure to competition as tariffs fell? Downes and Stoeckel (2006: 4) note that the ‘share of manufacturing, as traditionally defined, in output and employment has roughly halved over the last thirty years.’ They conclude that:

Note: OECD = Organisation for Economic Co-operation and Development.


Figure 11.4 Share of manufacturing output in total value added in OECD countries, 2006

![Graph showing share of manufacturing output in total value added in OECD countries, 2006.](image-url)
This relative decline is not primarily due to increased trade in manufactured goods (although that has made a small contribution) or falling productivity (as this has continued to increase). Rather it is mainly due to the contracting out of functions previously done inside the firm, and the increase (sic) proportion of services in the value of the final product. (Downes and Stoeckel 2006: 4)

Downes and Stoeckel show that changes in international trade patterns, including the rising importance of the People’s Republic of China (PRC) and India, led to the decline of labor-intensive sectors and the rise of knowledge- and design-intensive sectors, such as machinery and pharmaceuticals. This raises questions about industrial policy, which, as they note, has been ‘traditionally focused on physical production’ rather than knowledge-based activities.

A detailed analysis of the agricultural sector is beyond the scope of this chapter, but it is worth noting that Australia is one of the world’s most

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**Table 11.2 Employment in industry (in 100000s), Australia, 1984 and 2012**

<table>
<thead>
<tr>
<th>Industry</th>
<th>November 1984</th>
<th>February 2012</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>410.7</td>
<td>332.8</td>
<td>−19.0</td>
</tr>
<tr>
<td>Mining</td>
<td>94.1</td>
<td>249.7</td>
<td>165.5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1098.8</td>
<td>971.2</td>
<td>−11.6</td>
</tr>
<tr>
<td>Electricity, gas, water and waste services</td>
<td>152.1</td>
<td>156.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Construction</td>
<td>448.3</td>
<td>1021.6</td>
<td>127.9</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>347.9</td>
<td>397.5</td>
<td>14.3</td>
</tr>
<tr>
<td>Retail trade</td>
<td>702.1</td>
<td>1214.3</td>
<td>73.0</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>329.6</td>
<td>738.1</td>
<td>124.0</td>
</tr>
<tr>
<td>Transport, postal and warehousing</td>
<td>387.2</td>
<td>549.9</td>
<td>42.0</td>
</tr>
<tr>
<td>Information media and telecommunications</td>
<td>158.1</td>
<td>223.8</td>
<td>41.5</td>
</tr>
<tr>
<td>Financial and insurance services</td>
<td>261.7</td>
<td>427.2</td>
<td>63.3</td>
</tr>
<tr>
<td>Rental, hiring, and real estate services</td>
<td>80.0</td>
<td>225.0</td>
<td>181.1</td>
</tr>
<tr>
<td>Professional, scientific and technical services</td>
<td>258.2</td>
<td>888.4</td>
<td>244.1</td>
</tr>
<tr>
<td>Administrative and support services</td>
<td>122.0</td>
<td>404.4</td>
<td>231.6</td>
</tr>
<tr>
<td>Public administration and safety</td>
<td>381.9</td>
<td>742.1</td>
<td>94.3</td>
</tr>
<tr>
<td>Education and training</td>
<td>459.1</td>
<td>829.1</td>
<td>80.6</td>
</tr>
<tr>
<td>Healthcare and social assistance</td>
<td>536.8</td>
<td>1352.0</td>
<td>151.9</td>
</tr>
<tr>
<td>Arts and recreation services</td>
<td>70.6</td>
<td>203.1</td>
<td>187.6</td>
</tr>
<tr>
<td>Other services</td>
<td>277.0</td>
<td>481.1</td>
<td>73.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6576.1</strong></td>
<td><strong>11407.5</strong></td>
<td><strong>73.5</strong></td>
</tr>
</tbody>
</table>

Development and modern industrial policy in practice

Efficient producers of agricultural goods—a sector that is heavily protected by governments. The OECD (2012: 15) notes that, in 2011, support to producers across the OECD area amounted to €182 billion ($252 billion) as measured by the producer support estimate (PSE). This is equivalent to 19% of farm gross receipts in OECD countries. Moreover, it is the lowest level observed since the OECD began measuring support in the mid-1980s, when the PSE as percentage of gross farm receipts was about 37%.

Australia similarly protected agriculture until the 1970s, when it dismantled tariffs and other protective policies. The simple average applied tariff in Australian agriculture under World Trade Organization measures in 2011 was 1.3%, down from 57.63% in 1991. The government played a major role in restructuring agriculture by promoting farm rationalization and other measures to improve productivity as it withdrew financial support, reduced tariffs and sought to eliminate export subsidies.

Figure 11.6 compares the PSE for the OECD and Australia from 1986 to 2011 (OECD 2012). Australia’s PSE was only 3% in 2012, the second lowest in the OECD after New Zealand’s 0.8%. In comparison, the US had a PSE of 7.7%. In the PRC, it was 17.4% in 2010.

A defining characteristic of the Australian economy is its reliance on primary commodity exports. Even with high levels of protection, the manufacturing sector did not become a major exporter. Table 11.3 shows

Source: Lloyd (2007).

Figure 11.5 Australia’s rate of tariff protection of selected products

<table>
<thead>
<tr>
<th>Year</th>
<th>Blankets</th>
<th>Motor Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901-02</td>
<td>70%</td>
<td>60%</td>
</tr>
<tr>
<td>1905-06</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>1909-10</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>1917-18</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Lloyd (2007).
export shares by commodity as of January 1988 and July 2012 of the top 12 commodity groups. There is a clear and considerable concentration on a few commodity groups, with iron ore and coal alone accounting for 47% of total exports. The top six commodities—all basic metals or minerals—account for 70.3%, and the top 12 for 84.6%.

How concentrated are Australia’s exports? The standard measure of export concentration is the Herfindahl Index, calculated using the following formula:

\[ HI = \sum_{i=1}^{N} s_i^2 \]

where \( s_i \) represents the export share of commodity \( i \) in total exports and \( N \) is the total number of export products. \( HI \) lies between 0 and 1, and values closer to one indicate that exports are more concentrated.

According to Chandra et al. (2007), economies with highly diversified export baskets are likely to have Herfindahl indices below 0.05. These are followed by economies whose \( HI \) ranges from 0.05 to 0.10. Then economies with an index between 0.10 and 0.40 have more concentrated export baskets. Finally, values of \( HI \) above 0.4 denote highly concentrated export baskets.
Figure 11.7 plots the Herfindahl Index for Australian exports from January 1998 to July 2012. The data show that prior to the recent increase in the index in the late 2000s (HI > 0.10), the degree of concentration of Australia’s exports was already in the 0.05–0.10 range. Over the past ten years, the beneficial commodity price boom resulting from rapid urbanization in the PRC has largely driven the increase in concentration.

Figure 11.8 tracks the Reserve Bank of Australia’s Commodity Price Index from July 1982 to August 2012. Since the global financial crisis, economic growth has largely been driven by buoyant terms of trade (the ratio of export to import prices), which are currently at their highest level in 30 years. Rising terms of trade means that the prices a nation receives from abroad for its products are moving favorably relative to prices the nation pays for products from abroad. The data show that while rural commodities have faced flat or declining world prices, non-rural commodity prices, especially base metals, have escalated.

Demand from the PRC has caused base metal prices to hit record levels since the mid-2000s, with Australia’s mining sector expanding rapidly due to associated investment in infrastructure; for example, in rail systems...
Industrial policy: the Australian experience

**Figure 11.7** Herfindahl Index for Australian exports, 1988–2012


**Figure 11.8** Commodity price indices, all items and base metals, Australia, 1982–2012

Note: RBA = Reserve Bank of Australia.

Source: Reserve Bank of Australia, Commodity Price Index.
and port facilities. This has been an important contributor to Australia’s prosperity.

Commodity prices fell sharply in the immediate aftermath of the global financial crisis, although export volumes of minerals were maintained. The initial recovery in commodity prices was short lived because of anti-inflationary policies introduced by the PRC, as well as lower exports to Europe, which was grappling with the financial crisis. It is likely that the boom period in commodity prices has ended, although levels are still well above the long-term average.

The fluctuation in commodity prices highlights a perennial issue facing nations relying on primary commodity exports whose prices are set in world markets, but that import most manufactured goods to maintain a high standard of living. Fluctuations in commodity prices can significantly disturb national income, causing the boom–bust cycles that have featured prominently in Australia’s economic development history. Rising terms of trade usually promote exchange rate appreciation—and the Australian dollar has been highly sensitive to changes in world commodity prices.

Australia has shown that it is possible to achieve high per capita income with a narrow industrial structure dominated by exports of primary commodities and a growing service sector. However, with a highly specialized export sector, the real income of the nation is likely to be significantly affected by variations in the terms of trade.

11.3 THE OVERALL ECONOMIC AND SOCIAL SETTLEMENT SINCE 1945

To put Australia’s economic performance into perspective, it is important to consider the development of the policy framework since the early twentieth century. For many years, Australia sought to diversify the economy, mainly through industrial policy based on tariff protection. But by the 1970s, many were questioning this approach and a significant shift toward a policy based on competition and productivity followed.

During the postwar period, the government’s industrial policy was contained within a broader macroeconomic framework based on a commitment to full employment and human capital development. To understand where Australia is today, you have to appreciate the interaction between the industrial policies and the postwar approach to economic and social settlement based on a commitment to full employment. This was based on three pillars (Mitchell and Muysken 2008).

First, the economic pillar was defined by this unambiguous commitment, with industrial policy seen as part of an overall approach to generating
jobs. This also included a commitment to broad-based public education and training to ensure that the workforce was highly skilled. A large-scale immigration program supplemented the educational imperative.

Second, the redistributive pillar was designed to ameliorate market outcomes and defined much of the equity intervention by government. The redistributive pillar recognized that the free market was amoral and intervention in the form of income support and wage-setting norms was a necessary part of a sophisticated society. While this support was offered, the overwhelming ideology held that creating enough jobs in the economy was the best form of social security.

Third, the collective pillar provided the philosophical underpinning for the commitment to full employment. It was based on the intrinsic rights of citizenship and defined the role of the state as the primary agency for delivering basic public services.

After the Great Depression, the Australian government accepted the proposition that, without explicit government intervention, capitalist economies are prone to lengthy periods of unemployment. Employment grew after the depression as a result of government’s increased spending ahead of World War II. The war showed the government that full employment could be maintained with appropriate use of budget deficits. Postwar governments faced the problem of maintaining this full employment in peacetime.

The 1945 White Paper, *Full Employment in Australia* (Commonwealth of Australia 1945), stated the government’s aspirations and approach very clearly; namely, that it would use fiscal and monetary policy capacities to ensure full employment. The White Paper was consistent with an emerging Keynesian orthodoxy that regarded unemployment as the result of systemic failure in aggregate demand. However, while private and public employment growth was quite strong up until the mid-1970s, the major reason the economy was able to sustain full employment was that it maintained a buffer of jobs that were always available, and which provided easy employment access to the least skilled workers. Some of these jobs, such as process work in factories, were available in the private sector. However, the public sector also offered many buffer jobs that sustained workers through hard times. In some cases, these provided permanent work for the low-skilled and otherwise disadvantaged.

The development of the welfare state buttressed the full-employment commitment, and defined the state’s obligation to provide security to all citizens. The White Paper captured the aspirations of the government:

> In Australia, a significant contribution to living standards has been made in the past, and will continue to be made, by a high level of social services. Some
of these are in the form of direct money payments, such as invalid and old-age pensions, child endowment and widows’ pensions. Others are services provided directly by governments and public authorities, including education, health and medical services, kindergartens and libraries (Commonwealth of Australia 1945: 12).

The redistributive pillar noted earlier recognized that a mixed economy with a large market component would deliver poor outcomes—principally through unemployment—to some citizens. The government designed extensive cash transfer payments programs to provide income support to disadvantaged individuals and groups. Underpinning the welfare state and the commitment to full employment was a sophisticated concept of citizenship (the collective pillar). The rights of citizenship meant that individuals had access to the distribution system through cash transfer payments independent of market outcomes. Also, a professional public sector provided standardized services at an equivalent level to all as a right of citizenship. These included public sector employment services, public health and education systems and legal aid.

11.4  INDUSTRIAL POLICY: FROM PROTECTION TO COMPETITION AND ADVANCING PRODUCTIVITY

The development of industrial policy in Australia preceded the implementation of the postwar macroeconomic framework. The social settlement for full employment has to be seen against the fact that Australia is a small, open economy and its structure, as Downes and Stoeckel (2006: 1) observe, is ‘constantly evolving in response to domestic and international forces which themselves are continually changing.’ Initially, the government aimed to insulate the economy from international forces through a protective industrial policy focusing on physical production in manufacturing and agriculture. Since the 1980s, as successive governments have liberalized the economy, industrial policy has largely centered on dismantling the various components of the tariff wall and promoting competitiveness through productivity growth.

The ongoing structural change, however, has seen services grow very quickly in recent years and a resurgence of the mining sector on the back of surging base metal commodity prices. In this context, the once highly protected manufacturing sector has declined amid strong competition from Asia’s emerging economies, particularly the PRC. Australia has also shifted into ‘more “knowledge intensive” goods that emphasize design and other value-added components’ (Downes and Stoeckel 2006: 1). That
shift is consistent with trends in other nations, such as the US, which faced similar competition from the PRC in the labor-intensive components of manufacturing.

Tariff policy was a defining characteristic of Australia’s attempt to develop a viable secondary industry in the early twentieth century. The federal government introduced a protectionist regime soon after the Federation of Australia was established in 1901, with the Customs Tariff Act 1901 passed a year later to protect the development of local industry. Other forms of protection subsequently used to supplement tariffs included quantitative restrictions (for example, import licensing) and rules on the imported content of final products, especially for the automobile industry. There was a vigorous public debate on protectionism even when it seemed to have a positive effect on manufacturing employment. Tariff increases did indeed raise real incomes for some, such as owners of capital and workers employed in the industry affected. However, it also meant that consumers and firms had to pay higher prices for protected products, thus lowering their real income. Against this backdrop, protectionism can be seen as a rather opaque system of income redistribution.

Leigh (2002: 488) provides insight into why politicians bowed to lobby group pressures to maintain protectionist policies from manufacturing firms and associated trade unions: ‘Even though the national economic cost exceeds the benefits, the politician faces a different set of costs and benefits.’ Rodrik (1995a: 1471–2) argues that the motivation for politicians ignoring the national losses from protection ‘is because assisting lobby groups through tariffs is less politically costly than doing so through subsidies.’ While Australia introduced protectionism in the early twentieth century when the country was gaining nation status, it was not until the world slid into the Great Depression that it substantially increased its tariff wall. By the late 1940s, as the General Agreement on Tariffs and Trade was reached, the country introduced import licenses to reduce imports as a further measure to protect local industry. Leigh (2002: 491) shows that Australia’s merchandise exports as a percentage of GDP were lower in 1973 than in 1913 as a result of the protection it afforded local industry in those early days.

By the late 1960s, the national debate on industrial policy centered on the costs of protection to the economy. Measures of the ‘effective rate of protection’ were assembled, which allowed the commonly used measures of nominal protection to be replaced. These measures typically understated the degree of protection, while new measures also brought the distributional issues to the fore.

The tariffs and related measures were implemented to provide security to ‘infant industry’ firms and their employees. The problem in the
argument of those defending tariffs was that employment was falling in highly protected industries even as the government increased the effective protection, as it did in the late 1970s to the mid-1980s. High rates of effective protection clearly did not ensure jobs, and it became increasingly obvious that the direct beneficiaries were the owners of the companies and workers employed in the highly protected industries. Some quarters also argued that high rates of protection undermined the incentives to achieve strong productivity growth.

Two major federal government reports in 1973 voiced the need to cut tariffs. The Crawford Report (Crawford 1973) recommended that the name (and emphasis) of the Tariff Board be changed to the Industries Assistance Commission (IAC). The Rattigan Report, written by the then head of the Tariff Board, soon after recommended a 25% across-the-board cut in tariffs (Rattigan 1973). While the government of the day attempted to do just that, there was a major political backlash and effective protection rates actually rose during the 1970s. This was a period of high unemployment and the government was advised against dramatic cuts in protection. However, the pressure to reduce tariffs was also strong.

The establishment of the IAC widened the agency’s remit. The Tariff Board had previously been ‘confined to advising on taxes and subsidies on internationally traded commodities, and on some other trade barriers,’ while its statutory objectives were to encourage the ‘development of “economic and efficient” Australian industries’ (Productivity Commission 2003: 2). The commission, which is the most recent incarnation of the Tariff Board, further notes that: ‘The initial policy objectives guiding the IAC included not only economic development, but also the wellbeing of Australians and the efficient use of the community’s productive resources’ (Productivity Commission 2003: 2–3).

This shifted the debate toward the ‘costs’ of protection—for example, higher consumer prices—and away from the ‘benefits.’ The rhetoric of the day was to downplay the need for protection of industry and to promote structural change to achieve higher productivity across the industrial structure.

By the late 1980s, the IAC was renamed the Industries Commission in explicit recognition that its charter would be to reduce protection and promote productivity growth and competitive firms. The Productivity Commission (2003: 3) states:

Accordingly, the Industry Commission reported on matters that were far broader than those of the IAC. Included not only were a wider variety of industries, but also the operations of statutory marketing corporations, urban planning and transport, public housing, workers’ compensation, occupational health and safety, charitable organisations and defence procurement.
Its research helped prepare the way for the National Competition Policy... framework agreed in 1995, and the Commission went on to release reports on competitive tendering by public agencies, State and local government assistance to industry, private health insurance and ecologically sustainable land management.

The Industries Commission was absorbed into the Productivity Commission in 1998 in recognition that industrial policy was no longer based on protection but, rather, aimed to ‘focus on ways of achieving a more efficient and productive economy, as a key to higher living standards’ (Productivity Commission 2003: 3). The tools of industrial policy also shifted substantially. The strategy in the mid-1980s, under the then Minister for Commerce, Trade and Industry, John Button, was to introduce reforms to specific industries receiving protection (such as textiles, footwear and automobiles) as a prelude to more general tariff cuts, which were made in 1988.

The Button Car Plan is a good example of the shift in emphasis toward creating higher productivity and more competitive firms through the adoption of new policy instruments. The plan, introduced in 1985 and in operation until 1992, also demonstrates the central role that the national government played in the development of industrial policy. By 1985, Australia’s automobile industry was heavily protected by an array of tariffs and quantitative restrictions on imports and quotas. It was recognized at the time that import tariffs biased the industry against exporting and an export facilitation scheme was introduced in 1982 to redress this. The car plan broadened the export-facilitation scheme (an implicit subsidy for exports) to allow more liberal use of export credits for importing. This led to a rapid increase in exports, though the Australian consumer still paid the higher prices for imports and was forced to pay for the export subsidy as well because an imported automobile could still be on-sold at the protected local price. The export-facilitation scheme also distorted export production in favor of automobile manufacturing, leading to political pressure to retain the tariffs, the very thing the export credits were against.

Under the auspices of the then newly created Automotive Industry Authority, the government introduced phased tariff reductions of 2.5% per year, as well as minimum annual production requirements per model to rationalize the number of models and achieve efficient production scale. The authority also encouraged joint ventures to share, among other things, engines and body designs across firms and plant rationalization assistance. The plan retained the local content scheme whereby vehicle producers could import duty free vehicles, components worth up to 15% of the value of their production and, if they sourced locally, at least 85% of the value
of the vehicles they produced. Imports in excess of 15% were ‘penalised by a progressively higher duty the longer a vehicle producer failed to comply with the scheme’ (Productivity Commission 2003: 170). The government also established the Labour Adjustment Training Arrangements, which provided a framework to help workers retrenched in industrial restructuring to get retraining.

The government under former prime minister Bob Hawke followed the major tariff cut of 1988 with a second round of significant cuts in 1991, which aimed to reduce tariffs to negligible levels by 1996 (Leigh 2002: 502). A journalist at the time (quoted in D’Alpuget 2010) noted that the 1991 tariff cuts represented ‘An historical milestone . . . in that Hawke’s announcement effectively terminated Australia’s century of Protection.’

Australia’s history with tariff protection suggests the country failed to create the diversification in industry that it aimed for. Many explanations are offered for this in the research community and the matter is far from resolved, but the most obvious and well accepted is that the structure of tariff protection did not simultaneously offer incentives (rewards or penalties) for industries to innovate. It remains an important historical lesson, however, for other countries using industrial policy to help diversify their economies. There is no guarantee that the industrial sector will become internationally competitive. But it is also true, that while the economics mainstream argues for free trade, it is still difficult for emerging nations to grow with limited technology. The simple theoretical case against protection has limitations given that an emerging nation has no immediate, market-driven means of closing the technology gap when having to compete against highly advanced nations.

11.5 SECTOR SELECTION WHEN DESIGNING INDUSTRIAL POLICY

On the issue of sector selection in industrial policy, it is important to consider the broader global debate on market versus intervention. Industrial policy, by definition, involves intervention, which runs against the dominant view that markets are best left to allocate resources to their highest value use. The market view has been modified to include a narrowly defined role for government in providing the conditions for business development, such as tax breaks and subsidies, but eschewing direct public ownership.

Many counter-arguments can be made, particularly in low- and middle-income nations. These focus on issues relating to the depth of existing markets, especially financial markets, the richness and enforceability of
the regulatory framework, skill levels in the economy, the state of public infrastructure and, most importantly, the environmental and cultural sensitivities involved in any regional development proposals.

Industrial policy has to ensure all these elements are consistent with robust and equitable economic development. Australia’s experience suggests that the national government has seen industrial policy in that light. Although it was eventually shown that the system of protection was not in the national interest, it was seen at the time to be part of a full-employment strategy. More liberal approaches to industrial policy may err by giving the market too much latitude at a time when unregulated activity will not generate sufficient, well-paid employment. Industry sector selection should thus be seen as part of a full-employment strategy, given that macroeconomic efficiency requires effective use of all available labor resources. In that context, the strategy should be appropriate for the current state of economic development. For example, the availability of low-skill labor resources in a relatively unproductive agricultural sector allows underemployed or surplus workers to move to the secondary sector and increase productivity in both, along the lines envisaged by development economist Arthur Lewis.

The choice of techniques to invest in should provide a country with the capacity to maximize the employment gains. For example, in South Africa the Expanded Public Works Program recognized the dual development that apartheid caused. The program sought to create basic industrial infrastructure using labor-intensive methods where appropriate, despite the availability of more capital-intensive techniques and know-how. The program aimed to both improve infrastructure and maximize the employment advantages.

Recent work in in the fields of the Product Space theory, the Growth Identification and Facilitation Framework or industry cluster, is very helpful, but not sufficient to ensure that industrial policy will be successful. Selection should be context dependent. Australia’s industrial policy following World War II aimed to promote a labor-intensive manufacturing sector capable of providing productivity and real wage growth, choosing to provide support to key manufacturing sectors such as automobile production and assembly, textiles and steel production.

Context is very important. The Republic of Korea showed that comparative advantage can be ignored without precluding successful investment strategies if other supportive capacities are in place to allow an industry plan to work. Political willingness and sufficient flexibility within the planning structure is also needed to ensure that bad choices are quickly abandoned or modified (and here the Republic of Korea, again, offers an important lesson). In part, this requires that sectoral interests do not
Development and modern industrial policy in practice

capture the whole industrial process, but it also requires a framework to facilitate just transitions so that the costs of failed strategies are not disproportionately borne by one cohort over others. The experience of the Philippines demonstrates the importance of avoiding capture (see Chapter 2 in this volume).

11.6 MONITORING AND EVALUATION OF INDUSTRIAL POLICY

The Australian government has long held the view that it is responsible for establishing a framework to ensure that the private sector can generate wealth and employment, and has thus set the rules that businesses must operate with regard to product standards, regulation and oversight, tax, funding, and rules to encourage innovation and fiscal support.

The federal government’s main monitoring arm for industrial policy has undergone numerous changes as it evolved from the early twentieth century. The Productivity Commission is the statutory body that now monitors and evaluates industrial policy in Australia. The commission’s home page states:1 ‘The Productivity Commission is the Australian Government’s independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed simply, is to help governments make better policies in the long term interest of the Australian community.’

As its name implies, the commission’s focus is on ways of achieving a more productive economy—the key to higher living standards. As an advisory body, its influence depends on the power of its arguments and the efficacy of its public processes. The commission holds public inquiries, produces research that the government commissions, and engages in performance monitoring and benchmarking and other services to government bodies. Specifically, the commission’s statutory functions are to:

- hold public inquiries and report on matters related to industry and productivity, including safeguard procedures;
- provide secretariat and research services to government bodies such as the Council of Australian Governments;
- investigate and report on complaints about the implementation of the government’s competitive neutrality arrangements;

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advise the treasurer on matters related to industry and productivity as requested;
initiate research on industry and productivity issues; and
promote public understanding of matters related to industry and productivity.

The Productivity Commission interacts with the Commonwealth Treasury to formulate industry assistance packages consistent with the government’s overall fiscal position and direction.

A major function of the commission is performance monitoring and benchmarking the ‘equity, effectiveness and efficiency’ of numerous government services. It reports annually on these services, which include health, education, justice, housing and community services, and recommends improvements. The commission assesses economic and social outcomes for indigenous Australians using a range of indicators and provides spending estimates on basic services for them. It monitors the financial performance of government trading enterprises, and provides regular information on the performance of infrastructure industries and the impact of structural and other reforms. For international benchmarking, it undertakes national and international comparisons of the performance of key Australian infrastructure industries.

11.7  INDUSTRIAL POLICY FOR BROAD-BASED INFRASTRUCTURE DEVELOPMENT

While industry-specific developments such as tariff protection have dominated industrial policy in Australia, the government has also used broad-based infrastructure development as a major part of its support for industrial development and diversification. This section examines two big infrastructure projects. Both formed part of the government’s nation-building agenda and demonstrate its key role in advancing economic development.

11.7.1 Snowy Mountains Hydro-Electric Scheme

The Snowy Mountain’s Scheme provides hydroelectricity and large-scale irrigation capacity in southeast Australia, serving the cities of Sydney, Canberra and Melbourne. It was built to help shift Australia to manufacturing by providing cheap electricity to states where secondary industry was most concentrated. The scheme is a complex system of dams, power stations, pumping stations, linking tunnels, pipelines and aqueducts.
Construction began in 1949 and was completed in 1974. Its infrastructure allowed river systems in the Snowy Mountains to be diverted westward into the Murray and Murrumbidgee rivers by capturing water and pumping it through more than 225 kilometers of aqueducts, pipes and tunnels. Power stations then generate electricity for the states of New South Wales and Victoria and the Australian Capital Territory.

The scheme emerged from a joint federal–state consultative process, which aimed to bring together the capacity of the mountain river systems that adjoined Victoria and New South Wales, to generate electricity, and provide a more stable flow of water in the Murray and Murrumbidgee rivers to support more intensive agriculture downstream. The 1949 Snowy Mountains Hydro-electric Power Act created a public corporation, now called Snowy Hydro Limited. The company is jointly owned by the federal government (13%) and the states of New South Wales (58%) and Victoria (29%). The state-ownership proportions reflect the perceived benefits that each state gains. While there has been some debate and effort to force the various government owners to privatize their respective shares, the company is still wholly publicly owned and operated.

During construction, the scheme employed more than 100,000 workers, with 70% of the workforce recruited from more than 30 nations. The Australian Bureau of Statistics (1986) concluded that:

Construction of the Scheme has also brought new skills to Australia and greatly enhanced the recreation facilities in the Snowy Mountains area. The social impact of the Scheme on the region has also no doubt been significant on the increase in size and prosperity of towns serving the area.

The scheme has had significant impact on industrial diversification in the private sector. The project provides irrigation water to support private farming in western New South Wales. And the concentration of workers in that area, including the importation of skilled labor from Europe, led to the development of a skiing industry in the mountainous areas and, subsequently, to massive development of tourism in the previously remote region.

11.7.2 National Broadband Network

In 2007, the Federal government announced it would invest heavily in a national broadband network (NBN) as part of the National Digital Economy Strategy, which aimed to position Australia as a leading digital economy by 2020. The aims of the NBN were to support tertiary and knowledge-based industrial development, commensurate with the country’s highly skilled labor force, and was held out as the first step in developing a network to deliver high-speed broadband to all homes and businesses.
The decision to invest in this was taken on the assumption that private telecommunications development would concentrate on the lucrative inter-capital-city traffic and ignore the regional and remote areas. The government of the day took the view that a ‘national’ network would help act against inferior communications infrastructure in areas outside state capitals. Under the original NBN plan, the government would own the infrastructure and private participation in retailing broadband service would be allowed. Once operating nationally and with robust service delivery, the government indicated it would consider selling portions of the network’s wholesale capacity to private firms. The regulative structure was to be designed to allow private network providers to leverage off the infrastructure and then offer a diversity of crowded-in commercial and noncommercial services.

The government also introduced initiatives to allow private firms to participate in the National Digital Economy Strategy. These included grants to local communities to help residents maximize the benefits of the network and grants to small and medium enterprises and not-for-profit organizations for them to learn ways to benefit from the NBN. In addition, so-called telehealth trials would test the digital delivery of health services to the homes of sufferers of chronic illness.

Ventures are also planned to enhance awareness of how the NBN and the digital economy can improve productivity and expand markets. Several programs are already running to leverage private sector expertise; for example, ‘Getting Aussie Business Online’ is a national campaign by Google and Australian software firm MYOB (Manage Your Own Business) to help businesses, particularly small and medium enterprises, create an online presence. Furthermore, government and nongovernment research organizations are collaborating to develop new applications to enhance the country’s digital economy.

With the change in federal government in September 2013, the plans for the NBN have been significantly altered and downgraded. The new government intends to create a new national network based on optic fiber to the node rather than provided on a house-to-house basis. They have justified the revised plan on the basis of the reduced investment needed, although there is a vigorous ongoing debate about the financial and technological aspects of the new plan.

It remains the case though, that large-scale public infrastructure developments underpin national development and allow private firms to leverage profit-seeking ventures. Although less ambitious and less capable of providing best-practice services for a shorter period than the original plan, the revised NBN will still provide these leveraging opportunities for private venture capital.
11.8 THE ROLE OF EXCHANGE RATES IN INDUSTRIAL POLICY

Market imperfections can still slow or derail economic development (such as inadequate access to finance). Rodrik (1995b, 1996) argues that East Asian nations have developed not by suddenly perfecting their institutions, but by coming up with policies that overcame the market obstacles that their investors faced in modern tradable industries. He considers industrial policies an important part of the development process in this context, in that they can break down these imperfections through targeted subsidies and other assistance. He makes this case by showing that there is a strong positive relationship between the level of the real exchange rate and growth in a large panel of countries (Rodrik, 2007). The driving force in this relationship was that, in the cases he studied, including the PRC and the Republic of Korea, ‘growth was preceded and accompanied with a substantial rise in the undervaluation index for their currencies’ (Rodrik 2007: 7). The relationship appeared to only apply in ‘low-income’ situations but pointed to a conclusion that ‘currency undervaluation acts just like industrial policy, by favoring some (growth-promoting) sectors over others’ (Rodrik 2007: 8). This causality arises because the real exchange rate undervaluation acts as a subsidy to the tradables sector and breaks down the ‘costs’ that arise when there are market failures.

11.8.1 Foreign Exchange Deregulation

Australia was late in deregulating its financial system after the Bretton Woods system collapsed in 1971. Carron (1983: 195) observed that Australia had ‘a rigid structure often unresponsive to market opportunities, market segmentation impeding the flows of capital among sectors and administered prices and quantitative controls that failed to clear markets.’ After the collapse, the Australian government attempted to maintain exchange parity with the US dollar. That proved difficult and, after 1976, the focus shifted to maintaining an adjustable peg against the Australian dollar trade-weighted index.2

The Reserve Bank of Australia’s regular foreign exchange interventions from 1971 to 1983, however, meant the central bank needed to maintain

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2 The trade-weighted index is the weighted average value of the Australian dollar in relation to the currencies of Australia’s trading partners. The weights are based on the country composition of Australia’s merchandise goods and services trade, most recently updated to the 2012–13 financial year.
adequate foreign exchange reserves. In 1981, the Campbell Committee of Inquiry into the Australian Financial System recommended widespread deregulation, including floating the Australian dollar and abandoning exchange controls. This happened on 12 December 1983, some 12 years after Bretton Woods.

11.8.2 The Rationale for Floating

Economists present compelling arguments for floating the Australian dollar. Sieper and Fane (1982) exhaustively summarized the issues for the Campbell Committee and argued that floating would enable Australia to insulate domestic inflation from the rest of world, in particular, from the fluctuations in world commodity prices.

In a pegged currency arrangement, the domestic rate of inflation is largely determined by the inflation rate prevailing in the country that the currency is pegged to, or in the case of a multilateral peg, the weighted average inflation rate of a basket of currencies. A peg also imposes strict conditions on the conduct of domestic settings. Growth in unit labor costs must ensure that firms in the traded goods sector are profitable, which imposes limits on the growth of wages.

A peg also imposes constraints on fiscal policy, given that monetary policy must ensure that the peg is maintained. For nations facing persistent current account deficits, this policy risks creating stagnation. Australia had a history of so-called stop-go economic development under Bretton Woods. As the real GDP growth rate improved, aided by supportive fiscal policy, its reliance on imported capital equipment and growing consumer spending meant the current account deficit increased. This, in turn, put downward pressure on the exchange rate, causing the monetary authority to intervene to maintain parity. Fiscal policy also had to exert contractionary pressure, causing growth to stall before restarting again.

By choosing to float the Australian dollar, the government recognized that it could largely achieve an independent rate of inflation and free domestic policy instruments. The other main argument for floating, as summarized by Blundell-Wignall and Gregory (1990), is that because Australia’s international competitiveness—reflected in the real exchange rate—moved in tandem with the terms of trade, it was easier to maintain competitiveness through sympathetic movements in the nominal exchange rate, rather than domestic deflation of the type the euro zone is now enduring. Pitchford (1993) brought these arguments together to provide a convincing case for a free float of the Australian dollar.

International commodity price movements are the principal cause of
price shocks on the Australian economy. The country is a primary commodity exporter and, unlike the majority of advanced nations trading in industrial goods at relatively stable prices, ‘the prices of commodities have a far greater amplitude of fluctuation than do prices of final goods and services’ (Pitchford 1993: 150). This means that foreign price movements tend to be smaller than commodity price fluctuations, which, in turn, means that any pegged exchange rate arrangement will result in considerable price instability.

Variations in Australia’s terms of trade come largely from exports, driven by commodity price cycles. The import side is relatively stable because Australia imports a range of industrial goods. As a result, the terms of trade move in sympathy with the commodity price cycle. These movements can be quite sharp. For example, in three successive quarters in 1985, the terms of trade fell 6.2%, 1.3% and 4.4%. In 1998, three successive quarters saw gains of 3.9%, 4.4% and 5.6%. Instability was even more pronounced in the 1960s and early 1970s under fixed exchange rates.

A floating exchange rate can offset the nominal impacts of swings in the terms of trade. If foreign-currency export prices fall and this leads to a drop in domestic prices received, for example, local producers can face substantial nominal income losses because their costs are denominated in Australian dollars. But if the exchange rate depreciates in line with the declining terms of trade, the local currency price decline will be less, as will the income losses.

Pitchford (1993: 162–3) shows that Australia did not enjoy monetary independence prior to floating the exchange rate. However, he demonstrates that the ‘evidence of monetary independence since the float is that Australia realised a money growth and inflation rate significantly above that of its main trading partners for most of the 1980s.’ Pitchford (1993: 170) also shows that for two major swings in the terms of trade in the 1980s following the float that ‘nominal exchange rate movements were essentially consistent with there being insulation responses.’ This is in contrast to the experience of the 1970s ‘when there were foreign currency trade price shocks both from the export and import side and the exchange rate was pegged or heavily managed.’ In all these cases, as Pitchford observes, Australia appeared to import ‘significant’ inflation pressures.

11.8.3 The Experience of Floating the Exchange Rate

What has been the impact of floating the currency? Figure 11.9 shows quarterly movements in Australian dollar parity against the trade-weighted index from June 1970 to December 2013. It also depicts the real trade-weighted index and the terms of trade over the same period.
Up until the float, the real and nominal exchange rates moved in sympathy with the terms of trade. Australia’s international competitiveness rose and fell with movements in the terms of trade, which reflected international commodity price cycles. When the terms of trade were strong, Australia’s external competitiveness fell because the exchange rate appreciated at the same rate as the terms of trade grew. The opposite was the case when terms of trade fell. After the float in 1983, movements in Australia’s international competitiveness became somewhat unbundled from movements in its terms of trade, which helped insulate the local economy from the adverse impacts on international competitiveness arising from commodity price booms.

Table 11.4 summarizes the performance of the Australian dollar against selected currencies pre- and post-float. The float resulted in a depreciation of varying magnitudes against all currencies except the New Zealand dollar. Furthermore, as the Australian dollar depreciated against these currencies, the variations around the average value increased, in some cases, substantially (see the coefficient of variation data in Table 11.4).

Notes:
A$ = Australian dollar.
All series indexed with the base quarter June 1970 = 100.

Source: Reserve Bank of Australia, Other Price Indicators.

Figure 11.9  A$ parity in terms of trade and trade-weighted index (June 1970 = 100)
11.8.4 Recent Foreign Exchange Trends and the Dutch Disease

While the evidence suggests that floating allowed Australia to run more independent fiscal and monetary policies, other aspects have raised concerns. This chapter has already noted that rising terms of trade usually promotes exchange rate appreciation and vice versa. Since early 2001, the Australian dollar has fluctuated significantly. In March 2001, the trade-weighted index was 47.4. By June 2008, it had risen to 73.4, a 55% increase. It then plunged to 53.2 six months later, a 28% drop, only to rise again on a rebound in base-metal commodity prices to 79.2, up 49%.

Commodity prices for non-base metals have not enjoyed the same increases that have been experienced by the base-metal commodities. This suggests classic Dutch disease. In the Australian context, this typically applies to the impact of a resources boom on the Australian dollar (Gregory 1976). The appreciating currency then (1) damages the competitiveness of ‘import competing’ sectors (dominated by manufacturing, services and agricultural firms) because import prices fall relative to local cost levels; and (2) promotes wage pressures which further damage sectors not experiencing buoyant demand.

In a trend emerging in Australia for several years, some sectors (such as manufacturing) and regions (such as Sydney and Victoria) are struggling, while other sectors (such as mining) and regions (such as Western Australia) are booming. The trend is consistent with the aforementioned

<table>
<thead>
<tr>
<th>May 1970–Nov. 1983</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>317.4</td>
<td>1.2</td>
<td>1.1</td>
<td>0.6</td>
<td>1.0</td>
</tr>
<tr>
<td>CoV %</td>
<td>22.6</td>
<td>12.3</td>
<td>11.4</td>
<td>12.1</td>
<td>12.2</td>
</tr>
<tr>
<td>Dec. 1983–Sep. 2012</td>
<td>92.9</td>
<td>0.7</td>
<td>1.2</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Average</td>
<td>33.6</td>
<td>16.7</td>
<td>9.4</td>
<td>18.4</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Note: CoV = coefficient of variation (standard deviation divided by the mean expressed as a percentage), SDR = special drawing rights, TWI = trade-weighted index.

Source: Reserve Bank of Australia, Other Price Indicators G4, and Real Exchange Rate Measures – F15.

### Table 11.4 Average Australian dollar exchange rate and coefficient of variation, vis-à-vis selected currencies, pre- and post-float

<table>
<thead>
<tr>
<th></th>
<th>Japanese yen</th>
<th>US dollar</th>
<th>NZ dollar</th>
<th>UK pound</th>
<th>SDR</th>
<th>TWI</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1970–Nov. 1983</td>
<td>317.4</td>
<td>1.2</td>
<td>1.1</td>
<td>0.6</td>
<td>1.0</td>
<td>95.3</td>
</tr>
<tr>
<td>CoV %</td>
<td>22.6</td>
<td>12.3</td>
<td>11.4</td>
<td>12.1</td>
<td>12.2</td>
<td>11.4</td>
</tr>
<tr>
<td>Dec. 1983–Sep. 2012</td>
<td>92.9</td>
<td>0.7</td>
<td>1.2</td>
<td>0.5</td>
<td>0.5</td>
<td>60.6</td>
</tr>
<tr>
<td>CoV %</td>
<td>33.6</td>
<td>16.7</td>
<td>9.4</td>
<td>18.4</td>
<td>17.6</td>
<td>14.0</td>
</tr>
</tbody>
</table>
exchange rate dynamics. These developments, popularized by the term two-speed economy, are challenging the fundamental patterns of economic and social settlements and threatening the financial viability of many Australian households. While a two-speed economy often means different things in different countries, the imbalance of greatest interest in the Australian context is the economic precariousness of the states of New South Wales and Victoria and their two major cities relative to the prosperous mining regions of Western Australia, Queensland and the Northern Territory. Several coincident factors are driving this two-speed economy; among them, the fiscal austerity that the national government imposed before the nongovernment sector had recovered from the 2008–09 economic slowdown.

This situation is dangerous for any country where exports are highly specialized and the traded-goods sector comprises one dominant industry group. In Australia, mining has grown at the expense of manufacturing and agriculture.

11.9 IMMIGRATION POLICY: A BRIEF OVERVIEW

Australia’s immigration policy in the decades following World War II had a transforming effect on industrial development. In a large country with inadequate population growth, opportunities were needed for immigrants to contribute to national development. In terms of industrialization, many early migrants worked on large-scale public infrastructure projects, such as the Snowy Mountain Scheme, which established essential public capital upon which the private sector has profited.

The Federal Department of Immigration, established in 1945, set a 2% per year population growth target that reflected security concerns at the time—specifically, the realization that Australia, which the Japanese had nearly invaded, would need a larger population to defend itself. It was clear that the 2% target could not be reached by a natural increase in the population and that a large intake of migrants would be needed. The country therefore decided to accept some 70,000 new migrants a year, around half the 2% annual target.

Thus began the assisted immigration program whereby people from Europe, at first, were given free or heavily subsidized passage and housing assistance in return for an agreement to work within the public sector for some period (initially two years). By 1961, 8% of the population was of non-British origin, a major shift in demography.
11.10 TRAINING AND EDUCATION

At the heart of Australia’s skills development system is comprehensive public education from the primary to tertiary levels and a national apprenticeship scheme, which is dominated by the public sector.

From the 1950s to the mid-1970s, the government promoted rapid growth in public education as part of its human capital development program. Enrolment in higher education increased more than fivefold over this period, while the population increased from around 8 million to 13 million.

Skills shortages cause bottlenecks in economic development and often coincide with high underutilization of labor. The introduction of an integrated national training and employment framework marked Australian economic development, which meant that public employment initiatives also served to develop productive capacity. Furthermore, national and state governments developed effective school-to-work transitions through vocational training and tertiary education.

Societies with a strong capacity for producing skills are underpinned by institutional arrangements that emphasize the collective interest. In Germany, for example, the state requires employers and unions to share decision-making over vocational training content, ensuring the portability of skills, which supports the creation and distribution of higher skills throughout the labor force. The main bodies representing employers (the so-called peak employer organizations) also assert authority within their industries to reduce interfirm poaching of skilled workers, while the availability of ‘patient capital’ through local banks creates longer time frames for realizing a return on training investments (Gough 2005). Institutional arrangements differ in other high-skill countries, such as Japan and Singapore, but each gives the state a significant role in creating the social underpinnings for high skills formation. These include:

- social cohesion and cooperation among members;
- competing by adding value rather than by simply reducing costs;
- continuous investment in new skills, particularly communication and problem solving skills that support collaboration and innovation;
- coordinating the requirements of the employers with the available trainees to make the system function more effectively;
- high skills diffusion throughout the labor force rather than a polarization of high- and low-skilled workers; and
- broad distribution of the benefits of a high-skilled society (Brown et al. 2001). These are the benchmarks and design principles that any national skills development framework has to assess itself against,
and a specific national policy needs to mold the general principles of effective skills development to suit local institutions and aspirations.

The 1994 OECD Jobs Study-inspired ‘active employment strategy’—which has been gaining influence internationally in the past three decades—uses a combination of incentives and penalties to ease school-to-work transitions and to reintegrate long-term unemployed workers into active employment (Mitchell and Muysken 2008). In general, however, the strategy has not lived up to its promise. Labor market deregulation has made work increasingly precarious, giving workers less incentive to invest in human capital formation. Furthermore, unlike the strong influence that the peak working bodies in, say, Germany have maintained, the legislative changes in other nations have reduced the union input into the skills development process.

The result has been a general decay in the institutions that are conducive to high skills formation and a tendency by firms to adopt a free-riding reliance on poaching skilled workers from other firms and using skilled immigration (poaching from other countries) as the solution. The lesson taken from the period following the release of the Jobs Study in 1994 is that market-based skills development alone will not provide an effective basis for varied and high-quality human capital development.

A sustainable development strategy requires a strong public presence in all levels of skills development: early childhood education, primary and secondary school development, vocational and technical further education, university and college education, and skills development aimed at retraining workers who find their skills have atrophied or no longer match those required in the labor market.

The national government and its state counterparts have long played an important role in the development of skills as part of efforts to achieve full employment. Sustained full employment from 1945 to 1975 forced employers to compete for workers as they sought to expand market share. During this period, firms faced a constant challenge to find skilled workers as vacancy rates outstripped the number of unemployed. This shortage of skilled workers made for a dynamically efficient labor market. For every job offered, a corresponding training opportunity was also created (Thurow 1976).

Moreover, a central feature of the commitment to full employment in all nations was heavy public sector investment in apprenticeships and maintaining ‘manpower planning’ capacities to forecast likely new skills requirements so that policies could be forward looking (Coombs 1994).

Australia achieved full employment between 1945 and 1975, in part, because the state acted as a significant employer in its own right. It
achieved this by meeting the shortfall in demand arising from the deferral of investment and consumption endemic to market economies, by acting as an employer of last resort and by adopting a policy of training more skilled workers than required to meet its own needs, in effect becoming a net supplier of skilled workers to the labor market. Significant public sector employment had a positive effect on both private and public sector skills formation. In the former, private employers had to constantly compete for scarce labor and thus would be prepared to offer training to any available worker irrespective of the specific skills brought to the job. By contrast, the more recent market liberalization strategy of minimizing public sector employment to preserve unemployment as a driver of productivity creates a situation in which both the state and the private sector reduce the opportunities for novices to apprentice in more skilled work.

Australia's apprenticeship framework was at the heart of its vocational training system. Economists have long understood the difference between general and specific skills in the context of the labor market. Giving a new skill a very firm-specific application minimizes the problem. But if the enhanced skill is of value to at least one other firm, the training employer is obliged to pay the market rate to retain the worker's services. Clearly, this enables these workers to reap much of the benefit of the employer's investment.

Whereas apprenticeships for trainees accepting a reduced wage for the period of their training and wage subsidies may offset this phenomenon, it more commonly induces 'free riding' among private sector employers. Each firm reckons that since it will have to pay market rates for the skilled workers in any event, it may as well avoid the expense and trouble of training them and instead hire workers trained by other employers (hopefully competitors).

A rational market strategy for an individual firm is thus irrational for firms in the aggregate because it constrains supply and thus raises the price they pay for skilled workers. Supply constraints benefit workers with needed skills, but skill shortages deter investment, act as a brake on growth, limit employment opportunities, and undermine the living standards of the community as a whole. It is in this context that the Australian apprenticeship system was developed. Ray (2001) provides a useful historical snapshot of the role the Australian apprenticeship system played in the skills development process (Department of Employment, Vocational Education and Training 1988).

The Australian apprenticeship model was the main means for creating skills 'for both the traditional crafts (such as carpenter, plumber, hairdresser and metal worker) and more contemporary trade occupations (such as vehicle mechanic and electrician)' (Ray 2001: 2).
The Australian system, derived from the United Kingdom, was seen as more efficient than the US system, which broke down because employers were unable to reap the benefits of the training provided because of high levels of geographical mobility and job opportunities. Furthermore, mass production techniques pioneered in the US reduced the need for skilled labor (Gospel 1994). In part, this was because Australia introduced a well-structured ‘system of compulsory arbitration and legally binding awards . . . [which] . . . served to restore and codify apprenticeship rules and make them legally enforceable on employers. Simultaneously, the award system strengthened trade unions and thus provided further institutional support for apprenticeship’ (Gospel 1994: 513).

Importantly, in Australia’s postwar economic development phase, ‘there was a period of substantial growth in the use of apprenticeship in the 25 years between 1950 and 1975 and that its usage, relative to population, remained about the same for the next 20 years’ (Ray 2001: 11).

Ray notes that Australia’s apprenticeship system was ‘designed to directly benefit both the industrial parties—apprentices and employers’ (Ray 2001: 18) through two main characteristics: (1) apprentices benefit from guaranteed paid employment (nominally four years for trade apprenticeships) and an opportunity to learn skills from qualified tradespersons; and (2) employers benefit from having an employee who becomes more productive as time passes. The high costs of employing first-year apprentices are made more acceptable to employers on the basis that, by the third and fourth years, apprentices attain a work value about the same as a tradesperson, but receive apprentice wages below the qualified rate.

To ensure a balance between the desire of employers to minimize costs and address the problem of exploiting cheap labor, the government introduced extensive legislation that ‘enabled State supervision over the contracts of employment and training, including processes for resolving disputes between employers and apprentices’ (Ray 2001: 2).

Ray also points out that state involvement in the apprenticeship system, as part of a process of economic development, was further justified by the fact that they ‘benefited the community through its role in providing a supply of skilled people to provide quality goods and services’ (Ray 2001: 2).

11.11 LESSONS OF THE EARLY STAGES OF AUSTRALIAN ECONOMIC DEVELOPMENT

The public sector has a central role in the development of skills, not only by maintaining full employment, which creates incentives for private firms to simultaneously offer training with employment, but also directly
in creating and regulating the vocational training system and investing heavily in all levels of public education.

Public sector rationalization, privatization and persistent unemployment undermine the national training function and reduce the incentive for employers to undertake training. Incentives for private firms to internalize skills development are crucial. Persistent excess labor supply reduces the challenge private firms have in hiring skilled labor, which undermines investment in skills development.

The public sector can intermediate between labor demand and supply to ensure that workers can anticipate what skills they could profitably acquire and to gain them, both in locating sources of specialized training and support and identifying the means of paying for it. Furthermore, as intermediary, the public sector can help private firms gain necessary skills and project where to best place investment in skills development.

As with other types of market failure, the state is uniquely capable, and therefore responsible, for addressing insufficient skills formation. To do so, it has to play a significant role as an employer. Best practice experience suggests that the state has to play a central role in direct skills formation—and that this role should be designed to support the global competitiveness of industry.

11.12 CONCLUSIONS

The national government’s contribution to Australia’s economic development has broadly manifested itself in three ways. First, it committed to a full-employment strategy immediately after World War II and used its fiscal and monetary policy capacity to ensure enough jobs for all. Second, it supported that strategy with a national human capital development agenda that comprised large-scale immigration, a national apprenticeship program and a strong commitment to public education at all levels. Third, it introduced a comprehensive tariff-protection regime designed to allow the nascent manufacturing sector to develop into an internationally competitive industry.

The government established a coherent institutional structure to oversee this system of protection. As it became clear that protection was not achieving its goals, industrial policy shifted to promoting productivity and competition and reduced the tariffs, in addition to providing incentives to industry to restructure. To encourage industrial development, the government initiated several large-scale public infrastructure projects to provide electricity, irrigation and, more recently, state-of-the-art information technology.
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## APPENDIX

### Table 11A.1  Industrial policy instruments in Australia

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Details</th>
<th>Effectiveness</th>
<th>Period of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal incentives</td>
<td>The main categories of Commonwealth assistance through the budget have been:</td>
<td>Overall, Australian heavy industry has not achieved competitive levels</td>
<td>Typically used during the period when the federal government was prepared to run deficits as part of nation building up to 1980s</td>
</tr>
<tr>
<td></td>
<td>Output bounties (applied to various products such as books, shipbuilding, textiles, computers, machine tools, textile yarns and steel mill products)</td>
<td>Higher value-added manufactured goods (highly transformed, particularly in electronics), have become internationally competitive</td>
<td>The 1985 Button Car Plan was accompanied by such incentives</td>
</tr>
<tr>
<td></td>
<td>Export incentives to passenger vehicles and textiles, clothing and footwear</td>
<td>Agriculture is highly competitive and has low levels of protection</td>
<td>Emergency relief is still in use when deemed necessary</td>
</tr>
<tr>
<td></td>
<td>Export market development grants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research and development incentives, such as world best-practice programs for small and medium enterprises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment attraction programs</td>
<td>The government has provided: Tax relief to companies in the form of accelerated depreciation for plant and equipment</td>
<td>Mixed evidence</td>
<td>State governments still use a range of initiatives, such as subsidies to attract or retain industry</td>
</tr>
</tbody>
</table>
Table 11A.1  (continued)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Details</th>
<th>Effectiveness</th>
<th>Period of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment attraction</td>
<td>Extensive support for training and wage subsidies</td>
<td></td>
<td>Particularly important currently are energy policies, such as subsidized power and gas</td>
</tr>
<tr>
<td>programs</td>
<td>Export assistance</td>
<td></td>
<td>Federal government provides export assistance, such as market intelligence, through</td>
</tr>
<tr>
<td></td>
<td>Reductions in company tax rates</td>
<td></td>
<td>the Department of Foreign Affairs and Trade</td>
</tr>
<tr>
<td></td>
<td>State governments have provided a range of incentives, including</td>
<td></td>
<td>Department of Education, Employment and Workplace Relations uses wage subsidies and training</td>
</tr>
<tr>
<td></td>
<td>cheap land and reductions in utility prices and taxes</td>
<td></td>
<td>assistance as its preferred method of labor market support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A range of tax initiatives is continuously provided</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Apprenticeship support is ongoing, but less comprehensive than before the 1980s</td>
</tr>
<tr>
<td>Training policies</td>
<td>Extensive apprenticeship schemes dominated by public service agencies</td>
<td>A major source of skilled trade labor</td>
<td>Continuing strategy at Federal and State levels although since the 1980s there has been a</td>
</tr>
<tr>
<td>Infrastructure support</td>
<td>Rail infrastructure</td>
<td>Successful</td>
<td>shift in favor of public–private partnerships rather than</td>
</tr>
<tr>
<td></td>
<td>Road infrastructure</td>
<td>Successful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snowy Mountains Scheme</td>
<td>Successful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two airline agreement</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Broadband Network</td>
<td>In development</td>
<td></td>
</tr>
</tbody>
</table>

Continuing strategy at Federal and State levels although since the 1980s there has been a shift in favor of public–private partnerships rather than
Trade measures
- Barrier protection to manufacturing industries, dominated first by import quotas and then tariffs (40% going to textile, clothing and footwear, and passenger vehicle industries)
- Anti-dumping measures
- Use of bounties on intermediate products
- Local content plans particularly in the automobile industry

Public procurement
- Commonly used, particularly in the Australian Defence Forces

The barrier protection methods were based on the infant-industry argument. Rent sharing between the firms and workers became the norm and productivity improvements lagged behind world standards. Import penetration increased in the 1960s despite rising protection. The use of import quotas hid the deteriorating competitive position of the local industry. The 1970s oil crisis created problems for automobile firms. The entry of Nissan and Toyota into the Australian market, with new, streamlined production methods, exacerbated this. The culture and era of protection, which defined industrial policy from the early nineteenth century to the late 1970s, progressively gave way to a culture of productivity improvement in the 1980s.

The use of import quotas hid the deteriorating competitive position of the local industry. The 1970s oil crisis created problems for automobile firms. The entry of Nissan and Toyota into the Australian market, with new, streamlined production methods, exacerbated this. The culture and era of protection, which defined industrial policy from the early nineteenth century to the late 1970s, progressively gave way to a culture of productivity improvement in the 1980s.

Public procurement
- Continues to be used. However, national competition policy has restricted the capacity of governments to have preferred arrangements.
Table 11A.1 (continued)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Details</th>
<th>Effectiveness</th>
<th>Period of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial mechanisms (loans, risk-sharing)</td>
<td>Public–private partnerships for major road, hospital and school infrastructure</td>
<td>Several of the schemes have collapsed with the state resuming full responsibility for ongoing operations and project completion</td>
<td>Currently the main method of major public infrastructure provision</td>
</tr>
<tr>
<td></td>
<td>Australian Industry Development Corporation, a federal government bank, provided funding assistance to small firms unable to access capital markets</td>
<td>Was effective but its development role was downplayed with increased financial deregulation and ideological antagonism to non-market assistance</td>
<td>Prior to the 1980s, government at all levels had extensive staff and other resources in various departments (e.g., housing, roads, railways) responsible for infrastructure development</td>
</tr>
<tr>
<td></td>
<td>Rural Industries Research and Development Corporation established as a federal statutory authority to work with industry to invest in research and development for a</td>
<td>Continues to play an effective role</td>
<td>There is still strong research support for the rural industry retained within the government sector (e.g., Commonwealth Scientific Investigation and Research Organisation)</td>
</tr>
</tbody>
</table>
Industrial restructuring schemes

From the 1980s, there was a new approach to industrial policy, which replaced protection from competition with productivity enhancement. A series of industry restructuring plans were devised to assist industries that were uncompetitive in international markets. The main targets of the policy were automobiles, textiles, clothing and footwear, shipbuilding, and iron and steel. The federal government provided financial assistance to encourage plant modernization and export market development. A prime example of this restructuring was the Button Car Plan.

Staged reductions in protection from 1984
- Plant closures occurred
- Number of models reduced
- Export penetration increased dramatically
- Quality of output increased dramatically
- Automobile industry still uncompetitive in the face of international competition

Source: Author.
12. Diversification and industrial policies in Malaysia

Tham Siew Yean

12.1 INTRODUCTION

Since independence in 1957, the economic structure of Malaysia has changed significantly. At that time, Malaysia was a rubber and tin producing economy. Today, it is a vibrant producer and exporter of manufactured goods and services. In 1960, agriculture contributed 60% of gross domestic product (GDP), compared with just 7.3% in 2012 (Leete 2007). Following a similar pattern, the share of agricultural employment in total employment declined continuously over this period, and stood at 11% in 2012. Amid that decline, manufacturing value added has grown steadily, accounting for 25% of GDP in 2012 from just 9% in 1960, while the share of manufacturing employment in total employment was 29% in 2012. Malaysia’s services sector, meanwhile, is now the largest, representing 55% of GDP and 54% of total employment in 2012.

The shift in economic structure from agriculture to manufacturing production can be partially attributed to deliberate government policies. These reflect Malaysia’s underlying development philosophy of active government support and direction, combined with free enterprise (Kaziah 2005). The government gives the broad thrust and direction for overall development policies, including socioeconomic goals, while the private sector is given a relatively free rein.

This chapter examines industrial diversification in Malaysia and the role industrial policies have played in that process. Using the case studies of the electronics and automobile sectors, it looks at the formulation and implementation of key industrial policies and assesses their successes and failures. A broad lesson that emerges from the policies aimed at creating an internationally competitive automobile sector is that prolonged protection was a wrong turn because, among other things, there was no sunset clause for phasing out protection. Despite prolonged protection, PROTON, the country’s first national car project established in 1983, is still far from financially healthy.
Given the increasingly important role that services play in the Malaysian economy, this chapter looks at the sector’s potential to become the country’s next engine of growth. However, given the continuing importance of manufacturing exports, it is too soon to think in terms of moving out of manufacturing and shifting into a service-driven economy. For industrial policy, this means that being a strong service-oriented economy will entail focusing on the complementarities with other sectors and strengthening the links between manufacturing and services.

12.2 POLICY DESIGN, TOOLS AND IMPLEMENTATION


Malaysia’s recent economic growth has fallen to about half that of the first decade of the 2000s following its recovery from the 1997–98 Asian financial crisis. This has raised concerns that the country may be caught in a ‘middle-income trap.’ In purchasing power parity terms, Malaysia is a middle-income economy, a status reached in 1969. However, other Asian countries that were also middle-income decades ago, such as the Republic of Korea, have graduated to high-income status (Felipe 2012).

To become a high-income economy, the government in 2010 launched the New Economic Model, targeting a per capita income of $15,000–$20,000 by 2020 (National Economic Advisory Council 2010), from $7,590 in 2009. The New Economic Model aims to achieve a high-income level, economic inclusiveness and sustainability through four pillars of transformation: 1Malaysia, the Government Transformation Plan, the Economic Transformation Plan, and the Tenth Malaysia Plan. 1Malaysia seeks to enhance the country’s social unity. The Government Transformation Plan aims to strengthen public services and shift government’s role in the economy from a driver to an enabler of economic activity. The Economic Transformation Plan prioritizes 12 economic drivers (PEMANDU 2010): the Greater Kuala Lumpur area; oil, gas and energy; financial services; wholesale and retail trade; palm oil; tourism; electrical and electronics; business services; communications content and infrastructure; education; agriculture; and healthcare services. The Tenth Malaysia Plan, announced in 2010, is the most recent of the country’s five-year development plans; it maps out the government’s vision for overall development for 2011–2015 (Economic Planning Unit, Government of
Malaysia 2010). In 2009, the government established the Performance Management and Delivery Unit in the Prime Minister’s Department to oversee and assess progress on the Economic Transformation and the Government Transformation plans.

12.2.1 Objectives and Selection of Sectors

Although IMP1 targeted 12 manufacturing industries and IMP2 targeted eight industrial clusters, the industries and clusters chosen encompassed virtually all industries (Ohno 2006). Industrial Master Plan 1 aimed to improve the processing of local resources for export and to deepen industrial development; IMP2 sought to increase productivity and competitiveness. Similarly, the government chose the 12 manufacturing industries of IMP3 based on their potential to encourage growth and exports, and it covered most industries, but IMP3 differed significantly from the previous plans in that it promoted services as the new engine of growth because of the sector’s increasing contribution to GDP.

A study commissioned by the Ministry of International Trade and Industry in 2003 for IMP3 on the services sector led to the selection of eight subsectors for further development: business and professional services, distributive trade, construction, education and training, healthcare, tourism, information and telecommunications, and logistics. These were selected based on their potential: (1) as significant intermediate service providers for increasing inter- and intra-sectoral links, (2) to capitalize on global business outsourcing, (3) to have a significant impact on the economy through the diffusion of best practices and technology enhancement, and (4) for creating knowledge-intensive employment opportunities and skills (Ministry of International Trade and Industry 2006). The master plan targets are generally set in broad terms, such as for the growth of the manufacturing sector and its contribution to GDP, productivity growth and employment.

In the Economic Transformation Plan, the government selected 12 National Key Economic Areas based on the expected contribution of each

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1 Industrial Master Plans 1 targeted the following industries: rubber, palm oil, food, wood-based industry, chemical and petrochemical, nonferrous metals, nonmetallic minerals, electrical and electronics, transport equipment, machinery and engineering, iron and steel, and textiles and apparel. The eight groups of industries targeted by IMP2 were electrical and electronics, transportation, chemicals, textiles and apparel, resource-based industry, material and advanced materials, agro-based and food products, and machinery and equipment. IMP3 targeted 12 industries: electrical and electronics, medical devices, textiles and apparel, machinery and equipment, metals, transport equipment, petrochemicals, pharmaceuticals, wood-based industry, rubber products, palm-oil based industry and food processing.
to the country’s gross national income in 2020.\textsuperscript{2} Of the 12, only electrical and electronics is strictly manufacturing, while the other are services, agriculture and regional development. The overall targets are also broad and defined by number of projects, contribution to gross national income and new jobs created.

There was a distinct shift between IMP1 and IMP3 from the use of foreign consultants to increasingly using local expertise.\textsuperscript{3} For IMP3, the government also conducted more consultations with stakeholders, including the private sector by consulting 10 technical resource groups established to facilitate the writing of this plan (Ohno 2006). The government also used workshops to engage stakeholders in different sectors for the plan’s formulation (PEMANDU 2010).\textsuperscript{4}

\subsection*{12.2.2 Main Tools of Industrial Policy}

Malaysia’s industrial development has been largely based on and led by foreign direct investment (FDI), courted for both import substitution and export promotion (Table 12.1). It should be noted that the reintroduction of import substitution for heavy industries in 1980 did not mean the government had abandoned its FDI and export promotion strategies. However, instead of being a private-sector-led development strategy, like the first round of export promotion (1968–80), the government decided to prioritize the development of heavy industries. Here, the state partnered with foreign firms for the development of heavy industries in the hands of state-owned enterprises. Similarly, when the government reintroduced export promotion in 1986—owing to fiscal and external deficits caused by increased government spending and imports to support the development of heavy industries—it did not abandon the protection of heavy industries. Tariff protection and import licenses were used for the protection of

\begin{itemize}
\item [\textsuperscript{2}] These are oil, gas and energy; palm oil and rubber; financial services; tourism; business services; electronics and electrical; wholesale and retail; education; healthcare; communications content and infrastructure; agriculture; and Greater Kuala Lumpur and the Klang Valley.
\item [\textsuperscript{3}] A foreign consultant drafted the IMP1 report based on the Republic of Korea’s model of industrial policies. IMP2 used both local and foreign consultants, headed by a Malaysian research institute. The local consultant from the research institute crafted the cluster approach and the value-chain analysis used to frame industrial development during that period. Local academics were also used as part of the local expertise for IMP2 and IMP3; the Economic Transformation Plan used both local and foreign consultants.
\item [\textsuperscript{4}] The rise in these consultations also increased the number of people involved in drafting the plans. In IMP3, 338 people contributed to the drafting of the plan, while the Economic Transformation Plan tapped 500 experts, of which 350 were from 200 private corporations.
\end{itemize}
Table 12.1 Main tools of industrial policy in Malaysia

<table>
<thead>
<tr>
<th>Period</th>
<th>Industrial strategy: FDI-led industrial development</th>
<th>Main tools of industrial policy</th>
<th>Performance requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957–67</td>
<td>Import substitution in manufacturing, FDI for import-substituting industries</td>
<td>Tariffs, fiscal incentives</td>
<td>None</td>
</tr>
<tr>
<td>1968–80</td>
<td>Export promotion in manufacturing, introduction of free trade zones</td>
<td>Fiscal incentives, government promotion of FDI</td>
<td>Exports, Bumiputera equity ownership and employment, Technology transfer</td>
</tr>
<tr>
<td>1981–85</td>
<td>Import substitution in heavy industries Joint venture projects between state-owned enterprises for selected heavy industries such as automotive, motorcycle assembly, steel, cement and fertilizers</td>
<td>Tariffs, import licenses, various other government support measures including subsidies and government procurement Fiscal incentives, government promotion of FDI</td>
<td>Bumiputera equity ownership and employment, Technology transfer</td>
</tr>
<tr>
<td>1986–2005</td>
<td>Export promotion in manufacturing Relaxation of equity constraints for manufacturing</td>
<td>Fiscal incentives, special zones, government promotion of FDI</td>
<td>Bumiputera equity ownership and employment Exports, local content requirements, technology transfer</td>
</tr>
<tr>
<td>2006–20</td>
<td>Continuation of export promotion in manufacturing Export promotion of services, relaxation of equity constraints for selected services</td>
<td>Fiscal incentives, special zones, government promotion of FDI</td>
<td>Bumiputera employment, and equity ownership in service sectors Exports of manufactured goods, technology transfer Exports of services</td>
</tr>
</tbody>
</table>

Notes: 
FDI = foreign direct investments. 
Bumiputera is a term used to refer to ethnic Malays and indigenous people in the country.

Source: Author.
import substitution and infant industries. The 1986 Promotion of the Investment Act and the 1967 Income Tax Act stipulated the fiscal incentives to attract FDI. These included: pioneer status, which provided tax exemption on the statutory income of a company participating in a promoted activity or producing a promoted product; accelerated capital depreciation, investment tax and reinvestment allowances; and a variety of tax deductions.

The focus of the incentives depended on the industrialization objectives pursued in each period. For example, tax holidays were given to encourage greater use of labor when unemployment was a concern in the 1960s and 1970s. Subsequently, the focus of incentives was to promote exports, technology development and greater research and development (R&D); for example, through double-tax deductions on noncapital expenditures for undertaking R&D. The cost to the government in foregone tax revenues was estimated at 1.7% of GDP in 1988 (Doraisami and Rasiah 2001). These incentives were seen as essential to Malaysia’s FDI policy given their use by other competing economies, especially in Southeast Asia.

Malaysia’s government also developed special economic zones, such as free trade zones, to promote exports using duty-free imports, and set up specialized infrastructure through technology parks (OECD 2011). These benefitted from government support in the form of funds for infrastructure and tax incentives to attract firms. Kulim High Technology Park, established in 1993, was the country’s first such park, and was followed by the Technology Park Malaysia in 1996. In the same year, the Multimedia Super Corridor was launched as a specialized zone to attract high-technology FDI for deepening industrial development through the use of information technology. Iskandar Malaysia in the south is the most recent special economic zone, and is used to facilitate the development of nine economic sectors and to capture FDI and spillover from neighboring Singapore.

Performance requirements for employment, training and local content were imposed in the special economic zones receiving government support until some had to be phased out under Malaysia’s commitments to the World Trade Organization (such as local content requirements). In line with the redistributive requirements of the New Economic Policy of 1970, the government imposed a 30% Bumiputera equity ownership requirement, although there was flexibility in its implementation.5 New Economic Policy requirements also imposed employment quotas for Bumiputeras.

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5 Bumiputera is a term used to refer to ethnic Malays and indigenous people in the country.
Development and modern industrial policy in practice

12.2.3 Other Government Initiatives to Support Industrial Development

The government also invested in infrastructure, including information and communications technology, with improved airports and roads facilitating the movement and export of electronic goods and lowering trade costs (Tham et al. 2009). Improved broadband infrastructure helped household Internet penetration rates rise from 1% in 2004 to 32% in 2009 (OECD 2011). The capacity and speed are lower than in Singapore, but the cost of broadband is higher (Yusuf and Nabeshima 2009; Tham and Loke 2012). The government has also invested heavily in education to improve human resources, as discussed later in the chapter.

12.3 IMPLEMENTATION OF PLANS: MONITORING AND RISK MANAGEMENT MECHANISMS

The Ministry of International Trade and Industry is the main agency for approving licenses and incentives, and is also responsible for monitoring and assessment. It is supported by numerous government agencies under its supervision, including the Malaysian Investment Development Authority, the Small and Medium Enterprise Corporation Malaysia and Malaysian Industrial Development Finance. Newer agencies include the SME Bank, established in 2005 as a one-stop financial center to nurture small- and medium-sized enterprises (SMEs), and the Halal Industry Development Corporation, established in 2006 for the development of halal standards and capacity building for halal products and services. The Malaysia Automotive Institute, established in 2010, provides a platform for automotive industrialists to formulate strategies for industry challenges and acts as a coordination center for the development of the local auto industry.

In services, the focus of the Ministry of International Trade and Industry is the coordination of nonfinancial services provided by different ministries, while Bank Negara Malaysia, the central bank, oversees the development of financial services.

From when the New Economic Policy was first implemented in the 1970s and up to the 1980s, Ministry of International Trade and Industry officials monitored the implementation of Bumiputera employment and equity share requirements as stipulated in the policy. The Foreign Investment Committee established in the Prime Minister’s Department in 1974 to regulate domestic and foreign investment continued to monitor

6 Altogether, eight ministries oversee the services sector.
Bumiputera equity ownership until its deregulation in 2009. A Bumiputera Economic Council was established in 2013 to continue the implementation of the Bumiputera equity ownership. However, monitoring was rather loose and rarely enforced for other performance requirements (Lim and Ong 2007). For example, when domestic value-added fell below the 30% requirement of export value, the government did not withdraw the incentives for fear of repercussions on the country’s investment climate. Performance requirements were removed in compliance with the requirements of the World Trade Organization in 2005.

The Ministry of International Trade and Industry holds an annual policy dialogue with the private sector. The meeting focuses on operational issues, although strategic issues are also occasionally discussed. Follow-up on the consultative mechanism, however, is uneven and government agencies lack the staff capacity and capability to fully monitor compliance.

The United Nations Industrial Development Organization helped the government review industrial development under IMP1. Its assessment was used to improve the formulation of IMP2 (Lim and Ong 2007). Nevertheless, IMP2 was deemed poorly executed (Danaraj 2011). Furthermore, while IMP2 was also reviewed, the more than 300 people engaged in drafting IMP3 were not briefed on the outcomes of the review, except for the broad macro targets. Industrial Master Plan 3 therefore cannot be seen as a continuation of industrial planning in the same way that IMP2 was with respect to IMP1. Industrial Master Plan 3 is supposed to be reviewed every five years, but the reviews have not been shared with the public. It is therefore unclear whether the implementation of IMP3 is being monitored given the current priority and attention given to the Economic Transformation Plan.

The organization of the Economic Transformation Plan is different from that of the industrial master plans, as its projects focus mainly on investments and jobs. The plan states that the government’s role is to provide support and funding that will facilitate private sector delivery. Overall, its implementation is more transparent than the industrial master plans since it provides periodic updates on new projects and investments in the 12 targeted areas and an annual report is available on the Performance Management and Delivery Unit website.7

All government agencies must meet key performance indicators. For example, the Malaysian Investment Development Authority has FDI targets. The performance targets are generally broad, quantitative and easily measured by, for example, approved FDI and domestic investment,

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amount of funds provided to SMEs or the number of technology agreements. However, little attempt is made to conduct in-depth assessments of the parts of the plans that are under the ministries’ jurisdictions due to a lack of research capacity within ministries and government agencies. In-depth assessments, when conducted, are usually outsourced. Monitoring based on ‘narrowly defined numbers’ can also create a false sense of success when performance indicator targets are met, as these can obscure Malaysia’s broader development needs.

Since none of the industrial master plans discussed risk management, there is no monitoring of risk assessment. A brief section in the Economic Transformation Plan does look at managing risks, but these are vaguely defined as risks to implementation and the risks of an unpredictable global economy. The plan merely states that the government will mitigate risks and that the Malaysian Investment Development Authority will be corporatized to enhance its role in the plan, which is mainly to attract FDI. In fact, the plan acknowledges that there is little that can be done to mitigate the risks of an unpredictable global economy.

### 12.4 FOSTERING HUMAN CAPITAL FOR INDUSTRIAL DIVERSIFICATION

Malaysia has invested heavily in education since independence in 1957, with government spending at 3.8% of GDP in 2011, or 16% of total government spending. This is about the same as the Organisation for Economic Co-operation and Development (OECD) average of 3–4% (Ministry of Education, Government of Malaysia 2012). Enrollment in primary education was nearly universal at 94% in 2011, 87% at the lower secondary level and 78% at the upper-secondary level. The proportion of the adult population (aged 15 or higher) with no schooling declined from 60% in 1950 to less than 10% in 2010, while the proportion with secondary education increased from 7% to almost 75% in the same period.

In higher education, 24.4% of the population aged 19–24 was enrolled in tertiary education, up from 0.6% in 1970 (Mukherjee et al. 2011). In 2010, 15% of the adult population had a tertiary education, up from 1% in 1950 (Ministry of Education, Government of Malaysia 2012). The country has increased access to higher education by expanding the number of public and private higher education institutions (Ministry of Higher Education, Government of Malaysia 2012).

Despite these gains and priority given to education spending, the quality of education has deteriorated, especially at the lower secondary school level, as shown by Malaysia’s performance in the Programme
for International Student Assessment 2009. Here, 60% of 15-year-old Malaysian students failed to meet minimum proficiency in mathematics, 44% failed to meet it in reading and 43% in science. Rote learning in school, which is still common, simply does not prepare secondary students for independent learning and thinking at the tertiary level.

According to the National Economic Advisory Council (2010), about a quarter of graduates from local public universities were unemployed six months after completing their studies. Although graduate unemployment decreased from 30.7% in 2006 to 24.0% in 2008, this is significantly higher than the overall unemployment rate of 3–4% over this period. The fact that there are job vacancies in the labor market signals that there is a supply–demand mismatch. Despite targeting more science graduates, enrollment is higher in arts and social science disciplines in both public and private higher education institutions (at 55% in 2008) than for science, technology, and information and communication technology (Mukherjee et al. 2011). Not surprisingly, technical skills are in constant shortage. To counter this, the government set up TalentCorp in 2011 to attract Malaysian talent to return from abroad and to bring in foreign talent.

12.5 FOSTERING INNOVATION AND TECHNOLOGY DEVELOPMENT

Malaysia acquires foreign technology through FDI (Felker and Jomo 1999). This has fostered some degree of technology transfer as multinational corporations increased local procurement and sourcing. The links forged are mainly between multinational corporations and foreign supplier firms that have established operations in Malaysia, but a small though growing number of local firms has managed to link up with multinationals as subcontract assemblers (Tham 2004a). So far, these firms do not have a critical mass for the hoped-for shift up the value-added chain in manufacturing. Consequently, while some Malaysian firms are linked into the global supply chain as suppliers and design houses, this has yet to produce global, Malaysian-owned and designed products, such as Japan’s Sony or the Republic of Korea’s Samsung.

The use of R&D incentives for multinational corporations may have increased their profitability, but this has not necessarily led to an increase in R&D in Malaysia, which is determined by the headquarters of these corporations. Research and development skills in Malaysia are in short supply, and administrators and bureaucrats do not have the capability to assess the technology of firms applying for these incentives. Another problem in this area is that industry and university links are still weak.
Hence, while there is technology transfer, it is not occurring at a pace and speed that is necessary for Malaysia to achieve its ambitious goal to become a knowledge- and innovation-led economy by 2020, as envisaged under the Vision 2020 strategy of the Mahathir administration. Indeed, it could be argued that the country’s FDI-driven development has led to a lack of focus on enhancing resource-based sectors, such as rubber and palm oil, which already have a history of R&D institutions. This is changing under the new Economic Transformation Plan, which includes rubber and palm oil in its targeted areas.

Malaysia’s science and technology policies in the industrial master and five-year development plans aim to mobilize technology development to add value to agriculture and industry, focusing on biotechnology, information and communications technology, and advanced manufacturing. However, the actual targets of these policies are very broad—for example, reaching a certain percentage of R&D spending as a share of GDP. Moreover, they are basically statements of intent (Danaraj 2011). What is more, the science and technology policies are housed in a plethora of overlapping agencies and strategies, and they overemphasize supply-side public institutions instead of addressing deficiencies in the demand for technology from private firms (Danaraj 2011).

Among the many programs inspired by Malaysia’s science and technology policies, the Multimedia Super Corridor represents a key government-led initiative. Its objective is to help the country leapfrog into the development of high technology by replicating the Silicon Valley model (Okamoto 2004). The 20-year project (1996–2016), a brainchild of former prime minister Mahathir under the advice of McKinsey & Company (Vicziany and Puteh 2004), was initiated to attract FDI from multinational information technology corporations through tax incentives, government investment in infrastructure, such as a fiber-optic network, and importing skilled foreign knowledge and information technology workers. Another initiative is the use of government procurement for flagship information technology applications, including telemedicine, smart schools, electronic government operations, smart cards, international manufacturing coordination, electronic marketing and R&D (Felker and Jomo 1999).

Estimates from the Economic Planning Unit of Malaysia (Hamsha 2011) indicate that the Multimedia Super Corridor contributed a cumulative total of 34.5 billion ringgit (RM) ($10.2 billion) in value added to the country’s GDP from 2004 to 2009. This came from some 2520 Multimedia Super Corridor status companies and 99,590 knowledge-based jobs. Malaysian-owned companies form the largest share (64%), followed by foreign-owned companies (34%) and joint ventures (2%). Yet, despite
these efforts Malaysia’s rank in the World Bank’s Knowledge Economy Index in 2009—48 out of 145 countries—was roughly the same as it was a decade ago (World Bank 2012). Moreover, information and communication technology exports are small in the services sector (Mahani et al. 2012), and Malaysia was not among the top 20 exporters of computer and information services by value in 2010, unlike Singapore and the Philippines (UNCTAD 2012).

As Okamoto (2004) notes, the essence of Silicon Valley is not only infrastructure. Although infrastructure is clearly indispensable, other variables such as providing a favorable business environment (such as access to venture capital) are equally important. In this regard, overall and based on the World Bank’s Doing Business surveys, the business environment in Malaysia is relatively favorable compared with that of most of its competitors in the Association of Southeast Asian Nations (ASEAN)—with the exception of Singapore. Malaysia ranked 21 out of 178 countries participating in the 2006 survey and 23 out of 183 in 2010.8

Malaysia’s worst ranking in earlier surveys than these was in ‘dealing with licenses.’ In the 2010 survey, it was ‘dealing with construction permits.’9 This concurs with the findings of a 2003 World Bank survey showing that regulatory burdens are a constraint to doing business in Malaysia (World Bank 2005). In response to poor rankings in international business surveys and bureaucratic impediments, the government in 2007 established the special task force, PEMUDAH, to help remove barriers to doing business. PEMUDAH comprises high-level government and private sector leaders tasked with reducing bureaucratic impediments. This will be particularly important for the services sector as most services are governed by licensing requirements and its development has been affected by regulatory burdens (Tham and Loke 2012).

There are conflicting views on accessing credit. The World Bank’s Ease of Doing Business data indicate that, in general, Malaysia does not appear to have a problem with accessing credit. However, the 2012 SMEs Survey conducted by the Associated Chinese Chamber of Commerce and Industry of Malaysia (ACCCIM 2012) showed that financing difficulties continue to hinder innovation in SMEs, with 56% of respondents using self-financing and only 5% able to access government grants and assistance.

Although the government’s provision of venture capital has increased, this has not achieved its intended objectives. The reason is that the supply of capital from public entities is crowding out private provision and the

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9 In 2010, the ranking for dealing with construction permits was 109 out of 183 countries.
implicit or explicit social goals of public provision of capital compromise the economic objectives (Yusuf and Nabeshima 2009). Weak university–industry links and a general lack of high-quality research in universities also contribute to the slow development of the venture capital market. None of the country’s public universities have made it to the top in the league tables based on research and publications.

12.6 SUCCESSES AND FAILURES IN MALAYSIA’S INDUSTRIAL POLICY

Malaysia’s electronics and automobiles sectors illustrate the strengths and weaknesses of the country’s industrial policies. Electronics leads manufacturing, contributing significantly to manufacturing output (29.3% in 2010), exports (55.9%) and employment (28.8%). Over the years, Malaysia’s electronics industry has developed significant capabilities and skills for manufacturing a wide range of semiconductor devices, high-end consumer electronics, and information and communication technology products. Its producers are mainly multinational corporations. The automobile sector, in contrast, is dominated by the two national car projects, which continue receiving considerable government support.

12.6.1 The Electronics Sector

The Penang electronics cluster, which got underway before IMP1, is the best developed of the country’s industry clusters. The Nathan Report of 1970, drafted by an American company, recommended that the northern state of Penang shift to an export-oriented strategy by plugging into the global economy via the electronics sector. This recommendation was based on Penang’s human resource strengths and its limited agricultural potential and lack of mineral resources (Athukorala 2011). The recommendations were implemented through the active promotion of Penang as a host economy for multinational corporations. The availability of an English-speaking workforce, together with the government’s tight control over labor organizations, met the needs for cheap labor in the early 1970s. The establishment of free trade zones eased the operations of multinationals and facilitated duty-free imports of intermediate and capital goods.

There is consensus in the academic literature and government documents that most Malaysian firms are engaged in the least knowledge-intensive part of the electronics value chain (Yusuf and Nabeshima 2009; PEMANDU 2010; Rasiah 2012). Exports are high but local value added
is quite low. There are Malaysian firms engaged in wafer fabrication, which is part of the manufacture of semiconductors, with the assistance of foreign designs, and some firms are active in design activities and research (Rasiah 2012), but no Malaysian firm is in research and marketing using its own brand name.

Human capital is a key challenge in upgrading the electronics sector. In 1989, the Penang Development Corporation partnered with multinational corporations operating in the state to establish the Penang Skill Development Centre to increase the supply of skilled workers. While this partnership contributed to the development of human resources and skills, similar dynamics were not observed in other states. Moreover, the Penang project was not able to gain the committed involvement of local universities for long-term solutions to upgrade local capabilities (Piyanit 2010). With 40% of Malaysia’s firms identifying skill shortages as a top constraint (World Bank 2009), coupled with the graduate unemployment problem, education and human capital are problem areas for the country.

Furthermore, inflows of unskilled labor have reduced the urgency to shift out of labor-intensive operations and increase automation. The share of migrant workers, coming largely from Indonesia, increased from a mere 1.0% in 1980 to 14.1% in 1996 and to 28.0% in 2007. Malaysia’s migrant workers, generally, have low skills. Their main role is to fill the shortage of local workers, leading to even more excess demand. Tham and Liew (forthcoming) found that these workers have a negative impact on labor productivity as they substitute for capital and slow down automation. However, Samel (2012) contends that it is the flexibility provided by the ready availability of migrant workers that has deterred upgrading rather than their low wages. Nevertheless, local firms in Penang have created a sustainable niche in the global market by using this flexible migrant labor force to manage the volatility that characterizes the demand in the electronics sector.

At the other end of the skills spectrum, a brain drain exacerbates the shortage of skilled workers, especially the outflow to Singapore. Although there is little data on these outflows, estimates from the National Economic Advisory Council of Malaysia indicate that roughly 350,000 Malaysians were working abroad in 2008, with over half of them having tertiary education. Fong (2010) reports that the number of Malaysian migrants with tertiary education residing in OECD countries increased from 72,649 in 1990 to 102,321 in 2000. The World Bank (2011) found that the main factors motivating Malaysians to move overseas included higher earnings and better career prospects, quality of education and quality of life. More importantly, discontent with Malaysia’s policies of social inclusiveness is
a key factor for outward migration, especially among non-Bumiputeras, who make up the bulk of the diaspora.\textsuperscript{10}

A critical mass of local firms in the electronics sector has yet to be achieved. Over the past 40 years of industrialization, especially in the electronics cluster in Penang, some Malaysian firms have, as noted, emerged as vendors (suppliers who produce and sell), suppliers or outsourcing partners to multinational corporations, and are in this way linked to global supply chains. Unfortunately, the emergence of international procurement—driven by processes such as e-bidding, approved vendor lists and increased competition from other countries—have forced some local companies to shift into other businesses or to downsize.

A few local design houses in the electronics sector have emerged, but they lack the critical mass to be catalytic in the aspired shift up the value chain. Thus, there have been small incremental changes but not enough to produce a wave of transformation. Meanwhile, the technology cluster in the electronics sector is weakening because the country’s supply chain is unable to create a critical mass in R&D, design and testing.

Local R&D in the electronics sector that engages universities with industry is still weak and lacking. The government, through its provision of research grants to public universities, is trying to push these institutions toward commercialization. However, the commercialization rate of government-funded research grants remains low at around 5\% of the research output of Malaysian universities (OECD 2011). The OECD suggests the lack of industry-relevant research may result from a lack of dedicated intermediary organizations that can match the needs of industry with the research capacities of the universities.

\textbf{12.6.2 The Automobile Sector}

Malaysia’s first national car project, PROTON, was approved in 1983 as part of the country’s heavy industries program to deepen industrialization and create Bumiputera entrepreneurs. It is now clear that the two objectives have not always been compatible. Indeed, to nurture Bumiputera entrepreneurs and suppliers, the government has bypassed competitive Malaysian Chinese firms in the replacement components and parts industry.

The Heavy Industries Corporation of Malaysia and Mitsubishi Motor Corporation entered a partnership in 1983.\textsuperscript{11} Mahathir, who initiated the

\textsuperscript{10} This refers to Malaysia’s affirmative action policies for the Bumiputeras.
\textsuperscript{11} Heavy Industries Corporation of Malaysia is a public sector enterprise established in 1980 to develop the country’s heavy industries, both on its own or in joint ventures with foreign companies.
PROTON project, considered a partnership with a European or American carmaker unsuitable, as they were losing market share in Malaysia and elsewhere (Mahathir 2011: 513). Mitsubishi was chosen because it was the only willing Japanese partner.

The government invested RM480 million to establish the PROTON automobile factory in Shah Alam, the state capital of Selangor (Mahathir 2011). The company’s first car, the PROTON Saga, was launched in 1985. It was protected by tariffs of 140–300% as well as import quotas and approved permits for ‘completely built up’ units. The government also imposed import and excise duties on ‘completely knocked down’ units assembled locally. These tariff and nontariff measures immediately caused a price difference of 20–30% in favor of the national car over imported cars. For example, in 1987, the price of a 1.3 cc PROTON Saga was RM21,000, lower than the RM28,000–29,000 of similar imported cars. This allowed PROTON to capture a 65% market share in 1987 and 73% in 1988. This very high share dropped to around 25% during 2006–10 (Fong 2011) due to competition from Perodua, the second national car project started in 1993, and an increase in imported cars as a result of a proliferation in approved permits. Nevertheless, PROTON is still protected and continues to receive preferential treatment in public procurement. Not surprisingly it is the official car for civil servants.

Apart from tariff and nontariff measures, the government directly intervened by imposing local material content and vendor development programs. A mandatory deletion program was also introduced in 1979 in which a list of 30 parts and components were to be sourced locally rather than imported once local parts manufacturers were able to supply them for the assembly of automobiles (Alavi and Hasan 2001).

The viability of PROTON without protection is often questioned because Malaysia’s automotive exports amounted to a mere 0.6% of total merchandise exports in 2007, and the country remains a net importer of automobiles despite nearly three decades of protection. PROTON exported 23,407 units in 2009, compared with a domestic sales volume

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12 This was not the total amount spent on developing the national car as there were royalties to be paid and grants to support the development of Bumiputera vendors. Malaysia could afford this expensive experiment to build a national car because of its oil reserves.

13 Perodua is no longer deemed a national car since its equity was restructured in 2001. Daihatsu, a Toyota subsidiary, owns 41% of Perodua Auto Corporation (its manufacturing arm), and Mitsui holds 10% (Aminar 2010). Daihatsu effectively controls the company.

14 The World Trade Organization (2014) reports that Malaysia adopted protective measures during the global financial crisis. These facilitated the sale of Malaysia’s national cars. For instance, in 2009, under Malaysia’s temporary auto-scrapping scheme, the government gave rebates of RM5000 for consumers replacing a car more than ten years old with a national brand vehicle.
of 148,785 units. PROTON cars are also reportedly being exported to other countries at prices even lower than those in the home market, which suggests the possible use of export subsidies (Fong 2011). The index of revealed comparative advantage for Malaysian automotive products, a commonly used indicator for export competitiveness, was a mere 0.04 in 1990 and still only 0.10 in 2012 (WTO 2014). Clearly, Malaysia has not established export competitiveness in the automotive sector after prolonged protection because export conditions were not imposed and there was no sunset clause for phasing out protection. In the meantime, the country remains a net importer of auto components and parts.

Alavi and Hasan (2001) and Rosli and Kari (2008) have questioned the viability of the local vendor system. They show that foreign suppliers have performed better economically and financially, even though Bumiputera vendors were given extensive support in the form of financial facilities and technical assistance under the PROTON Bumiputera Vendor Scheme. Inefficiencies were created through the single-sourcing system, initially used to guarantee and protect the market so that new vendors could reach economies of scale in production. Although multisourcing was introduced in 2000 (and was phased out in 2005 with the liberalization of the automobile sector in the ASEAN Free Trade Area), the need to nurture Bumiputera suppliers has affected PROTON’s cost efficiency. Indeed, estimates put PROTON’s costs in 1995 at 20% higher than those of its competitors (Tham 2004b).

Malaysia’s trade policy commitments required the withdrawal of protection. Under the Agreement on Trade Related Investment Measures, the country was granted two extensions and had to phase out its local content requirements in 2005 (Tham 2008).

In the ASEAN Free Trade Area, Malaysia managed to delay the liberalization of the automotive sector by placing it on the temporary exclusion list. Consequently, although the six founding members of the ten-nation ASEAN agreed to lower tariffs to a maximum of 5% by 2003, Malaysia’s automotive sector was excluded and it was only in 2005 that it reduced its tariffs for completely built-up cars from other ASEAN countries to 20%, and to 50% for non-ASEAN countries’ cars. Malaysia then used an increase in excise duties to offset the reduction in tariff revenue, with the national cars reportedly exempted from a certain percentage of

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15 The index of revealed comparative advantage is the ratio of the share of a country’s product in total exports to the same ratio at the worldwide level.
16 PROTON reportedly secured RM7 million in grants from the government under the Fifth Malaysia Plan (1986–90) and RM15 million under the Sixth Malaysia Plan (1991–95) to help SMEs venture into automotive parts manufacturing. By the end of 1996, a total of RM14 million in grant assistance was awarded to 19 SME PROTON vendors producing 135 parts (Rali 1999).
Diversification and industrial policies in Malaysia

These duties. This was subsequently reduced to 5% and then to zero for completely built-up units and completely knocked-down units from other ASEAN countries, but excise duties and sales taxes were again used as compensation for the loss in tariff revenues (Table 12.2). The opening of the ASEAN market means that carmakers could source cost-competitive components from within the bloc and benefit from economies of scale (Malaysian Investment Development Authority 2010).

Given the sizeable presence of Japanese automotive makers in Southeast Asia, it is not surprising that Japan’s main interest in its bilateral free trade negotiations with Malaysia is this sector (Higashi 2008). Malaysia’s first bilateral trade agreement with Japan, the Japan–Malaysia Economic Partnership Agreement, was concluded in 2005. Under the pact, the elimination of tariffs on imported small-engine cars from Japan was postponed until 2015—a very significant move for PROTON which generally produces small cars—while tariffs for cars with bigger engines are scheduled for earlier reduction.

The ongoing trade negotiations under the Trans-Pacific Partnership Agreement and the European Union are bound to affect tariffs in the automotive sector given the interests of the parties involved in the Malaysian market. It should be noted that ASEAN and the Japan–Malaysia

Table 12.2  Malaysia’s import and excise duties for imports from ASEAN and non-ASEAN countries, 2010 (percentages)

<table>
<thead>
<tr>
<th></th>
<th>Imports from ASEAN countries</th>
<th>Imports from non-ASEAN countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Import duties</td>
<td>Excise duties</td>
</tr>
<tr>
<td>Completely knock-down vehicles</td>
<td>0</td>
<td>60–125</td>
</tr>
<tr>
<td>Completely built-up vehicles</td>
<td>5</td>
<td>60–125</td>
</tr>
<tr>
<td>Completely knock-down motorcycles</td>
<td>0</td>
<td>20–50</td>
</tr>
<tr>
<td>Completely built-up motorcycles</td>
<td>5</td>
<td>20–50</td>
</tr>
</tbody>
</table>

Note:  ASEAN = Association of Southeast Asian Nations.

Source:  Malaysian Investment Development Authority (2010).
agreements have left government procurement untouched. But this is unlikely to be the case for the potential Trans-Pacific Partnership Agreement and a free trade agreement with the European Union.

PROTON’s future looks bleak. The reasons are a global excess manufacturing capacity of 20 million units in conventional cars (Fong 2011) and Malaysia’s small domestic market. Automobile companies need to sell at least 1 million cars a year to remain profitable (Cheong 2011). Thailand, with a population of 67 million and car registration of 800,000 vehicles, is closer to the size needed for sustaining a viable domestic manufacturing base. Kuchiki (2007) argues that domestic demand conditions in Malaysia do not satisfy the minimum average cost of production essential for cost competitiveness in the global automobile industry.

Malaysia’s automobile sector also requires huge expenditure on R&D and capital, and faces high entry barriers and demanding economies of scale that practically render automobile projects futile (Fong 2011; Wad 2011). By contrast, Thailand is one of six countries housing Toyota’s global R&D operations and one of the eight hosting Bridgestone’s tire test track and proving ground for tire development (Cheong 2011).

Conventional cars that continue to rely on fossil fuels are not sustainable, especially for Malaysia, where fuel subsidies and poor public transportation have supported the high demand for automobiles. Unless PROTON is able to innovate and shift to green vehicles, and partner up with a global player, its future is uncertain, especially with deeper liberalization that impinges on other forms of protection besides tariffs (Fong 2011; Wad 2011; Wad and Govindaraju 2011).

PROTON is seeking a global technology partner but has yet to make a tie-up. A renewed technology collaboration with Mitsubishi in 2006 and 2008 did not involve equity transfer and it remains to be seen if this will lead to substantial technology transfer and green innovation given that Japan is among the leaders of hybrid cars. PROTON had intended to mass produce hybrid cars by 2013 (Ahmad 2011), but this target has been extended to the end of 2014.

The government has been searching for a partner for PROTON since the Asian financial crisis. Negotiations to sell Khazanah’s share failed in 2007 owing to the government’s insistence on keeping PROTON a domestically owned company. In 2012, Khazanah sold its entire stake to DRB-Hicom, a privately owned Bumiputera company that is a leading car distributor, importer and assembler of various car brands. Despite its extensive network of partners with global car companies, DRB-Hicom is

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17 Khazanah is a government-linked company.
essentially a car assembler and, therefore, it remains to be seen whether it can help raise PROTON to the level of a global car manufacturer based on its own designs, as Mahathir envisioned.

12.7 SERVICES AS THE NEXT ENGINE OF GROWTH

Malaysia has targeted the services sector as its next engine of growth based on stylized facts (namely, that developed economies are services-led) and on the declining competitiveness of manufacturing with the rise of the People’s Republic of China and India. Against this backdrop, it has identified several services subsectors for development.

Labor productivity in services was lower than that of manufacturing until 2009 (Figure 12.1). Labor productivity in Malaysia’s services is below that of the OECD average, and far lower than Singapore’s (Noland et al. 2012). With the exception of travel, most services are directed toward the domestic economy, as shown by the sector’s low export competitiveness (Tham and Loke 2011).

![Diagram of labor productivity in manufacturing and services, Malaysia, 1980–2011](image)

**Note:** RM = Malaysian ringgit.

**Sources:** Ministry of Finance Economic Report, various issues; World Bank, World Development Indicators.

**Figure 12.1** Labor productivity in manufacturing and services, Malaysia, 1980–2011
Given that manufacturing exports still account for an important share of total exports, it is premature to think of shifting out of manufacturing into services. Instead, the industrial strategy should focus on the complementarities between the two sectors. The challenge in the short and medium terms is therefore to raise the efficiency and productivity of the services sector by strengthening its links with manufacturing.

Malaysia’s near full employment implies that the shift to services is not needed to create employment, especially labor-intensive employment. Moreover, structural problems in the labor market, such as the dependence on unskilled foreign workers and a shortage of knowledge workers, will likely impede a shift into knowledge-intensive services rather than labor-intensive services.

Since FDI is one of the most important modes of trade in services, liberalizing the equity constraints in this sector is one way to increase exports of services. Foreign equity ownership has been capped at 30% in services subsectors since the implementation of the New Economic Policy. However, comparing FDI inflows between 1990–99 and 2000–2009 shows an increase in the share of services, from 15% to 37% (Table 12.3). This is in line with the current policy focus on the promotion of Islamic finance in Malaysia. Consequently, an increasing number of banking licenses with 100% foreign equity have been given for Islamic banks, leading to a net inflow into the financial sector during 1999–2009 (Mahani et al. 2012). In 2009, the government removed foreign equity constraints on 27 services subsectors and relaxed foreign equity ownership in financial services. The same year, Foreign Investment Committee guidelines were deregulated and the decision was made that the limitation on foreign equity be decided by the regulating agencies of the concerned industries. Hence, the extent of

Table 12.3  Services FDI into Malaysia and Malaysia’s outward investment in services, selected periods

<table>
<thead>
<tr>
<th>Sectors</th>
<th>1990–99 (as % of total FDI into Malaysia)</th>
<th>2000–2009 (as % of Malaysia’s total outward investment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI into Malaysia in services</td>
<td>15</td>
<td>37</td>
</tr>
<tr>
<td>Malaysia’s outward investment in services</td>
<td>49</td>
<td>70</td>
</tr>
</tbody>
</table>

Note: FDI = foreign direct investments.

Source: Central Bank (2010).
foreign equity permitted varies from sector to sector and ranges from 30% to 100%. It is therefore important to continue the progressive liberalization of equity constraints in services.

Reducing the regulatory burden has been shown to be the most effective way of increasing productivity in the services sector and to increase its trade (Dee 2004; Noland et al. 2012). Current efforts to this end need to be accelerated. The longer-term challenge is to enhance the export competitiveness of services exports to increase their share in total exports by addressing structural problems in the labor market.

12.8 CONCLUSIONS

The formulation of industrial policies in Malaysia has evolved and taken into account global trends and practices. Policy advice comes from external as well as domestic consultants and from engagement with domestic stakeholders. The country successfully shifted into simple labor-intensive manufacturing with the help of FDI and has over the years developed some passive technology absorption with the emergence of supporting industries and local firms that supply multinational corporations in the country, but it has yet to master technology management or to acquire full capabilities in innovation and product design (Ohno and Ohno 2009).

Based on this experience, government can improve the use of industrial policy in several ways. First, policies have suffered from a lack of implementation and change is needed in this area. Specifically, IMP2 and IMP3 had no accompanying action plan or road map for their implementation. Similarly, the development of services and the setting of sector goals are left to different ministries to execute. These other ministries may lack the capabilities and capacities to do this, and may also have different objectives. In particular, they may not be as enthusiastic about liberalization as the Ministry of International Trade and Industry because they work with government-linked companies, many of which are in services.

Second, the objectives of industrial policy are too broad and both implementation and monitoring mechanisms need to be refined to capture more than just broad targets. Greater focus is needed on improving the capacity and capabilities of ministries and government agencies to conduct in-depth assessments and increase information flow and data for independent assessments by the nongovernment sector.

Third, in-depth assessments looking at why some policies did not work are important for continuity in policy formulation. The shift to services, in particular, should not be used to circumvent the difficulties or failures
for upgrading the manufacturing sector. Rather, learning and a concerted
effort to address failures are needed for more effective policy formulation.
Services should complement and strengthen manufacturing development
rather than operate as a separate niche.

Fourth, unconditional protection will not foster competitiveness, and
mixing socioeconomic goals with protection measures undermines the
economic objectives of infant-industry protection. Protecting a firm
without forcing it to compete domestically and internationally, as well as
imposing national, noneconomic goals, is at odds with the targeting of
activities that support industrial development (Rodrik 2008). Moreover,
tariff protection is increasingly difficult to implement under liberalization
pressures at the regional and bilateral level.

Finally, an FDI-led industrial development strategy needs to ensure
that domestic absorptive capacities are well nurtured. The passive absorp-
tion strategy in Malaysia has led to limited backward links and to a small
number of home grown firms (Yusuf and Nabeshima 2009).

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Development and modern industrial policy in practice


13. Industrial policy in the European Union

Kristine Farla, Francesca Guadagno and Bart Verspagen

13.1 INTRODUCTION

Industrial policy is often used to spur economic development, which is driven by structural change. This is a process that, if in the right direction, results in the reallocation of resources toward more productive activities. It also entails the diversification and upgrading of the country’s production and export basket, as well as the emergence of some activities and the disappearance of others. The transformation of an economy includes shifts from farming agriculture into agribusiness and manufacturing, within manufacturing into more knowledge-intensive activities, and from manufacturing into modern services. More broadly, structural change enables modernization and raises living standards.

Experience in many economies makes clear that development and structural change are not automatic or natural. Indeed, among the many countries that operate far from the frontier of riches, few have successfully managed to change their economic structure and to boost living standards. It is well known that in the most successful cases, such as the Republic of Korea and Taipei, China, government industrial policy played an important role in this transformation. Industrial policy, in practice, entails a combination of ‘horizontal’ measures aimed at levelling the playing field firms operate in and ‘vertical’ measures to help specific sectors and the firms operating in them.

In this chapter we argue that industrial policy is relevant for developing and developed economies alike. The role of industrial policy and its basic aims do not differ fundamentally between both. We discuss Europe to illustrate this point. European Union (EU) policymakers have repeatedly argued that structural adjustments in the global economy are among the EU’s main economic challenges and that this justifies a European industrial policy.
In keeping with Pelkmans (2006), we classify European industrial policy into three broad categories that directly affect firms. The first are framework aspects that affect the general environment in which firms operate. This category includes policies aimed at the general working of markets, which have been very important in EU history, and competition policy. The second are horizontal industrial policy measures that take a more active stance toward firms. These aim to influence firm behavior, but do not discriminate between economic sectors. Examples include subsidies and tax incentives aimed at nurturing investment—either in general or in specific activities related to technology such as research and development (R&D)—and providing risk-capital and other measures to stimulate entrepreneurship. The third category is vertical industrial policy targeted at specific sectors and therefore most directly associated with the process of structural change. It includes technology policies aimed at facilitating the regional clustering of firms.

This chapter seeks to define EU industrial policy, broadly and in country-specific contexts, and to assess its effectiveness. European Union industrial policy is very rich, covering many tools, instruments, actors and organizations. Assessing its overall effectiveness and impact is not easy, therefore, and this partly reflects the current state of monitoring and, especially, evaluation of policies. Table 13A.1 in the appendix to this chapter provides a summary of the industrial policy instruments in the European Union.

13.2 THE POLITICAL ECONOMY OF INDUSTRIAL POLICY IN THE EU

Unification dominates the EU political economy. The EU and its member states form a complicated array of political decision-making bodies that have a strong impact on the policy mix. The political economy, in turn, has had a particularly strong impact on industrial policy. Now with 28 member nations, the EU began in 1951 as an experiment in industrial policy around the European Coal and Steel Community involving just six nations (Pelkmans 2006). The effort brought together Belgium, France, Italy, Luxemburg, the Netherlands and the former West Germany in a common market for coal and steel, and installed a supranational regulatory body to increase living standards and ensure employment.

After its establishment, a process of harmonization gradually emerged and the idea of a common market beyond coal took shape and moved to the forefront. The goals of a common market for trade and the free movement of people were set for completion in 1992. Afterwards, further
steps for political and monetary integration, and the addition of services to the internal market, were taken. For industrial policy, a common market appealed to the idea of creating a framework with conditions that ensured universal access to markets. This was embodied in efforts to level the playing field—the notion that firms from all countries should have an equal opportunity to enter the national markets of member states. This involved the removal of both formal barriers to trade between nations and national policies to protect or favor domestic firms.

The completion of the common market therefore had to cope with a large variety of national policies, often related to industry. The attitude toward industrial policy also changed gradually in most member states. Still today, a complex set of interactions between the EU and its member states dominates the industrial policy mix (Pelkmans 2006).

An important principle that links these two levels of policymaking is subsidiarity—meaning that the EU level undertakes some policies because it would be inefficient if member states did. Where this does not apply, individual member states create national policy. With the achievement of the common market and increasing European integration, the European Commission argued that industrial policy was most efficiently handled at the European level. Nevertheless, member governments have managed to maintain an important although declining role in setting industrial policy.

The European Commission followed the creation of the single market in 1992 with actions to implement industrial policy. In various policy documents, it outlined its conceptual and practical approach to industrial policy and the developments to justify it. Among the many arguments presented, the Commission stressed that the internal market provided an important impetus to undertake industrial policy. This part of EU industrial policy has mostly aimed at bolstering competition and improving antitrust policy, and at policies to improve regulation.

The European Commission has also outlined several reasons for a more active industrial policy, with the most important and recurring linked to structural change and competitiveness. Structural change is a process that refers to the changing composition of the output and employment structures of an economy as income per capita increases. The context in which this term is used in EU policy documents includes broad trends such as deindustrialization in some countries, industrialization in others and also the rise of particular sectors mostly associated with high-technology activities. In the European Commission’s vision, structural change is a reason for industrial policy because it requires member economies to adapt to changing circumstances. It also presents potential threats such as a loss of competitiveness and market share if the adjustment is slower than in other parts of the world. By contrast, competitiveness in this context refers to
the idea that enterprises in the EU cannot always draw upon high-quality resources or that these resources are more expensive than in other parts of the world.

At the level of the European Commission, these justifications for industrial policy have led to a complicated policy mix. This has been mostly horizontal and does not make explicit choices to favor firms in one sector over those in another. However, the policy mix also contains important elements of vertical policy and there are two reasons for this.

First, the specific experience supporting individual industries is often associated with a defensive strategy of protecting declining industries. Because of structural change and increasing levels of international trade, industries such as textiles and basic metals came under severe competitive pressure from abroad. Because of the negative consequences for employment, many governments in Europe provided subsidies to firms in these sectors or supported these industries by taking ownership shares in threatened firms. Some also supported individual industries in sectors considered to be of national interest that were under competitive pressure. In almost all cases, these interventions were unsuccessful because industries could not be protected against global competition. It became clear that such policies were often associated with a loss of public funds and that they had led to market distortions of the kind that the internal market wanted to abolish.

Second, the dominance of the internal market strategy and the level-playing field attached to it requires by its very nature an approach that stimulates competition. Linked to this is the idea that markets are a way to achieve an efficient allocation of resources and that any government intervention favoring specific sectors will interfere with this mechanism by diverting resources to supported sectors. This idea has often been popularized by the notion that governments are inefficient and the market’s invisible hand is efficient in picking winners.

These two factors led to an emphasis on horizontal policies. However, the specific recognition of structural adjustment as an impetus for industrial policy has also led to the development of the vertical dimension. In translating the notions of competitiveness and structural adjustment into an actual industrial policy, the European Commission has shown a strong bias toward policies aimed at stimulating the development of new knowledge, innovation, education and the development of high-technology activities, especially information and communication technology (ICT). The notion of structural adjustment, as the European Commission uses it, often underscores the tendency of knowledge-intensive activities to become more important in the global and EU economies. Innovation is also seen as an important component of the competitiveness of firms. This
Development and modern industrial policy in practice has led to a specific emphasis on knowledge development through R&D in EU-level industrial policy.

The European Commission is not alone in trying to shift toward stimulating knowledge development, diffusion and innovation. Almost all EU member-state governments are doing so where considerable diversity exists in industrial policy approaches. France stands out for the very active involvement of its public sector in industry. French industrial policy was long dominated by a mission-oriented approach in which the government pursued large-scale goals considered crucial to the country’s competitiveness. And these were often inspired by a desire to have technologically independent firms. This approach was highly visible in the aerospace industry (Airbus is rooted in such policies), atomic energy and high-speed trains.

This active involvement in specific sectors contrasts sharply with the approach of other major European countries, particularly Germany and the United Kingdom (UK). In Germany, no strong tradition of sector-based industrial policy exists. Instead, horizontal policies to foster investment by firms and to develop a broad set of technological competencies in large public research institutes, such as the Max Planck Society for the Advancement of Science, have dominated.

In the UK, defensive industrial policies (that is, policies to fight industrial decline) were more common than in many other European countries, although this was subject to the ups and downs of the political cycle. European Union member states have tended to adopt industrial policies more in accordance with market-based thinking, partly under the growing realization that defensive industrial policies were an inefficient means to increase competitiveness and partly because of the emphasis on the internal market in the integration process. At the EU level, this often implied a shift toward policies aimed at knowledge creation and diffusion, and innovation (Sharp 2001).

The emphasis on innovation and knowledge also implied a move away from pure horizontal measures in industrial policy, both at the level of the EU and member states. This is what Aiginger and Sieber (2005) call a ‘matrix organization’ of industrial policy. One dimension of the matrix is formed by horizontal policy measures that result from the emphasis on the internal market and market-based thinking in general, such as stimulating innovation and entrepreneurship and human capital development (Pelkmans 2006). The other dimension is formed by sectors that are traditionally the subject of a more vertical or sector-specific industrial policy.

According to the matrix approach, although industrial policy is horizontally designed and motivated (that is, through the use of horizontal polices), differences between sectors imply that at the level of
implementation and impact horizontal policies are actually sectorally differentiated. For example, a horizontal policy of tax credits for R&D will have much more impact in sectors that are highly intensive in this area than those that are not. Similarly, a horizontal education policy aimed at a specific skill level will have the strongest impact in sectors in which the skill level is used most intensively. The technology-based subsidy programs the EU has implemented also have this strong tendency. This is because they tend to make very detailed and specific choices on which technological fields will be covered even if they are intended to stimulate innovation and knowledge in a horizontal way.

Another major factor in EU industrial policy is the notion of social cohesion. This is mostly used in a geographical dimension and refers to the idea that differences, mostly in living standards and employment rates, should not be too large across the EU’s regions. Differences in living standards have traditionally been large within the EU and accentuated by every successive enlargement. This is because, on the whole, new member states are relatively poor compared with existing members and display large geographical disparities in living standards (Fagerberg and Verspagen 1996).

Member states and the European Commission view such disparities as undesirable. To reduce them, they set up the Structural Funds in 1975 (Begg 2010; Cappelen et al. 2003). The funds involve a trade-off between equity and efficiency as their impact on the working of markets is similar to that of sectoral (vertical) industrial policies and, by their sheer size, they are an important part of EU industrial policy. Under the Structural Funds, a budget in multiyear cycles is allocated and then—depending on the initiative of private firms or regional governments or combinations of both—projects are proposed to help stimulate economies in targeted regions. In many cases, these regions are defined by strict criteria based on living standards, the employment situation and specific structural features such as a large dependence on specific sectors.

Projects funded by Structural Funds are mostly suggested by the general conditions that the EU wants to stimulate from the perspective of a common market. Thus, instead of supporting specific firms, the funds target the development of infrastructure projects or other framework conditions that improve access to markets and the competitiveness of firms in targeted regions. Because the funds are targeted at specific regions and countries, they add another vertical dimension to the industrial policy mix.

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1 For more information on Structural Funds see section 13.5.3 on regional policy.
As the EU has expanded eastward, the number of regions qualifying for Structural Funds has greatly increased, and funds are now a major input into industrial policies in Central and Eastern Europe. However, this has raised issues about the financial feasibility of the regional cohesion policy, although reforms have been implemented to deal with these problems.

In summary, industrial policy in the EU can be best described as a mix of horizontal measures, in principle affecting all firms, and vertical measures that imply choosing specific activities in certain sectors. The vertical measures are integral to industrial policy and reminiscent of policies often applied in a development context. Their justification in the EU comes from an emphasis on structural change as a driving force in the global economy, and the need conceived by policymakers for firms in to adapt to this. The vertical dimension of EU industrial policy is strongly associated with the emphasis on knowledge and innovation and on regional cohesion.

13.3 A SHORT HISTORICAL CHARACTERIZATION OF INDUSTRIAL POLICY

Needing significant structural transformation toward larger industrial sectors, postwar Europe turned to industrial policy. This took the form of selective intervention in traditional heavy-capital and scale-intensive manufacturing such as coal mining and steel production. An emerging consensus on neoliberal policies and the consequent global shift in perception about industrial policy switched the focus toward the creation of the conditions for a common European market. That shift also occurred because policies assisting the adjustment of those sectors most hit by international competition became increasingly difficult to maintain. Thus, the ambition of a single market had the effect of redirecting industrial policy away from member states and toward the supranational EU and resolving the regulatory and political fragmentation that some argued were at the root of the EU's structural adjustment problems.

At the same time, the international environment started providing opportunities for selective intervention in areas often related to technology development. An example of this was the 1986 Semiconductor Trade Agreement in which Japan agreed to limit exports of dynamic random-access memory chips to the US. This ‘managed trade’ orientation, together with some influential academic studies on the relation between innovation and socioeconomic development, reoriented the debate on industrial policy toward innovation and strategic policies (Soete 2007, 2009). The EU slowly turned to a vision of industrial policy in which selective intervention and a technology orientation played a larger role than before. The
European Commission’s White Paper, ‘Growth, competitiveness, employment. The challenges and ways forward into the 21st century’ (European Commission 1993) can be seen as delineating a new era in which neutral policies were combined with technology targeting (such as ICT and biotechnology). Following this, a focus on innovation and, more recently, sustainability characterized policy documents in the 1990s and 2000s.

In March 2000, this process culminated in the grand plan of the Lisbon Strategy to make the EU the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion. It set 2010 as the target for achieving this.

The EU formulated the Lisbon Strategy to continue the long fight against unemployment and low growth rates and exploit the potential of globalization and the knowledge-based economy. The way to achieve the latter was by integrating R&D under a common European Research Area, stimulating research in firms and universities, and by creating a conducive environment for innovative start-ups. When it became clear that the 2010 target would not be reached, the Lisbon Strategy was replaced with ‘Europe 2020: a strategy for smart, sustainable and inclusive growth’ (European Commission 2010a), launched in April 2010. The plan renewed the Lisbon agenda but proposed new ways of achieving it.

13.4 THE OBJECTIVES OF INDUSTRIAL POLICY

This process led to the current stance of industrial policy at the EU level, focusing on science, innovation and technology, and the objectives of Europe 2020. Among these are increasing the EU’s average employment rate from 69% to 75%, investing 3% of the EU’s gross domestic product (GDP) in R&D, and reducing greenhouse gas emissions by 20% by 2020.

Because it does not target specific sectors or activities, Europe 2020 complements horizontal interventions with vertical ones (European Commission 2010b) and thereby follows the EU tradition of industrial policy. Europe 2020’s policies are first and foremost related to reinforcing the knowledge base for what the European Commission calls ‘key enabling technologies.’ Europe 2020 also states that although all sectors are important, different sectors need different support. Again, this reaffirms the idea of the matrix-orientation of EU industrial policy.

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2 This is consistent with what has been referred to as the ‘matrix type approach’ (Aiginger and Sieber 2005).
The main objectives of the horizontal element of Europe 2020’s policies are (1) improving framework conditions for industry by ‘smart regulation’ and better access to finance; (2) strengthening the single market through increased legal harmonization, standardization, improved infrastructure, better management of intellectual property rights and an active competition policy; (3) promoting excellence in education and research; and (4) encouraging industrial modernization through resource-efficient production, sustainable practices and environmental technologies, and restructuring companies hit by an economic crisis.

‘Smart specialization’ is particularly prominent among the new policy ideas that Europe 2020 promotes. This concept starts from the notion of local clusters of firms and other organizations, especially the knowledge-based, working together in regional clusters to improve industrial competitiveness by bringing together resources and expertise, and fostering cooperation among businesses, public authorities and universities. Structuring policy initiatives on the basis of regional clusters has a couple advantages. It allows policymakers to better understand both the needs of industry and new ways to provide specialized industrial support. Also, it creates awareness for support programs tailored to the industry.

By pushing the identification and consolidation of clusters, the European Commission aims to direct member states toward smart specialization, which emphasizes a number of issues concerning local economic structure. Smart specialization means that regions should specialize in certain scientific and technological fields. However, rather than stimulating regions to specialize in the list of activities that the overall policy defines as important—for example, ICT, biotechnology and nanotechnology—it suggests that regions focus on the development of innovation niches and build excellence and competitive advantage in their particular niches.

Smart specialization calls for a process of ‘self-discovery’ by which firms, entrepreneurs and universities identify the domains of R&D and innovation in which their region can excel given its existing capabilities and productive assets. In this way, smart specialization proposes a way for regions to actively influence the process of structural change and to cope with the challenges of structural adjustment. It involves the search for what makes a region special and unique, and seeks to enhance that knowledge base. Its advantages are not simply at the local level but also at the ‘system’ level, because the EU will benefit from greater knowledge diversity, distinct local agglomeration economies and less vulnerability to global markets (Foray et al. 2011).
13.5 TOOLS OF INDUSTRIAL POLICY AT THE EU LEVEL

13.5.1 Trade Policy

The EU’s 28 countries implement a community-wide customs code that implies they act as one in trade policy. The rules not only regulate common tariffs but all aspects of trade policy, such as nontariff instruments, preferential trade, health and environmental controls, agricultural and fisheries policies and external relations.

Article 23 of the European Community Treaty stipulates the free circulation of community goods throughout the EU. This principle applies to goods made in the EU and imported goods that have been released for free circulation after payment of duties. Regulations on trade are based on the principle of freedom to import, subject to surveillance and safeguard measures such as import or tariff quotas. Quantitative quotas exist for steel, textiles, footwear and potassium chloride. Other measures are evaluated case by case.

In line with the transparency the European Commission often advocates, the EU maintains a public database on tariff rates and other protective measures. Apart from *ad valorem* duties, several non-*ad valorem* duties are applied, mostly on agricultural products. According to World Trade Organization (WTO) data, the average tariff rate for agricultural products in 2011 was 15.2%. By contrast, tariff rates for industrial products are among the lowest in the world. In fact, average tariffs for non-agricultural products are 4.1% (WTO 2011). Even though protection has decreased since 2008, support to agriculture is still considerable.

Apart from import tariffs, the EU offers several incentives to agriculture. According to the Organisation for Economic and Co-operation and Development (OECD) estimates, total European expenditures on agricultural policy (including EU, national and regional expenditures) were €77 billion in 2010 (OECD 2011).

Similar to the import regime, the EU respects the principle of freedom to export. Member states manage their export credit insurance systems and other export finance schemes. For export credit insurance, the EU tries to reduce distortions of competition among EU companies caused by differences in member states’ systems by providing common principles and rules on coverage and transparency.

13.5.2 Investment Policy

This refers to policies aimed at spurring investments from the private sector. In the EU, these include ensuring basic conditions for private
business, such as infrastructure and competition policy, and providing financing, credit or tax incentives. For the latter, the European Commission provides guidelines on how to design these tools, which are managed by member states.

At the EU level, Structural Funds finance many infrastructure projects. About €82 billion was planned for transport at the EU, national and regional levels during 2007–13, a 65% increase over 2000–2006. The EU also defines a particular set of infrastructure—known as research infrastructure—as physical infrastructure (that is, facilities) and the ICT-based research communities needed for EU research projects. This is financed under the EU’s Seventh Framework Programme (2007–13), with a budget of €1.8 billion (roughly 3% of the total program budget). Recently financed projects include upgrades of existing infrastructure, investment in new research infrastructure and the formation of networks through which leading actors in specific scientific fields exchange data and cooperate in research (see Chapter 9, on networks, in this volume).

Member states can offer financing to specific firms, sectors or projects using state aid in the form of grants, fiscal incentives, equity, soft loans and guarantees or through public procurement. State aid and public procurement are traditional industrial policy tools that have often been criticized for taking a defensive stance to support industries and firms facing intense foreign competition. This type of policy has become associated with market distortion and inefficient use of public funds. Because of this, the European Commission set very specific rules on state aid and public procurement to resolve tensions between competition and industrial policy.

The development of the common market has narrowed the policy scope for national industrial policies (Valila 2006). In fact, state aid is prohibited, but exemptions can be made when it serves the major EU objectives of strengthening the single market or knowledge-based goals (European Commission 2006a). Following Article 107 of the Treaty on European Union, state aid must have ‘a social character, granted to individual consumers, provided that such aid is granted without discrimination related to the origin of the products concerned.’

In the specific case of aid for research, development and innovation, the requirement is that no better instruments to achieve the desired objective

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3 Structural Funds are the main financial instrument of regional policy in EU. The details of these funds are discussed in section 13.5.3.

4 Framework Programmes for Research and Technological Development are the main instrument of the European Commission to finance collaborative transnational research. The first program was launched in 1984 to strengthen the knowledge base and increase the competitiveness of European firms (Breschi and Cusmano 2004).
should exist, and the project should be sizable. Preferred projects are those significantly cofinanced by the applicants and that involve organizations from many member states. Even in these cases, however, state aid should be designed in such a way that it limits market distortions. Without going into technicalities, it is worth noting that the degrees of support allowed depend on whether a project qualifies as fundamental research, industrial research or experimental development (in decreasing order of aid intensity), and on firm size. Even though these rules are set at the EU level, member states ultimately manage state aid, having some freedom in the amount of allocation and displacement of state aid as well as in the policy instruments. Before implementing state aid, member states must have approval from the European Commission.5

Similarly, EU member states have discretionary power in defining the details of their public procurement procedures, an important issue since public procurement accounts for 16% of the EU’s GDP. European Commission rules dictate harmonized and transparent conditions in selecting contractors, and recommend the inclusion of special provisions for small- and medium-sized enterprises (SME). These provisions are ultimately meant to facilitate SME access to public procurement contracts, and the European Commission allows member states to divide contracts into separate lots. The Commission also offers business consultancy services to SMEs and guidelines on how to manage contracts for transparency and to lessen the administrative burden of public procurement contracts. The legislative framework of public procurement is currently under review and a policy shift toward increased flexibility is expected. Flexibility in this context means increased recourse to negotiation to better tailor purchased services and goods—although that could put the competitive character of EU procurement contracts at risk—and simplifying tendering by using electronic procurement procedures. Proposed modifications to the legislative framework should contribute to the Europe 2020 objectives by encouraging public procurement of green and inclusive solutions.

13.5.3 Regional Policy

Regional policy at the EU level is an investment policy because it is aimed at job creation, competitiveness and economic growth—and seeks to do so in a truly regional way. Its main objectives are convergence and solidarity among regions, regional competitiveness and employment. Most

5 See Buts, Jegers and Joris (2011) and Zahariadis (2012) for a review of the determinants of state aid decisions.
financial instruments are dedicated exclusively to regions with low per capita GDP. Given its relevance within the EU agenda, regional policy takes a conspicuously large share of the total European Commission budget. During 2007–13, it received €347 billion, or 35.7% of the total EU budget and 0.38% of EU GDP. Of this, €282.8 billion (81.5% of the total regional policy budget) is devoted to the convergence objective and €55 billion (16%) to regional competitiveness and employment (European Commission 2008).

The first objective, regional convergence and solidarity, is to reduce disparities between EU regions by improving infrastructure, creating a productive environment for enterprise, and developing human capital. The second objective, competitiveness and employment, aims at facilitating the transition of workers and firms—through the development of new activities and job creation—in areas that have recently suffered a decline in traditional productive activities. These have been hit by job losses, not only in traditional industries such as textiles, coal and steel, but also in services. During 2000–2006, this objective was allocated €22.5 billion, 9.6% of the total regional policy funding. Compared with the 2007–13 figures (€55 billion or 16% of total regional policy funds), this objective has gained more attention in recent years.

According to Article 159 of the EU Community Treaty, the regional policy is financed through Structural Funds, the European Investment Bank (EIB) and the other financial instruments. The EU uses Structural Funds as the main instrument to attain regional policy objectives and reduce regional disparities. For this reason, their priority is to provide funds to the poorest regions. Financing is also subject to other conditions, especially that additionality to national expenditures is met; that is, that EU funds add to national spending. Figure 13.1 shows the main areas of budget spending of EU regional policies.

Figure 13.1 shows that spending on research and technical development, innovation and entrepreneurship took one of the biggest budget slices, at 19% of the total (€86 billion). This shows that even Structural Funds have a general orientation to science, technology and innovation, and this trend has become more pronounced in recent years.

Regional policy financial instruments support 19% of national cluster programs in the EU. Cluster policy is, in fact, a national matter, with the EU intervening only with guidelines, information services for enterprises and SMEs and financial support.

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6 For more information on Structural Funds, see EU Council Regulation No. 1083/2006.
13.5.4 Science, Technology and Innovation Policies

Science, technology and innovation are the mainstay of the EU’s industrial policy. Its two largest programs are the European Research Area (ERA) and the Framework Programmes for Research and Technological Development.

**European Research Area**

The EU launched the ERA under the Lisbon Strategy to coordinate research, avoid duplication of effort and form intra-European collaborations and networks. It emerged as a remedy to a poorly functioning innovation system and was expected to lead to highly specialized research hotspots to help spur growth and competitiveness. According to the 2007 ERA Green Paper (European Commission 2007a), the ERA is essentially an internal market for research; coordination of national and regional research activities, programs and policies; and research initiatives funded...
at the EU level. It aims to achieve a single market for research by promoting mobility for researchers and through collaborations and specialization. Initiatives undertaken in the ERA policy domain include research infrastructure and coordination of national and regional research programs.

The ERA does not have a dedicated budget, but relies on funding sources such as Structural Funds, state aid and public procurement. It also relies on EU-level funding instruments for science and technology, such as the Seventh Framework Programme and the European Institute of Innovation and Technology.\(^7\)

**Framework Programmes**

While the ERA focuses on higher education institutions and research, the Framework Programmes aim at strengthening the scientific and technological base of EU industry to make it more internationally competitive. The programs are a system for sponsoring transnational European R&D consortia that adopt joint work programs to maximize complementarities. They are essentially R&D subsidies awarded in a competitive process to projects with precisely defined technological goals. Usually, the consortia awarded projects are a mix of private firms and public or semipublic research organizations, including universities.

In line with the logic of the common market, the Framework Programmes for Research and Technological Development traditionally sponsor pre-competitive research (that is, research projects that have not entered the innovation phase). In Soete’s (2007) analysis, these programs are the ERA’s intellectual basis. Seven programs have followed the first program in 1984 and have been given increasingly bigger budgets (Figure 13.2).

The Seventh Framework Programme, covering 2007–13, was subdivided into four categories of projects: (1) cooperation between European universities, industry, research centers, and public authorities; (2) ideas, targeting bottom-up projects aimed at frontier basic research; (3) people, whose principal objective is training; and (4) capacities that focus on prerequisites for effective research; for example, research infrastructure, innovation capacities of SMEs, and initiatives that provide the basis for new knowledge-based clusters (European Commission 2005a). This program constitutes a broadening of the original form of the Framework

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\(^7\) The European Institute of Innovation and Technology, established in 2008, offers physical infrastructure where research and business people can work together and higher education programs and entrepreneurship courses. Its focus is on EU priority topics with high societal impact, such as climate change, information and communication technologies and sustainable energy.
Programme for Research and Technological Development, which used to focus on cooperation.

The European Commission also designates specific scientific areas (a vertical orientation) only for cooperation. These are health, food and biotechnology, information and communication technology, nanotechnology, energy, environment, transport, socioeconomic sciences and humanities, space and security.

The overall budget of the Seventh Framework Programme (over €50 billion) is not evenly split across the four categories of projects, with 60% of the total going to cooperation, the traditional focus of the original Framework Programmes for Research and Technological Development. This weighting shows the importance the European Commission puts on partnerships and networks. Awarded projects receive grants under different funding schemes, depending on the type of participants and activities. In addition to direct funding, privileged access to debt finance is ensured through the EIB’s Risk-Sharing Finance Facility.

Note: ECU = European Currency Unit, FP = framework programs.


Figure 13.2  Budgets for the Framework Programmes, EU, 1984–2013

Programme for Research and Technological Development, which used to focus on cooperation.

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8 The Risk-Sharing Finance Facility is a debt-based instrument created as a joint program of the EIB and the European Commission. It has €2 billion in capital, of which half is provided under the Framework Programmes for Research and Technological
To spur SME innovation, the Competitiveness and Innovation Framework Programme (CIP) gave innovative SMEs easier access to finance and business support services. The program ran during 2007–13 and had a budget of €3.62 billion. The CIP was divided into three operational programs: (1) entrepreneurship and innovation, with a budget of €2.16 billion; (2) information and communications technology (€728 million); and (3) energy (€727 million). The first program provided better access to finance through CIP financial instruments managed by the European Investment Fund. The purpose of these instruments was to assist SMEs in the stages of their development (European Commission 2005b).

Starting in 2014, with an €80 billion budget, Horizon 2020 became the sole financial instrument responsible for research and innovation, substituting the innovation funding schemes provided by the Framework Programmes for Research and Technological Development, the CIP and the European Institute of Innovation and Technology. Horizon 2020 aims to improve on the previous funding opportunities by simplifying rules under a single institution.

A special category of industrial policy tools is the ‘visions’ that the EU formulates for its specific policy goals. These are expressed in the Europe 2020 strategy and through Key Enabling Technologies and the Lead Market Initiative. The visions are largely based on detailed analysis, supportive studies and data. To formulate them, the European Commission sets up discussion forums, such as the European Forum on Forward Looking Activities and by commissioning analysis, such as the Sectoral Innovation Watch. Here, a consortium of leading European innovation organizations help in adapting existing policies and designing new evidence-based innovation policies based on industrial sector dynamics.9

Societal challenges, such as population aging, climate change and the reduced availability of resources often motivate the visions (European Commission 2010c). The Lead Market Initiative (European Commission 2007b) is one of the programs that meets this objective. It targets fast-growing markets before they take off internationally, including eHealth, protective textiles, sustainable construction, recycling,

9 See http://www.europe-innova.eu/web/guest/sectoral-innovation-watch/about (accessed 2013) for details.
biotechnology-based products and renewable energies.\textsuperscript{10} By generating more knowledge about these technologies, the European Commission is able to offer ‘educated visions’ that can contribute concretely to strategic industrial diversification and competitiveness. The Lead Market Initiative assists participants in these markets by facilitating legislation, standardization and access to finance through the EIB and European Investment Fund. It does this with direct financial support through public procurement and state aid, and by offering complementary instruments such as support systems and training.

Similar visions are formulated through Key Enabling Technologies. According to the European Commission (2009), the principal aim of this initiative is to enable innovation throughout the economy and so benefit technology leaders in connected sectors. These are advanced materials, nanotechnology, micro- and nano-electronics, industrial biotechnology and photonics. The Commission recognizes their value for industrial competitiveness and encourages their further development by means of state aid and procurement, and by coordinating research and innovation.

13.5.5 Policy Measures for Higher Education and Training

Education and employment are a priority for Europe 2020. Investment in education has two very specific objectives: to reduce the ratio of early school leavers from 20\% to 10\% and to increase the share of the population with tertiary education from 31\% to 40\%. The first objective is achieved by using prevention, intervention and compensation mechanisms. The second through actions to (1) broaden access to higher education by removing financial barriers to education, (2) reduce drop-out rates and the time it takes to complete a degree by counseling and guidance, and (3) improve the quality and relevance of higher education.

In 2010, the European Commission launched several initiatives to address these two objectives. As noted earlier, Europe 2020 also aims to achieve full employment for 75\% of the working-age population, an objective that may require member states to implement more flexibility and security in the labor market by promoting reform in contractual agreements, lifelong learning strategies, labor market policy and social security systems.

Support for disadvantaged regions is part of Europe 2020’s objectives on human capital development. This includes support to projects in the

\textsuperscript{10} eHealth refers to the application of ICT to the health sector such as by using it to improve prevention, diagnosis, and monitoring, and to facilitate data sharing between patients, hospitals or professionals.
areas of lifelong learning, modernization of the work environment, access to employment for disadvantaged populations, and education reforms and training systems. The main objectives of all these initiatives are to increase the adaptability of workers, firms and entrepreneurs to the challenges of structural adjustment in the EU, and to help overcome language and cultural barriers within the EU.

13.5.6 Public–Private Partnerships

Public–private partnerships play a very significant role in EU industrial policy, for two reasons. On the one hand, the European Commission recognizes the role of networks and cooperation in knowledge creation. On the other, these initiatives seem to be tailored to solve the ‘European paradox’ in which the EU leads in basic research, but is unable to translate this into commercial innovation and competitive advantage (Dosi et al. 2006). In this context, public–private partnerships bringing together policymakers, research and industry appear the best locus for innovation.

As noted earlier, the Framework Programmes for Research and Technological Development, including New Horizon 2020, strongly emphasize public–private interactions, but there are also specific initiatives to stimulate this cooperation more directly, including the European Technology Platforms, Joint Technology Initiatives and public–private partnerships.

European Technology Platforms
These focus on five technology areas: ICT, energy, biotechnology-based economy, production and processes, and transport; and are aimed at priority-setting activities to shape the agendas of research funding schemes. A public–private interaction is therefore at the heart of setting the specific vertical activities that EU policy targets. The platforms, meanwhile, create only informal networks.

Joint Technology Initiatives
These are fairly ambitious, industrially driven R&D programs, mainly tailored to key strategic technological areas (European Commission 2007c). Joint Technology Initiatives operate as a subset of the European Technology Platforms by granting financial contributions and fiscal exemptions that other projects in the Framework Programmes for Research and Technological Development do not receive. Funding can come from the framework programs, Structural Funds, the EIB and national sources.

Even though the selection and funding of Joint Technology Initiatives have to follow the rules for state aid (that is, a research project should
Public–private partnerships
These have been developed as a tool for funding research and innovation. They differ from the European Technology Platforms in their focus on sustainability. The three public–private partnerships established in 2009 are Factories of the Future, Energy-efficient Buildings, and Green Cars. All have similar budgets, although Green Cars receives a €4-billion loan from the EIB in addition to its regular grant. Under Horizon 2020, public–private partnerships are extended to additional areas; among them, robotics, phonics and biotechnology.

13.6  TOOLS OF INDUSTRIAL POLICY AT THE NATIONAL LEVEL

Experience with industrial policy among EU member countries has been varied, but the centralization of some policy matters at the EU level has generated a convergence of priorities and policy orientation.

France, after a long history of selectivity and grand projects, started using horizontal policies to overcome market failures and to foster competition, without excessively distorting the market mechanism. The conversion of French industrial policy was, to a large extent, a reaction to the idea that national industrial policy had become difficult to sustain after the Maastricht Treaty (Cohen and Lorenzi 2000).

The UK’s industrial policy experience is similarly interventionist, followed by a more neutral stance. According to Beath (2002), the difference between policy in the UK in the 1960s and today lies in the new policy instruments used rather than in the themes, namely, competition and technology. The key repository of innovation policy in the UK is represented by the Technology Strategy Board, which the government set up in 2007 to finance private sector investments in innovation and to promote access to UK and EU funding schemes and network opportunities for them. The board also advises the government on innovation policies by leveraging its contacts with the business world.

According to Fioretos (2001: 237), German views on industrial policy fall ‘roughly between the British minimalist and French maximalist
Development and modern industrial policy in practice

positions.’ Feldenkirchen (1999) characterizes German industrial policy as fluctuating between a market-oriented and an interventionist view. Regardless of political orientation, horizontal policies in Germany aimed at improving the business environment were accompanied by policies supporting specific industries or firms.

Historically, German policy has fallen into three categories: domestic protection to guarantee domestic supplies or military security, policies to alleviate social issues connected to structural adaptation, and strategic policies to support promising industries. The first two have traditionally been mainstays of Germany’s industrial policy, while the latter was introduced in the 1970s and has progressively gained more influence.

The following sections present examples of national policies for various industrial policy instruments.

13.6.1 Investment Policy

Financial and fiscal incentives are managed at the national and not the EU level (European Commission 2001). Member states’ policies present differences as well as commonalities. For example, in Germany, investment policies are essentially regional in character regardless of the investor’s origin, with a greater chance of support for investments if they are in eastern Germany.

Ireland, by contrast, has focused its latest policy efforts on attracting foreign direct investment and creating local industries around them. The commonalities include a preference for tax rather than financial incentives and a focus on innovation.

Several other member states also offer favorable tax regimes to attract firms. The Netherlands’ tax regime has made it a very attractive location for global businesses. Corporate tax rates are among the lowest in the EU.

The UK is in the process of gradually reducing corporate tax rates. Rules for controlled foreign corporations, unchanged for 25 years, are now undergoing the biggest transformation in the country’s reform of its tax regime. This is needed to adapt the tax system to the changes in how global business is conducted and to enhance the system’s competitiveness. Such changes should ensure a fairer system by taxing artificially diverted UK profits without interfering with businesses. The main direction of these reforms for controlled foreign corporations is to tax profits from UK activity rather than the worldwide income of a group to the UK. Importantly, this is being conducted in consultation with the private sector.

The variations in the tax systems of EU member states create a ‘race to the bottom’ tax competition that has generated an interesting debate on
whether EU taxation needs increased harmonization (see Sørensen 2004; Zodrow 2003).

13.6.2 Science, Technology and Innovation Policies

While science, technology and innovation are common objectives of industrial policy in Europe, specific actions vary considerably across the major economies. EU countries support private industrial R&D in various ways, including traditional public procurement mechanisms, financing of large R&D projects in strategic industries and public–private partnerships for innovation projects and R&D tax incentives.

Science, technology and innovation policies in the UK are primarily focused on private business and financing for basic research when there is joint interest for industry and higher education. By contrast, the French and, especially, the German governments offer large funding resources to public research centers and universities.11 In all three countries, however, project-based financing is the main form of support. In Germany, projects need to be mission oriented (that is, related to a specific research area and for a fixed term).

Following the example of the Key Enabling Technologies and the Lead Markets Initiative, some governments have adopted a long-term view in the selection of strategic sectors to invest in. For example, Germany has focused on key emerging technologies and forward-looking projects in the fields of sustainable energy, health, mobility, security and communication.

In a similar vein, the UK’s Foresight Programme identifies food and farming, land use, mental capital and well-being, sustainable energy, construction and obesity as key priorities that combine a need for long-term thinking with the need to tackle current societal needs. Together with this project, the UK supports investments in industrial projects under the UK Strategic Investment Fund. The partnership with Rolls-Royce to develop low-carbon-emitting aircraft engines is an example.

In the French tradition of grand projects, meanwhile, the Agence de l’Innovation Industrielle supports industrial capabilities by creating, selecting and backing large R&D industrial programs. Its priority areas include health, information and communication technology, construction, transport, biofuels, energy and the environment.

As well as EU-level initiatives to involve the private sector in the policy-making process, member states have their own initiatives for this. In

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11 See the Excellence Initiative, Joint Initiative for Research and Innovation and the Higher Education Pact in Germany, and the projects financed by the National Agency of Research in France.
Germany, the initiative Innovation Alliances is directed toward thematic, long-term cooperative projects with high strategic potential. For financing, the federal government puts up one euro to a firm’s five. Projects are selected on the basis of their innovative content and they should be breakthrough technologies that can sustain German competitiveness.

In line with the EU focus on innovation, tax systems in many member states include incentives for research and development. For R&D tax incentives, the European Commission provides guidelines to ensure that member states’ tax systems are geared toward the implementation of EU strategies and priorities and do not harm the common market (European Commission 2006b).

Research and development tax credits in the Netherlands effectively lowered the costs of R&D for Dutch firms from 1996 to 2004 and stimulated investment (Lokshin and Mohnen 2007). The Dutch tax system also contains a fiscal tool that creates incentive to invest in intellectual property: the patent royalty box, which has been in place since 2007. This makes the Netherlands one of the pioneers of such tools. The UK adopted a similar fiscal tool, the Patent Box, in 2013, which provides tax relief of 225%, or £2.25 for every pound invested in patents, and a corporate tax rate of 10% on all profits coming from the patent. Although this is seen as an improvement on the previous R&D tax system, based on relief of capital expenditure, there is no incentive in the Patent Box to develop new technologies or to invest additional resources in R&D. This reform is seen as necessary to adapt to the new trends in modern business practices, whereby intellectual property is often the result of cooperation between actors from different countries. As a consequence, many firms used to register their intellectual property in other EU countries with more favorable conditions than in the UK. That this happened is not only a failure of the UK tax system, but also of EU coordination efforts.

13.6.3 Cluster Policies

These refer to bottom-up measures to stimulate the rise and growth of productive clusters. This is the basis of the idea of smart specialization. Clusters are considered engines of growth and innovation because they stimulate interaction among customers, suppliers, competitors and research institutes located in the same area. Following the examples of productive industrial clusters in Emilia-Romagna (Italy) and Baden-Württemberg (Germany), policies at the EU and national level try to reproduce these environments.

France, Germany and the UK have all either set up or are setting up high-profile programs for cluster policy. In France, so-called Poles of
Competitiveness bring together the three major actors of the French innovation system: universities, research centers and private firms. With a budget of €1.5 billion, Poles of Competitiveness aim to create partnerships characterized by complementary expertise to encourage collaborative R&D projects in strategic areas and to ensure framework conditions favorable to innovation. Participating firms also benefit from tax exemptions if they conduct R&D in the cluster and if they are part of a state-approved collaborative project.

In Germany, the Top Cluster Competition promotes industrial clusters using a competitive process. Each competition round, which is held every one-and-a-half years, is allocated a budget of up to €200 million. Winning clusters have so far concentrated on priority technological fields such as health, biotechnology, energy, mechanical engineering, aircraft and electronics.

In the UK, the Technology Strategy Board has been charged with establishing nine excellence centers following the model of Germany’s Fraunhofer-Gesellschaft, Europe’s largest application-oriented research organization. These centers of excellence were launched under the name ‘Catapult,’ the first of which was set up in 2011. They focus on high-value manufacturing and have a six-year budget of £140 million. Other Catapults launched or being launched focus on cell therapy, offshore renewable energy, satellite applications, connected digital economy, future cities, transport systems, diagnostics for stratified medicine and energy systems. Similar to related initiatives in France and Germany, these centers aim to reap the benefits of the geographical concentration of innovation activities, and to foster links between universities, research centers and the private sector (Technology Strategy Board 2011).

Lack of selectivity is seen as a critical issue for France’s cluster policy. In 2005 France supported 66 clusters out of 105 applications requesting financial support. By contrast, Germany’s cluster competition incorporates the concept of selectivity under a rule that allows the selection of a maximum of 5 clusters in each round of competition. The promotion of clusters in the UK has always been influenced by government selection of what clusters to support. This is made on the basis of their technological specialization, and preference has traditionally been for the automobile industry, ICT, creative industries, media, food and drink, and biotechnology (Bailey and Driffield 2007).

### 13.6.4 Promoting SMEs

Small- and medium-sized enterprises are common targets of industrial policy due to their perceived important role in the economy and to their
difficulties in accessing finance and other limits imposed by their size. At the EU level and under the Seventh Framework Programme, only a few schemes offered incentives to spur SME growth. More support for SMEs has been allocated across the different components of Horizon 2020, with particular focus on supporting SME innovation capacity. Member states, however, have more active policies for promoting SMEs, likewise the main thrust is innovation and improving access to finance, especially for R&D.

In Germany, three main initiatives specifically aim at funding the R&D projects of SMEs: the Central Innovation Programme, the ‘KMU-innovativ’ program and the High-Tech Gründerfonds. The first has no restriction on sectors and thematic areas, while the second finances only projects in biotechnology, ICT, nanotechnology, production research, optical technologies and resource and energy efficiency. The High-Tech Gründerfonds targets innovative start-ups and offers venture-capital-like services.

In the UK, SMEs are eligible for 225% tax relief, or £2.25 for every pound invested in allowable R&D costs. By contrast, large companies are entitled to 130% relief. The cost of this policy is estimated to be £1.1 billion a year. The tax relief is available only if R&D projects aim to advance knowledge or capability in a field of science or technology through the resolution of an uncertainty and if it is related to a firm’s actual or future trade. It may not be used simply to advance a firm’s own knowledge or capability or for a commercially innovative product. Several programs also provide financing to innovative SMEs, including project-based R&D grants, information services and guidelines to develop research ideas within the framework of procurement procedures for government departments (for example, the Small Business Research Initiative), and various funds to close what the government calls the ‘equity gap’. The gap is the differential between the demand for equity by high-technology SMEs and start-ups and the unwillingness of investors to share innovation risk. The Technology Strategy Board also addresses high-potential SMEs by facilitating partnerships with the public sector under the Knowledge Transfer Partnerships program.

13.7 A SUMMARY OF INDUSTRIAL POLICY INSTRUMENTS

European industrial policy offers a mix of horizontal and vertical measures. Horizontal policies aim to create a favorable environment for growth, basically in education, research competition policies and investment in infrastructure. Vertical interventions are generally at the EU level,
but become more specific at the national level. At the EU level, targeting largely implies coordination and financing of public–private partnerships and collaborative R&D in selected technological fields, ‘educated visions’ and guidelines on specific tools, such as state aid. Targeted sectors are expected to generate high growth, to sustain future industrial competitiveness and to address societal challenges. Table 13.1 summarizes targeted sectors at the EU level, and specifically for France, Germany and the UK.
Table 13.1 well illustrates the EU’s ambition to be a leader in highly strategic technologies. The inclusion of some sectors, the recurrence of others, and the practice of establishing priorities after consultations with industry stakeholders suggest a lobbying process in the workings of industrial policy that is more evident in some contexts than others.

This chapter has so far shown that the EU, as well as individual member countries, has an active industrial policy program, and uses both horizontal (general) and vertical (sector-specific) tools. Industrial policy plays a key role in the EU economy, and takes the form of a science, technology and innovation policy, particularly at the European Commission level. However, challenges and risks to it could affect developments in the EU and the global economy—for example, in how the global economy emerges from the economic crisis that started in 2008—and the way the EU implements industrial policy.

13.8 THE OLIGARCHIC CORE IN EUROPEAN INDUSTRIAL POLICY

European Commission policies to stimulate research and technological development are organized in a bottom-up approach under the Framework Programmes for Research and Technological Development. The budget for the program is determined before its start and is allocated in tranches to specific topics for which calls for proposals are launched. The majority of calls targets consortia and collaborations between public and private research centers, industry and universities, and often require international collaboration. The logic behind this process is to stimulate knowledge spillover among partners. Nevertheless, spillover is limited because partners do not necessarily collaborate (intensely) on projects.

Breschi and Cusmano (2004) note that the framework programs have led to the unintended creation of an ‘oligarchic core’ of industry, academics, technology leaders and public actors.¹² There is considerable competition to win project grants in this process and much to gain from national, regional and sector-specific representation, as is evident by the sizable presence of lobby groups in Brussels. The lobbying targets all stages of the process, starting with determining the content of the program. This involves consultations between European Commission officials from various departments, known as Directorates-General, and

¹² Coen (1998) finds that some firms recognized more quickly that political representation at the national level decreased in importance, while lobbying at the EU level became more rewarding.
representatives of member states and organizations that will participate in the research. Lobbying extends to the phase in which the consortia prepare project proposals, which is when the Commission is of particular interest to lobby groups, as its officials have influence on the precise content of what the Directorates-General want to achieve with a particular call for proposal.

The involvement of member-state governments, the private sector and research organizations generally leads to an efficient implementation of industrial policies because the instruments are precisely calibrated to the needs of the organizations that the policies target. That said, the lobbying can mean that funding does not flow to the regions and sectors most in need, but rather to those with a strong voice.

A particular risk of this lies in the potential difficulty to reorient the network toward higher growth areas. Lobbying and public–private partnerships can result in a reluctance to implement new EU policy reforms as well as substantial differences in the impact of policy across countries. For example, Stenzel and Frenzel (2008) find that in the UK and Germany, incumbents hindered technological development in renewable energy by blocking structural market change. However, the authors also find that incumbent firms drove regulatory change in Spain, thus generating a supportive environment for the development of firms’ capabilities.

13.9 MONITORING THE INDUSTRIAL POLICY PROCESS

The European Commission, comprising the commissioners of the Directorates-General, coordinates EU industrial policy; it seeks to ensure regulatory quality throughout the policy cycle, from policy design to implementation, enforcement, evaluation and revision. Regulatory quality is checked under a process called ‘smart regulation,’ the aim of which ‘is to design and deliver regulation that respects the principles of subsidiarity and proportionality and is of the highest quality possible’ (European Commission 2010d: 3). In short, smart regulation refers to the governance structure of the European Commission, whose evaluation criteria include relevance, efficiency, effectiveness, impact and sustainability (European Commission 2004a, 2004b), as well as analysis of the cost benefits and unintended effects of policy.

Part of the policy drafting process is the analysis of the impact assessment (welfare analysis) of policy proposals. This is intended to ensure that policies are grounded on the basis of balanced evidence. Unlike US impact assessments, those in the EU are conducted prior to political debate and
have a broad policy orientation (Close and Mancini 2007). Impact assessments are of similar importance to *ex-post* evaluations of policy.

In the field of industrial policy, impact assessments—which are intended for competitiveness-proofing—apply to policy proposals deemed to have a significant impact on industrial development. This includes policy proposals for new internal market legislation and financial market regulations. They assess ‘investment, cost, price, and innovative implications for industry and individual sectors, as well as consumer satisfaction and taking particular account of the potential interactions between a policy proposal and other existing or planned legislation and regulation’ (European Commission 2010a: 5). The steps of the impact assessment are (1) identifying the problem, (2) setting objectives, (3) defining policy options, (4) assessing impacts, (5) comparing policy options, and (6) outlining policy monitoring and evaluation options. An important component is the consulting of stakeholders and external experts (see European Commission 2002 for guidelines on the use of external experts in impact assessments). The involvement of the private sector in the process improves understanding of problem areas and the feasibility of the policy proposal.

In 2006, the European Commission established an independent board to evaluate the quality of impact assessments in support of the Commission and other EU institutions (European Commission 2012). The board also aims to ensure that policy proposals are in line with the principle of subsidiarity, and it can request a revision of an impact assessment before the publication of the assessment report and the follow-up legislative process. European Commission framework proposals and projects are subject to midterm, end-term and annual evaluations. For example, the progress report on the Europe 2020 Strategy (European Commission 2011) provides an overall review of the state of policymaking and suggestions. The reports include requests to member states to prioritize funding for sectors showing high growth potential. The *ex-post* evaluation of the effects of legislation on competitiveness helps identify ‘new opportunities for improving the quality of legislation, including simplification and administrative burden reduction’ (European Commission 2010a: 6). Similarly, the EIB’s operations plan (EIB 2011) includes an assessment of overall targets for disbursements, financial sustainability and the value-added of financed projects.

Although European institutions govern the overall EU industrial policy framework, a significant part of industrial policy is implemented at the country level. To monitor the progress of initiatives, the European Commission regularly monitors the level of competitiveness and industrial policies in member states. The European Commission (2010b) defines
targets for progress on coordination and monitoring at the EU-level and on EU coordination with member states. Assessment measures focus on four trends in the economies of member states: (1) productivity and cost developments relative to international competitors; (2) creation of jobs in the industrial and related sectors; (3) growth in manufacturing output, with particular reference to developments in eco-industries;\textsuperscript{13} and (4) the contribution of medium- and high-technology manufacturing sectors to value-added and employment.

Based on the Lisbon Treaty (Article 173), the European Commission coordinates with the European Council and European Parliament, and both jointly review assessments of member states’ progress toward treaty objectives and assess member states’ industrial policy efforts. The Competitiveness Council and the European Parliament oversee the monitoring of competitiveness and policies for competitiveness. Recommendations are carried forward to national reform programs. For the development of the industrial sector, these include research and innovation, intellectual property rights, skills training, regulation in the single market, energy and environmental challenges, international markets participation, policies for decreasing administrative burdens, access to finance and the design of industrial policies that are specific to member states.

Despite the increase in demand for transparency and the number of guidelines, the EU does not systematically monitor or evaluate industrial policy, largely because it does not have systematic and consistent set of guidelines for this (rather than a lack of effort). Another factor is that because it’s industrial, innovation and regional policy is so broad, evaluations require a range of approaches to assess the policy impact.

Monitoring and evaluating industrial policy has also become more complex due, among other things, to (1) the partial shift from vertical toward horizontal policy, (2) the integration of industrial policy into related policy areas (innovation and regional policies), (3) the shift toward investing in sectors important in the value chains for overall industrial development, and (4) the change toward a systemic industrial policy approach. These changes imply that there is no longer a single policy instrument that steers industrial development, instead policies are more interrelated. Furthermore, policies focus on stimulating long-run growth.

\textsuperscript{13} OECD and Eurostat define eco-industries as activities that produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems. This includes technologies, products and services that reduce environmental risk and minimize pollution and resources such as waste and waste-water management, renewable energy sources, environmental consulting, air pollution and control and eco-construction. See http://ec.europa.eu/enterprise/glossary/index_en.htm (accessed 2013).
and evaluations may occur years before the policies yield returns. Also the spillover effects of industrial policy on labor markets, education and international trade are difficult to measure, even though, for several policies, the spillover effect is arguably more important than the direct impact. For example, investment in research is intended to have a positive effect on industrial innovation processes.

The evaluation of industrial policy is particularly complex because of the difficulty in attributing the policy intervention to all stakeholders of a project. Stakeholder analysis and detailed expert assessments, such as modeling the potential impact of policy reforms, are therefore an important part of the policy assessment process. Despite the rather pessimistic conclusion on the overall state of monitoring and evaluation in the EU, there are nevertheless many examples of good monitoring and evaluation of policy initiatives.

Because a systematic, ex-post approach to evaluation is largely missing, specific evaluation practices are often instead used in specific fields. For example, because evaluation practices in innovation lack rigorous study, Technopolis and the Manchester Institute of Innovation Research (Technopolis and MIOIR 2012), with European Commission support, have published a guide to evaluate innovation activities. The focus is on the evaluation of the following policies: (1) university–industry cooperation networks and platforms for science; (2) strategic research programs, centers and infrastructure; (3) advisory, innovation management, technology transfer and training services to innovative firms; (4) funding for innovative companies; and (5) cluster policies.

According to a study on the use of European Commission evaluations conducted by the European Policy Evaluation Consortium (2005), evaluation studies have an impact on policy design and intervention and on reallocations of resources within a given policy scheme. Nevertheless, this study also reveals that, overall, political rather than efficiency motives influence the allocation of resources to a policy.

Mosselman and Prince (2004), in a report reviewing evaluation practices on aid to SMEs in member states, find wide variations in the degree to which state aid is evaluated. As they point out, ‘one sixth evaluates all state aid to SMEs, two thirds evaluate some state aid to SMEs and one sixth does not evaluate state aid to SMEs at all’ (Mosselman and Prince 2004: 5). The authors also find that the scope of evaluation and the focus and methods of evaluation implemented across the EU differ substantially. For example, industrial policy evaluation in the Netherlands focuses on assessing the extent to which policy adequately responds to its objective. In Slovakia, state aid is evaluated using input–output analysis comparing the characteristics of aid recipients with non-aid recipients.
Measurement criteria implemented include value-added, profits, taxes, exports and number of employees (Mosselman and Prince 2004). The monitoring and evaluation process of industrial policy by national governments may have strengthened following the EU emphasis on accountability and countries’ progress toward common industrial policy initiatives.14

Technopolis and MIOIR (2012) provide a more recent overview of the methods and practice of the evaluation of innovation activities. Similar to the findings in Mosselman and Prince (2004), the study concludes that some member states focus more on qualitative methods of evaluation and others on quantitative methods. Furthermore, the policy impact on the wider community is less frequently analyzed than the impact on the direct project participants. Common evaluation tools include descriptive statistics, input–output and cost–benefit analysis, counterfactual approaches, case studies, network analysis, before-and-after group comparison approaches and microeconomic modeling.

13.10  INDUSTRIAL POLICY AND THE FINANCIAL CRISIS

Since the financial crisis of 2008, EU industrial policy programs have become more important as fiscal policies in several member states have become severely restrained. Initially, to stimulate recovery, EU programs worked in cooperation with regional policy to help ensure access to finance for the private sector, but the crisis soon had a wider impact on industrial policy. At the macroeconomic level, and influenced by the requirements of monetary union, the solution to the crisis was thought to be a question of public sector austerity. When this did not stimulate the economy, policymakers turned to a broad form of industrial policy to stimulate long-run growth. The general idea was that, while austerity could provide sound long-run macroeconomic conditions, an investment program was needed to stimulate long-term growth. In line with the pre-crisis industrial policy, this investment program, although at that time not clearly specified, targeted specific activities such as the environment (green growth) and technology development. The EIB envisaged an important role for itself in such a program, although it remains largely unspecified.

14 For example, see Lenihan et al. (2007) for a study on industrial policy evaluation in Ireland.
13.11 INDUSTRIAL POLICY AND THE EU BUDGET

The EU budget is divided into four main expenditure groups: (1) management of natural resources, mainly direct aid to agricultural markets; (2) cohesion for growth and employment, which mainly comprises the structural and cohesion funds; (3) competitiveness for growth and employment, which, prior to Horizon 2020, included the Seventh Framework Programme, lifelong learning strategies, the Competitiveness and Innovation Framework Programme and energy projects; and (4) other expenditures, which include funds for pre-accession instruments and administrative costs (Figure 13.3).

Most EU expenditures directly target industrial policy or are closely related to it. In terms of expenditures, industrial policy programs aimed at stimulating growth and development are overshadowed by sectoral priority programs, such as agriculture and the promotion of social cohesion. As such, the costs of the growth program, such as public–private partnerships, innovation platforms and training programs, are far less expensive than agricultural support programs.

The role of the European Commission in stimulating industrial development has grown in terms of the budget dedicated to industrial policy and related expenditures, mainly because of the addition of new member states, which has increased overall contributions to the EU budget. The budget increased significantly in 2004 when Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and Slovakia joined, and again in 2007, when Bulgaria and Romania started contributing. The funds allocated to the new members only became substantial from the year these countries contributed. Prior to becoming members, they did receive pre-accession funding (categorized in Figure 13.3 under ‘Other’). As a result of the multi-annual programs and budgeting, the allocation of funds has steadily increased since 2001.

Figure 13.4 shows that despite the EU’s enlargement during 2000–2011, the EU budget has increased from 0.8% of the contributing member states’ GDP to just over 1% (here, the ratio of expenditure to GDP is based on the EU countries that contribute to the budget in a given year). Because some members are net contributors and others net recipients, the EU budget is subject to fierce political discussion.

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15 Prior to the Seventh Framework Programme, these objectives were presented under the following budget categories: internal policies, structural actions and agriculture.

16 Pre-accession instruments are the means by which the EU provides assistance to (non-EU member) countries that are engaged in the accession process to the EU.
result of the financial crisis, political pressure to reduce national contributions has increased, with the EU budget for 2014–20 interrupting the increasing trend. The politicization of funding toward industry is a growing risk.
13.12 STATE AID

This section provides an overview of state aid based on the amounts of aid available from the European Commission State Aid Scoreboard. This is the instrument by which the European Commission benchmarks total state aid expenditures (and foregone revenue such as for tax exemptions) of all member states, as regulated under Article 107 of the Treaty on the Functioning of the European Union. State aid is classified according to the primary objective and includes aid for the environment; regional development; research, development and innovation; SMEs, training and employment aid; culture; tackling natural disasters; social aid; and sectoral aid, such as for the coal, financial services and manufacturing industries.

State aid expenditure decreased over 1992–2001 (Figure 13.5). In the early 1990s, state aid as percentage of the 27 member states GDP dropped from over 1% to less than 0.6 percent, and has fallen to even lower levels in several EU countries (Bianchi and Labory 2006). To some degree, the entry of new member states explains peaks in state aid and the level of state aid as a percentage of GDP of these countries was higher than the EU average.

Despite the restrictions on state aid and its decline, it still represents a large part of national budgets dedicated to projects and issues regarded as industrial policy. Figure 13.6 shows total expenditure on industrial policy as a percentage of total EU GDP in 2011. Relative to expenditure on industrial policy and related areas, state aid represents a substantial 36% of the total.

State aid is implemented using different financial vehicles, such as grants, tax reductions, equity participations, soft loans and guarantees. As shown in Figure 13.7, there is considerable variation in the implementation of state aid instruments across EU countries. Overall, most state aid is distributed in the form of grants, followed by tax deductions.

13.13 CONCLUSIONS

Since the 1951 launch of the European Coal and Steel Community, industrial policy in Europe has been frequently reformed. EU enlargement and global economic developments, such as structural change toward a specific set of industries and technologies have been the main drivers. Today, EU industrial policy has a strong horizontal component and focuses on stimulating advancement in science and development in technology.

17 State aid data includes total noncrisis aid excluding aid for railways.
Industrial policy in the European Union

Notes:
GDP = gross domestic product.
The chart includes 27 members of the European Union, but does not include Croatia, which joined in July of 2013. GDP percentages in the chart refer to EU-27, with: (1) Austria, Finland and Sweden from 1995 onward; (2) EU-10 (Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, and Slovakia) from 2000; and (3) Bulgaria and Romania from 2002.


Figure 13.5  Trend in total value of state aid, EU, 1992–2011


Figure 13.6  Total expenditure on industrial policy, EU, 2011
Development and modern industrial policy in practice

and innovation. Although the European Commission started off with a plethora of policy instruments, different programs have converged over the years into a common platform that provides a better overview of the instruments available to industry, start-ups and researchers. European Union funds for industrial policy have also increased with enlargement and the integration of the common market.

The common market has also reduced the choice of EU countries in the implementation of policy instruments. Remaining policy discretion in member states is fundamentally important, allowing the adjustment of policy instruments to the needs of domestic industries. National industrial policy has more sectoral focus, is subject to frequent reform and the distribution of funds appears to be sensitive to cyclical trends.

Despite the strong horizontal component of industrial policy, there is also a strong vertical dimension. This is because the structural change—or structural adjustment as the EU likes to call it—is an important underlying factor for industrial policy. The EU regards the changing sectoral composition of the global economy as a challenge and opportunity for European firms, and it wants to stimulate them to adapt to structural adjustment. While some may associate such a view of industrial policy mostly with developing economies, it is clear that even for an

Note: This excludes aid to agriculture, fisheries and transport.


Figure 13.7 State aid to industry and services by financing instrument, EU, 2008–10
advanced region there are motives for industrial policy to target specific sectors.

Structural change is perceived to be biased in the direction of knowledge-intensive activities, and hence industrial policy aims at knowledge generation and diffusion. This is helped by the notion of subsidiarity, which prevents the European Commission from implementing many of the ‘traditional’ industrial policy instruments applied at the member-state level.

The resulting industrial policy setting in the EU is large-scale and complicated. This chapter’s overview of the policy instruments, though not covering all areas, nevertheless reviews a large set of initiatives, measures and instruments. The implementation of industrial policy involves many actors from several government levels (regional, national and supranational), and large-scale professional organizations, such as Directorates-General of the European Commission. The involvement of private sector firms and public and semipublic research organizations in policy, important though it is, nevertheless increases the complexity of policy setting, and, potentially, its effectiveness.

Such a policy setting presents opportunities and risks. Among the former, industrial policy addresses a real need for increasing competitiveness, which the EU needs in its struggle to remain a global economic leader. As for the latter, this chapter has pointed to the issues of lobbying and monitoring and evaluation. On a larger scale, such risks are perhaps best illustrated by the transition from the ambitious Lisbon Strategy, which wanted to make the EU the most competitive knowledge economy in the world, to Europe 2020. Despite elaborate policy efforts, this goal has not been achieved, though this is not to say that the Lisbon Strategy was ineffective. Monitoring and evaluation tools remain too crude to form a well-founded, overall verdict on the effectiveness of European industrial policy.

All the same, many individual policy successes exist, and micro-based evidence may well be a better way to evaluate and identify successful industrial policy rather than to try to assess the grand challenges of the Lisbon Strategy or the Europe 2020 challenge. Setting these challenges may be needed to provide the political and societal support for mobilizing the significant resources that go into industrial policy, though they may not be the right vehicle for impact evaluation.

REFERENCES

Aiginger, K. and S. Sieber (2005), ‘Towards a renewed industrial policy in Europe’, prepared as Chapter 1 for the background report of the Competitiveness


### APPENDIX

#### Table 13A.1 Industrial policy instruments in the European Union

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Description</th>
<th>Outcome</th>
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| Fiscal incentives| **United Kingdom**  
Gradual reduction of corporate tax rates from 24% in 2012 to 23% in 2013 and 22% in 2014  
Small- and medium sized enterprises (SMEs) eligible for a 200% tax relief on allowable research and development (R&D) costs (increased to 225% in April 2012); large companies eligible for 130% relief if R&D costs are at least £10,000 per year  
Reform of taxation for controlled foreign corporations by taxing profits from United Kingdom (UK) activity rather than worldwide income of a group to the UK  
Patent Box scheme involves tax relief of 225% for every pound sterling invested in patents and a favorable corporate tax rate of 10% on all profits coming from the patent  
Sector-specific tax for green (Enhanced Capital Allowance Scheme) and creative industries (animation, high-end television and video games) | Impact of corporate tax reform and SME tax relief yet to be determined  
Tax reform for controlled foreign corporations, designed in consultation with the private sector, seeks to tax artificially diverted UK profits, while not taxing profits (genuinely) originating from activities conducted abroad  
Patent Box scheme launched in April 2013 to adapt to the new trends whereby intellectual property (IP) is often the result of cooperation between actors from different countries. Many firms currently register their intellectual property in other European Union (EU) countries with more favorable conditions. Details on Enhanced Capital Allowance Scheme available at: http://etl.decc.gov.uk/ |
| Netherlands      | Corporate tax rate is 20% for the first €200,000 and 25% thereafter                                                                                                                                         | Impact of corporate tax reform and SME tax relief yet to be determined  
Tax reform for controlled foreign corporations, designed in consultation with the private sector, seeks to tax artificially diverted UK profits, while not taxing profits (genuinely) originating from activities conducted abroad  
Patent Box scheme launched in April 2013 to adapt to the new trends whereby intellectual property (IP) is often the result of cooperation between actors from different countries. Many firms currently register their intellectual property in other European Union (EU) countries with more favorable conditions. Details on Enhanced Capital Allowance Scheme available at: http://etl.decc.gov.uk/ |
The Patent Royalty Box is a fiscal tool to incentivize intellectual property by offering more favorable tax rates for profits originating from IP. Launched in 2007, the Netherlands is one of the pioneers of such tools. Initially 10%, reduced to 5% in 2010. Losses are deductible at the general rate of 25%, R&D costs are deducted upfront. Firms are eligible for an R&D deduction of 42% of the first €100 000 in R&D wage costs and 14% for the remaining amount. Start-up companies are allowed a 60% deduction of the first €100 000. Foreign companies can agree in advance on tax treatment on future investments in the Netherlands (advance tax ruling).

Germany

The Investment Allowance is a special incentive program created in 2008 to promote investment in the former East Germany through a tax-free cash payment or tax credit automatically given to firms. The Joint Task Program for the Promotion of Industry and Trade offers grants for investment costs throughout Germany, with the amount depending on the investment and wage costs, and on the localization of the investment. The regions of eastern Germany provide the largest grants: 50% of the investments to small firms, 40% to medium-sized firms and 30% to large firms.

The Dutch tax regime makes the Netherlands an attractive location for businesses with global operations. Lokshin and Mohnen (2007) studied the effect of the R&D deduction on Dutch firms in 1996–2004 and found this policy tool was effective in lowering the costs of R&D and stimulating investment. The standardized process of advance tax ruling ensures clarity and certainty for future transactions.

According to Ernst and Young’s European Attractiveness Survey in 2012, Germany has recently increased its appeal as a destination for foreign direct investment (FDI). Investors identified quality of infrastructure, economic stability, industrial and exporting power, local expertise and better economic outlook as primary strengths.
### Table 13A.1 (continued)

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<th>Instrument</th>
<th>Description</th>
<th>Outcome</th>
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| Fiscal incentives| Ireland                                                                     | Low corporate tax rate; generous exemptions; absence of legislation on controlled foreign corporations; and the efficient use of EU funds make Ireland an extremely attractive business location in Europe
|                  | A favorable corporate tax regime is a cornerstone of Irish industrial policy | A total of 148 FDI-related projects were approved in 2011, 28% of which were outside the most developed cities (Dublin and Cork). More than 50% of the investing companies came from the United States, generating employment in international and financial services (accounting for almost half of the jobs created), with medical and dental supplies and instruments and pharmaceuticals accounting for much of the remainder |
|                  | FDI attraction is also achieved through investment in education and the training of local workers |                                                                                                                                                                                                                                                                                                                                       |
|                  | Many infrastructure projects are financed under the Structural Funds       |                                                                                                                                                                                                                                                                                                                                       |
|                  | About €82 billion was planned on transport at the EU, national and regional levels in 2007–13, an increase of 65% over 2000–2006 |                                                                                                                                                                                                                                                                                                                                       |
|                  | Transport strategies proposed by member states and regions have to seek a balance between road, rail and sustainable transport modes. Priority in this field is given to the trans-EU transport |                                                                                                                                                                                                                                                                                                                                       |
network launched in 2006. Investments in this project are estimated at €1.5 trillion for 2010–30, financed from the Cohesion Fund, the European Regional Development Fund and European Investment Bank loans and credit guarantees.

The EU also defines a particular set of infrastructure—known as research infrastructure—as physical infrastructure (the facilities) and the information-and-communications-technology-based research communities needed for EU research projects. This is financed under the Seventh Framework Programme (2007–13), with a budget of €1.8 billion (roughly 3% of the total program budget). Recently financed projects include upgrades of existing infrastructure, investment in new research infrastructure and the formation of networks through which leading actors in specific scientific fields exchange data and cooperate in research.

TENT-T is an initiative for an EU-wide transport network launched in 2006, with a budget of more than €1.5 trillion for 2010–30.

Trade measures

The 27 EU countries implement a community customs code that implies that they act as one when it comes to trade policy. These rules not only regulate common tariffs, but all aspects of trade policy, such as nontariff instruments, preferential trade, health and environmental regulations, and national and EU import duties.

Article 23 of the European Community Treaty stipulates free circulation for community goods throughout the EU. This principle applies to goods made in the EU and imported goods that have been released for free circulation after payment of the import duties. Quantitative quotas exist for...
Table 13A.1 (continued)

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<th>Instrument</th>
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<th>Outcome</th>
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<tr>
<td>Trade measures</td>
<td>controls, agricultural and fisheries policies and external relations policy measures</td>
<td>the following products: steel, textile, footwear and potassium chloride</td>
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<td></td>
<td>The EU maintains a public database with tariff rates and other protective measures. Apart from <em>ad valorem</em> duties, several non-<em>ad valorem</em> duties are applied, mostly on agricultural products. According to World Trade Organization data (WTO 2011), in 2011 the average tariff rate for agricultural products was 15.2% against 4.1% for non-agricultural products. Tariffs for industrial products are among the lowest in the world (3.9%)</td>
<td>Even though protection has decreased since 2008, support to agriculture is still considerable, according to the World Trade Organization. Apart from import tariffs, the EU offers export subsidies in agriculture totaling more than €100,000 billion per year according to an Organisation for Economic Co-operation and Development estimate</td>
</tr>
<tr>
<td>Export credit</td>
<td>systems and other export finance schemes are managed by EU member states. The EU tries to reduce competitive distortions between EU companies by providing member states with common principles and rules about coverage and transparency</td>
<td></td>
</tr>
<tr>
<td>Public procurement</td>
<td>Within the framework of EU directives, countries define the details of their respective public procurement procedures. Rules dictate harmonized and transparent conditions in selecting contractors. Member states can divide contracts into separate lots, offer business consultancy to SMEs and give guidelines on</td>
<td>Details on public procurement in the EU are available at: <a href="http://ec.europa.eu/internal/_market/public">http://ec.europa.eu/internal/_market/public</a> procurement/index_en.htm (accessed 2013)</td>
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how to manage contracts. Public procurement accounts for 16% of the EU’s gross domestic product.

**Structural Funds**

Structural Funds are composed of the European Regional Development Fund, with a budget of €201 billion, and the European Social Fund (€76 billion).

The European Regional Development Fund supports the development and structural adjustment of disadvantaged regional economies, including declining industrial regions and cross-border, transnational and interregional cooperation. It provides direct financing for productive investments, especially in SMEs and toward low-carbon solutions, and sustains investments in infrastructure, innovation and research.

While the Regional Development Fund focuses on physical investments, the European Social Fund focuses on investments in human capital to improve worker adaptability and access to employment.

In 1994, the Cohesion Fund for low-GDP regions and covers the trans-European transport system and environmental issues, especially energy efficiency and renewable energy. Support is conditional on the compliance of member states.

Structural Funds seek to reduce disparities across regions, with the ultimate goal of convergence.
### Table 13.4.1 (continued)

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<th>Instrument</th>
<th>Description</th>
<th>Outcome</th>
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<tr>
<td>Financial mechanisms (loans, risk-sharing)</td>
<td>with its convergence program for economic and monetary union. Its budget for 2007–13 was €66 billion. In 2007–13, regional policy will account for over one-third of the total European Commission budget. Out of a total of €347 billion, €86 billion was allocated to innovation, including infrastructure, entrepreneurship, information and communications technology development and human capital. The Competitiveness and Innovation Framework Programme increases SME access to finance and business support services. The Risk-Sharing Finance Facility is a joint program of the European Commission and European Investment Bank that supports high-risk, high-reward ventures through loans, guarantees, and equity investment.</td>
<td>France Oséo is a public institution that finances innovative SMEs through loan guarantees, subsidies and grants. It accounted for 22% of total public funding to private sector R&amp;D in 2010.</td>
</tr>
</tbody>
</table>
**Industrial restructuring schemes**

**Germany**

The government funds biotechnology research in universities and government laboratories based on multi-annual thematic programs. The biotechnology program includes contests to identify young scientists and researchers, support for commercialization of innovation through the formation of new firms, promotion of clusters and the financing of start-ups through government venture capital programs.

**France**

Under the Poles of Competitiveness initiative, 71 clusters have received public funding, with seven information and communications technology clusters receiving more than one-third of total funding. Companies, research centers and education institutions in the clusters receive direct aid (subsidies for research projects, infrastructure), tax incentives (deductions from corporate and social taxes), marketing and networking support, and access to funding under privileged conditions (guarantees).


*Source:* Authors.
Index

Abrenica, M. 41
absorptive capacity 74
Accelerated Industrial Innovative Development Program, Kazakhstan 2010–14 163–4
Accountable Government Initiative, US 66–7
Acemoglu, D. 198
active employment strategy 309
advanced battery sector, US 232–3
advanced economies and industrial policy 10–11
Advanced Technology Program, US 231
Agosin, M. 167
agricultural sector
Australia 285–6
EU 355
Aiginger, K. 350
Akamatsu, K. 129, 130, 132
Alavi, R. 336
Alba, E.M. 143
Amsden, A. 75
Anderson, P. 80
apprenticeships, Australia 310–11
appropriability problems 98–104
ASEAN and Malaysian automotive sector 336–7
Australia 279–312
as catch-up target for Kazakhstan 147–53
economy 280–90
exchange rates 302–7
immigration policy 307
industrial policy development 290–96
infrastructure projects 299–301
public sector role 311–12
sector selection 296–8
structural transformation 149–53
training and education 308–11
automobile industry
Australia 295–6
Malaysia 334–9
Automotive Industry Authority, Australia 295
avant-garde SMEs 261–2
Bank of Korea 251, 259
banks
Kazakhstan 163
and SME finance, Korea 251–59
Bayh–Dole Act 1980 230
Beath, J. 365
Beijing–Seoul–Tokyo consensus 70
Bell Trade Act 41
BeST (Beijing–Seoul–Tokyo consensus) 70
Blundell-Wignall, A. 303
Boehm, E.A. 49
Bonvillian, W. 229
Bozeman, B. 221, 230
brain drain, Malaysia 333–4
Brazil
export structure 168, 172–3
telecommunications industry 78
Breschi, S. 372
broadband network, Australia 300–301
Bumiputera 325, 326–7, 336
Button Car Plan 295
capabilities 3, 4, 33–4
capability building 70–81
Asia 119–23
see also organizational capabilities
capital intensity, PRC 211–15
Carron, A. 302
Catapult centres of excellence, UK 369
catching up 110–12, 127–57
Australia as target country for Kazakhstan 147–53
identifying target countries 144–7
Japan 132–4
PRC as target for Asian countries 154–5
strategies 135–41
Central Intelligence Agency, venture capital fund 235
Chandra, V. 139, 287
Chang, H.-J. 9
China, see People’s Republic of
Chu, W. 75
Chung, M.Y. 75
Cimoli, M. 9
CIP (Competitiveness and Innovation Framework Programme) 362, 394
cluster policies, EU countries 368–9
codevelopment 75–9, 89
Cohen, W.M. 74
Cohesion Fund 393–4
collateralization bond obligation programs, Korea 275–6
commodity exports, Australia 286–90
comparative advantage 129, 130–31, 166–7
measurement 143–4
comparative advantage defying industries 132
competitiveness
and effort levels 117–18
and industrial policy, EU 348–69
competitiveness curve 113–14
Competitiveness and Innovation Framework Programme (CIP) 362, 394
concentration index 201–2
contracting failures 94–6
and discovery of profitable activities 103–4
and innovation 101–3
investment in formal skills 98–101
in technology acquisition 96–8
coordination failures 6–7, 105–7
Costa Rica 168
export composition 171
Crawford Report 294
credit, Malaysia 331–2
credit guarantee programs, Republic of Korea 64, 266–70
Crow, M. 221, 230
currency floating, Australia 303–5
Cusmano, L. 372
Customs Tariff Act 1901, Australia 293
D’Alpuget, B. 296
DARPA (Defense Advanced Research Projects Agency) 228–9
Davis, G.F. 227
decentralization
PRC 200
and risk evaluation 234–7
Defense Advanced Research Projects Agency (DARPA) 228–9
demand-side innovation policy, US 231–4
development stages, see stage of development
discovery of profitable activities 103–4
diversification 135–7, 165–8
and economic development 197–8
and education 51–9
Kazakhstan 168–88
Malaysia 320–42
measurement 201–3
PRC 201–16
Product Space theory 179–87
Downes, P. 284–5, 292
Dutch disease, Australia 306
dynamic comparative advantage 199
economic development 3–4
and industrial diversification 197–8
economic diversification, see diversification
economic geography and sectoral concentration 198
Economic Transformation Plan, Malaysia 64, 321, 322–3, 327
education
Australia 308–11
and economic diversification 51–9
EU 363–4
Malaysia 328–9
Republic of Korea 53–5, 74, 75
effort levels and learning success 117–19
EIB Risk-Sharing Finance Facility 361–2, 394
electronics sector Malaysia 332–4
Electronics and Telecommunications Research Institute, Korea 56, 57
employment
Australia 284–5, 290–91, 309–10
China 211
Employment Retirement Income Security Act, US 231
Energy Act, US 231
Engineering Research Centers, US 231
entropy measure of industrial diversification 202
ERA (European Research Area) 359–60
Ethiopia, Huajian Shoe Factory 156
Europe 2020 353–4, 363–4
European Investment Fund 37–9
European Regional Development Fund 393
European Research Area (ERA) 359–60
European Social Fund 393
European Technology Platforms 364
European Union 346–83
budget and industrial policy 378–9
industrial policy development 352–3
industrial policy objectives 353–4
monitoring and evaluation 65–6, 373–7
Multiannual Program for Enterprises and Entrepreneurship 37
policy tools 355–72
political economy 347–52
state aid 380
evaluation, see monitoring and evaluation
exchange rates and industrial policy 302–7
Expanded Public Works Program, South Africa 297
expenditure
and industrial policy, EU 378–9
regional policies, EU 359
state aid, EU 380
see also government finance; R&D investment
export concentration, Australia 287–8
export diversification 167–8
Brazil 168, 172–3
Kazakhstan 168–79
and Product Space theory 179–87
export facilitation scheme, Australia 295
export promotion, Malaysia 323
Fane, G. 303
FDI, see foreign direct investment
Federal Credit Reform Act 49
Feldenkirchen, W. 366
Felipe, J. 1, 14, 52
finance
capability development 94–5, 119–23
for innovation, Malaysia 331–2
SMEs, Republic of Korea 47, 247–77
and stage dependence of industrial policies 26
see also expenditure; government finance; R&D investment
financial crisis and industrial policy, EU 377
financial markets and indirect industrial policy 36–40
financial mechanisms as policy instruments
Australia 318
EU 393–4
Fioretos, O. 365
fiscal decentralization, PRC 200
fiscal incentives
Australia 315
EU 366–7, 388–90
Malaysia 45
Republic of Korea 45
Fisman, R. 212
flying geese pattern of economic development 130
East Asia 138–9
Fong, C.O. 333
footwear industry, Ethiopia 156
foreign direct investment 12
Malaysia 57–8, 323, 329–30, 340–41
foreign equity ownership, Malaysia 340–41
Development and modern industrial policy in practice

foreign exchange deregulation, Australia 302–3
foreign technology, see technology acquisition
Foresight Programme, UK 367
framework industrial policy, EU 347
Framework Programmes for Research and Technological Development, EU 359–63
France 350, 367
cluster policy 368–9, 395
SME finance 394
Frankel, J.A. 137
Freeman, C. 80
Frenzel, A. 373
full employment, Australia 290–91, 309–10
Full Employment in Australia 291–2
Fund of Funds, Republic of Korea 272–3
GDP
Australia 280–81
and sectoral concentration 207–10
German Development Bank (KfW) 39–40
Germany 350, 365–6
biotechnology programme 395
cluster policy 369
fiscal incentives 389
industrial revolution 131
investment policy 366
science, technology and innovation 367, 368
SME promotion 370
training 308
Gershenkron, A. 129–30
Ghana, resource-for-infrastructure 143
Gospel, H. 311
Government Accountability Office, US 67
government finance 109
EU state aid 356–7, 376–7, 380
for innovative SMEs, Korea 263–70
US 221
government role
in coordination 105–6
in industrial policy 26–7
in innovation development, US 223–6
new sector identification 104
Government Transformation Plan, Malaysia 321
Gregory, R.G. 303
‘Growth, competitiveness, employment’ (EC White Paper) 353
Australia as target for Kazakhstan 147–53
Growth Technology Program, Republic of Korea 274
Hall, P. 219, 222
Hasan, S. 336
Hausmann, R. 72, 135, 137, 202, 215, 226
Hawke, Bob 296
He, X. 76
Heavy and Chemical Industrialization Program, Republic of Korea 87
Heckscher–Ohlin model 166–7, 197
Herfindahl Index, Australia 287–8
Hidalgo, C. 31, 33, 35
high-value sectors, entering 73–81
higher education
EU 363
Malaysia 328
Horizon 2020 362
horizontal policies 5–6
EU 347, 349, 350–51
Huaqian Shoe Factory, Ethiopia 156
human capital development 12, 51–60
EU 363–4
Malaysia 328–9, 333
Republic of Korea 74–5
US 58–9
see also education
Hyundai Motors 76
Imbs, J. 197, 198, 207–8
immigration policy, Australia 307
impact assessment, EU 65, 373–4
import substitution, Malaysia 323
In-Q-Tel 235
incentives for industries 147; see also fiscal incentives
income level and sectoral concentration 207–10
income per capita, Australia 280
India, automobile sector 120–22
indigenous people, Malaysia 325, 326–7, 336
indirect industrial policy 11, 36–40
industrial diversification, see diversification
industrial high schools, Republic of Korea 53–4
Industrial Master Plans, Malaysia 321, 322, 323, 327
industrial parks 147, 156
industrial policy 5–8
Australia 292–6
design and implementation challenges 91–124
EU 346–83
Malaysia 321–6
objectives 35–6, 353–4
Republic of Korea 27–9, 40–44
UK 350, 365
industrial policy instruments 44–8
Australia 315–19
EU 365–72, 388–95
Malaysia 45–6, 323–5
Republic of Korea 45–8
and stages of development 71–3
industrial proximity 202–3
industrial restructuring schemes
Australia 319
EU 395
Republic of Korea 46
industrial revolutions 131–5
Industries Assistance Commission (IAC) 294
Industries Commission 294, 295
infrastructure development, Australia 299–301
infrastructure support
Australia 316
EU 390–91
Malaysia 46
Republic of Korea 46
Inno-biz certification, Republic of Korea 262
Innovation Alliances, Germany 368
innovation policy
Malaysia 329–32
US 225–6
innovative SMEs 259–62
financing 248–9, 251–9, 264–74
Republic of Korea 247–9, 262–4
innovators and appropriability problems 101–3
input productivities 112
intellectual property rights 101–2
inter-sectoral upgrading and diversification 81–2, 83–4
International Trade and Industry, Ministry of, Malaysia 326–7
intra-sector upgrading and diversification 81–3
investment attraction programmes
Australia 315–16
Malaysia 46
Republic of Korea 45–6
investment policy, EU 355–7, 366–7
Ireland
fiscal incentives 366, 390
picking winners 145
Iskandar Malaysia 46, 325
Japan
industrialization 132–4
and Malaysian automotive sector 337
Japan–Malaysia Economic Partnership Agreement 337
Joint Technology Initiatives, EU 364–5
Jomo, K.S. 5, 10
Jung, M. 72
Kari, F. 336
Kazakhstan 160–88
Australia as catch-up target 147–53
export composition 170
export structure 168–79
industrial policy 161–5
product space 179–87
Kazakhstan 2030 Strategy 161–4
Key Enabling Technologies 363
KfW (German Development Bank) 39–40
Kibo Technology Rating System 269
Kim, B.-Y. 72
Klinger, B. 137, 202, 215
knowledge economy and innovative SMEs 259–62
KODIT (Korea Credit Guarantee Fund) 64, 267, 268–9
KONEX (Korea New Exchange) 276–7
Konka 83
Korea, see Republic of Korea
Korea Credit Guarantee Fund (KODIT) 64, 267, 268–9
Korea Federation of Regional Credit Guarantee Funds 267, 270
Korea Finance Corporation 249, 258–9
Korea New Exchange (KONEX) 276–7
Korea Technology Finance Corporation (KOTEC) 267, 269
KOTEC (Korea Technology Finance Corporation) 267, 269
Kreditanstalt für Wiederaufbau (KfW) 39–40
Kremer, M. 7–8
Krugman, P. 198, 215
Kuchiki, A. 338
Kulim High Technology Park 325
Kuznets, S. 129
labour productivity, Malaysia 339
latent comparative advantages 31
Lead Market Initiative 362–3
leapfrogging 1, 79–81, 89
learning organizational capabilities 107–10
Lee, K. 70, 72, 75, 76, 78, 80, 81, 83
Leigh, A. 293
Levinthal, D.A. 74
Lewis, Arthur 297
Liew, C.C. 333
Lin, J.Y. 31, 71, 72, 127, 130, 145, 199
Lisbon Strategy 353
MAP 37
Lloyd, P. 284
lobby groups, EU 372–3
local government, PRC 200–201
loss-financing for learning 113–17
Love, I. 212
Maddock, R. 149
Mahathir, M. 334–5
Main-biz certification, Republic of Korea 262
Malaysia 320–42
automobile sector 334–9
education 328–9
electronics sector 332–4
FDI and technology transfer 57–8
industrial policy 321–6
innovation and technology development 329–32
monitoring and evaluation 63–5
policy implementation 326–8
policy tools 45–6
service sector 339–41
Manufacturing Extension Program, US 231
manufacturing sector
Australia 283–5
SMEs, Republic of Korea 251
MAP (Multiannual Program for Enterprises and Entrepreneurship) 37
market failures 6–7, 226–8
market-niche finding SMEs 260–61
Maruti-Suzuki 121
Mathews, J. 70, 78, 81
matrix approach 350–51
McLean, I.W. 149
Mehta, A. 14, 52
middle-income countries 59–60, 71
migrant workers, Malaysia 333
migration, Malaysia 333–4
Ministry of International Trade and Industry, Malaysia 326–7
Mitchell, J. 135
modern industrial policy 5–8
Monga, C. 31, 145
monitoring and evaluation 12, 60–68
Australia 298–9
EU 65–6, 373–7
Malaysia 326–8
Republic of Korea 61–3
US 66–8
Mosselman, M. 376
Multiannual Program for Enterprises and Entrepreneurship (MAP) 37
Multimedia Super Corridor, Malaysia 325, 330
Index

Nathan Report 332
national broadband network,
Australia 300–301
National Research Laboratories, US 229–30
National Science Foundation, US 67
natural resources, see resources
Nazarbayev, Nursultan 161, 162, 164
Netherlands
fiscal incentives 366, 388–9
policy evaluation 376
R&D incentives 368
network failures 8, 227–8
network partners, US 29–30
New Economic Model, Malaysia 321
New Structural Economics 15, 31, 72, 128, 135
Nokia 141
Office of Management and Budget, US 67
Okamoto, Y. 331
oligarchic core, EU industrial policy 372–3
on-lending 39–40, 258
1Malaysia 321
organizational capabilities 7–8, 107–10
Asia 119–23
and competitiveness 110–13
Patent Box, UK 368
path dependence 1–2
pegged currency 303
Pelkmans, J. 347
PEMUDAH 331
Penang electronics cluster 332–4
People’s Republic of China (PRC) 197–216
as catch-up target for Asian
countries 154–5
development strategy 199–201
diversification 203–10
and Ethiopian footwear industry 156
income level and sectoral
concentration 208–10
industrial growth 210–15
intra-sector upgrading 82–3
and low-income countries 139–41
manufacturing growth 137–8
Perez, C. 73, 80
pharmaceutical industry, US 223–4
Philippines 41–4
Pitchford, J. 303, 304
Pohang Steel Corporation (POSCO) 84–8, 90
Poles of Competitiveness, France 368–9, 395
policy tools, see industrial policy
instruments
political economy and industrial
policy 10, 26
EU 347–52
POSCO (Pohang Steel Corporation) 84–8, 90
PRC, see People’s Republic of
China
Prince, Y. 376
Product Development with Option to
Purchase program, Korea 274
Product Space theory 31, 33–5, 179–87
productive capabilities, see
capabilities
productive knowledge 136
Productivity Commission, Australia 294–5, 298–9
productivity sources 112–13
Program Assessment Rating Tool, US 66
protectionism, Australia 293–4
PROTON cars 334–6, 338
public–private partnerships
EU 364–5
R&D consortiums 55–7, 73–4, 77–9, 89
US 230–31
public procurement
Australia 317
EU 357, 392–3
Malaysia 46
Republic of Korea 46
public sector
and sector selection 25–7
skills development, Australia 311–12
public sector finance, see government
finance
Development and modern industrial policy in practice

R&D investment 76–9
  public–private consortiums 55–7, 73–4, 77–9, 89
  Republic of Korea 273–4
R&D policies
  EU 359–63 367–8
  Malaysia 329–32
Rattigan Report 294
Ray, J. 310, 311
regional policy, EU 357–8
rent-seeking activity 5
rents for learning 115
Republic of Korea 2, 297
  absorptive capacity 74
  capability development financing 119, 120
  education 53–5, 74, 75
  foreign joint ventures 76
  industrial policy 27–9, 40–44
  inter-sector upgrading and diversification 83–4
KONEX stock market 276–7
leapfrogging strategy 80
monitoring and evaluation mechanisms 61–3, 64
policy tools 45–8, 72–3
securitization 275–6
SMEs 247–77
  telecommunications industry 55–7, 73–4
venture capital investment 270–73
Research and Development Points System, Republic of Korea 274
resources
  resource curse 137
  resource-for-infrastructure 143
  resource intensity and diversification 182–7
  resource-rich countries 141–4
risk-adjusted industrial policy 48–9
risk capital for innovative SMEs 265–6
risk management 11–12
  in decentralized system 234–7
Malaysia 328
Risk-Sharing Finance Facility, EU 361–2, 394
Robertson, P.L. 149, 151, 153
Rodrik, D. 6, 71, 72, 199, 215, 293, 302
Rosli, M. 336
Rostow, W.W. 129
Sabel, C. 236–7
Samel, H.M. 333
Samsung 76, 83
SBC (Small and Medium Business Corporation), Republic of Korea 249, 257–8
SBIR program 231
Scandinavian countries 142
Schumpeterian rents 101
science and technology policies
  EU 359–63, 367–8
  Malaysia 330–32
sector promotion 44–8
sector selection 6, 24–44, 296–8
sectoral concentration and income level 207–10
securitization, Republic of Korea 275–6
Semiconductor Trade Agreement 352
service sector, Malaysia 339–41
Shin, H. 72
Sieber, S. 350
Sieper, E. 303
Simon, Herbert 118
Simon, W.H. 236–7
Singapore 2
skills investment
  appropriability problems 98–101
  Australia 308–12
  Slovakia, state aid evaluation 376
Small and Medium Business Administration (SMBA) 249
Small and Medium Business Corporation (SBC) 249, 257–8
small and medium enterprises, see SMEs
smart regulation, EU 373
smart specialization 354
SMEs
  EU member countries 369–70
  and knowledge economy 259–62
  Republic of Korea 247–77
Smith, Adam 197
Snowy Mountain Hydro-Electric Scheme 299–300
social cohesion, EU 351
social services, Australia 291–2
Soete, L. 73, 80, 360
Soskice, D. 219, 222
South Africa, Expanded Public Works Program 297
special economic zones, Malaysia 325
spending, see expenditure
stage of development
and industrial policy 10–12, 25–9
and policy tools 11, 71–3
state aid
EU 356–7, 376–7, 380
see also government finance; incentives for industries
State Program on Accelerated Industrial Innovative Development, Kazakhstan 2010–14 163–4
Stenzel, T. 373
Stevenson–Wydler Act 1980 229
Stigler, G. 197
stock market for venture businesses, Republic of Korea 276–7
Stoeckel, A. 284–5, 292
Strategy 2030, Kazakhstan 161–4
Strategy 2050, Kazakhstan 164–5
Strategy of Industrial Innovation Development for 2003–15, Kazakhstan 161–2, 163
structural change, EU 348
Structural Funds, EU 351–2, 356, 390–91, 393
structural transformation 3, 127–31
catch-up strategies 135–41
Growth Identification and Facilitation Framework 144–7
industrial revolutions 131–5
resource-rich countries 141–7
see also diversification
Suárez, F.F. 82
subsidiaries 115
Sunshine Loan Guarantee 270
Sutton, J. 7
Suzuki 121
Szirmai, A. 9
tacit knowledge 107
tacit productive capabilities 94, 108–9
Taipei, China, laptop industry 78–9
Tan, K.W. 5, 10
tariffs
Australia 284, 293–4, 296
EU 355
Tatung 83
tax incentives, see fiscal incentives
technological capabilities 107
technology acquisition 74–5
contracting failures 96–8
Malaysia 329–30
Technology Innovation Development program, Republic of Korea 273
Technology Innovation Program, US 231
Technology Park Malaysia 325
technology rents 101
Technopolos France and European Policy Evaluation Consortium 65–6
telecommunications industry 55–7, 73–4, 78
Tenth Malaysia Plan 321
Tham, S.Y. 333
30 Corporate Leaders of Kazakhstan program 162–3
Top Cluster Competition, Germany 369
trade measures
Australia 317
EU 391–2
Republic of Korea 46
see also tariffs
trade policy, EU 355
training policies
Australia 308–11, 316
Malaysia 46
Republic of Korea 46
Trans-Pacific Partnership Agreement 337–8
Turkey 168
export composition 171
Product Space 179–82
Tushman, M. 80
unfairness of industrial policy 26
United Kingdom
cluster policy 369
fiscal incentives 366, 368, 370, 388
industrial policy 350, 365
industrial revolution 131
science, technology and innovation policies 367, 368
SME promotion 370
United States 219–38
evaluation programme 66–8
human and organizational capital 58–9
industrial revolution 131
network partners 29–30
risk management in credit programs 48–9
University–Industry Cooperative Research Centers program, US 230
Utterback, J.M. 82

Vallas, S.P. 223
Venezuela 168
export composition 170
venture capital funds
Central Intelligence Agency 235
Republic of Korea 270–74
venture companies, Korea 262
vertical industrial policy 6
EU 347, 349
Wacziarg, R. 197, 198, 207–8
welfare state, Australia 291–2
Zilibotti, F. 198
DEVELOPMENT AND MODERN INDUSTRIAL POLICY IN PRACTICE

‘This superb text defines and describes modern industrial policy. For many years economists, politicians, and policymakers have worried over inward-looking and damaging industrial policies, associating them with poor economic performance and arrested industrial development. At last we have a book which identifies and analyses new forms of modern industrial policy which work effectively and are able to overcome the problems of the past. The book is replete with concrete examples and new conceptual developments, showing how modern industrial policy is able to initiate, upgrade, and transform economic activity for the benefit of all. The evidence is used to provide a new theory of industrial policy, distinguishing modern industrial policy from the practices of the past – leaving no room for doubt as to how policymakers should proceed in the twenty-first century. Essential reading for policymakers, analysts, scholars, teachers, and consultants concerned with industrial policy and modern economic development.’

Mike Hobday, University of Brighton, UK

‘Jesus Felipe is to be congratulated for assembling a first-rate group of authors to address one of the most important policy issues of our time. Their main contention is that, to succeed, latecomer developing countries need a “modern industrial policy”. Aware of the pitfalls, they provide empirical evidence in support of their arguments. The country studies are particularly interesting. A stimulating volume that deserves to be read, including by the skeptics.’

Hal Hill, Australian National University

Development and Modern Industrial Policy in Practice provides an up-to-date analysis of industrial policy. Modern industrial policy refers to the set of actions and strategies used to favor the more dynamic sectors of the economy. A key aspect of modern industrial policy is embedding private initiative in a framework of public action to encourage diversification, upgrading, and technological dynamism to achieve development in the twenty-first century.

The book reviews key questions that policymakers ask about industrial policy, such as: who selects sectors; what is the rationale for sector selection; what are the main tools to promote sectors; what is the role of human capital; and what are the mechanisms for monitoring and evaluation? Expert contributors discuss how to undertake industrial policy effectively and examine the experiences of Australia, the EU, the Republic of Korea, Malaysia, and the US.

Policymakers, multilateral development institutions, and scholars will find the discussions on industrial policy, structural transformation, economic diversification and upgrading, and capabilities to be useful and practical.

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