ADB-ADBI Structural Transformation and Innovation Database

-Good afternoon and thank you very much for being here today

-What I am going to do is a brief introduction to the database, how it was constructed and what it contains
**Introduction**

- Joint project between ADB (ERCD) – ADBI - Group of scholars at the United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology, UNU-MERIT (The Netherlands): (i) Neil Foster-McGregor; (ii) Önder Nomaler; (iii) Bart Verspagen

- Started about one year ago

**Objective:** create a database (public good) populated with variables that are fundamental to understand long-run growth and development

- Some of these variables exist in other databases, while some others do not

- Some variables are very simple to construct and understand while some other require some knowledge
How did we do it?

• We thought there are FOUR key variables or set of variables that economists refer to when discussing long-run growth and development:
  • (i) productivity;
  • (ii) innovation (in the context of the 4IR);
  • (iii) GVCs; and
  • (iv) complexity

• We used these variables as the basic framework to construct the database, around four pillars: (i) Structural transformation; (ii) Innovation – The Fourth Industrial Revolution; (iii) GVCs; (iv) complexity
Result

• A database (data extraction) + Website (visualization) –User friendly
  • https://innovatransformation.adbi.org

• All ADB members + many other economies (depending on the series) (Up to 171 economies)

• About 90 series as of now – Version 1

• Series are grouped into the four pillars I just mentioned

• This allows: (i) data extraction and transformation: (ii) visualization; (iii) Policy analysis

• Time series since 1990-91, 2000-2019

• Sectoral information
I. Structural Transformation: how changes in the composition of the economy affect growth

• Key variable around which this pillar is constructed is labor productivity; and the decomposition of its growth rate into within and reallocation

• Structure of the economy: Employment - Value Added

• Trade structure:
  • (i) By use: intermediates – consumption goods – capital-goods;
  • (ii) Exports and Imports of: robots, CAD-CAM, 3D printing, automated welding, regulating instruments, ICT
II. Innovation in the context of the Fourth Industrial Revolution

- Patent information about 4IR technologies
III. Global Value Chains

• Backward and Forward linkages

• Regional and global GVCs

• RCA in GVCs

• Imports and Exports in GVCs
IV. Complexity

• Diversification

• Uniqueness – Standardness

• Complexity (product and economy)

• Upgrading possibilities

• GVC complexity
Where are we?

• Database is constantly evolving as we add series and new data become available – Version 1

• Recall databases like WDI, Penn World Tables, KLEMS…have undergone significant changes in time

• This database will also evolve
Next

• Brief tour of the website by Neil Foster-McGregor

• What you learn by using the database: Neil and myself

• Open the floor: Önder Nomaler and Bart Verspagen will join us
Brief tour of the website by Neil Foster-McGregor
What you learn by using the ADB-ADBI database

Easy to download the series and undertake analysis
I. Structural Change

how changes in the structure or composition of the economy – output, employment, affect growth

https://innovatransformation.adbi.org
It is (almost) all about productivity…

• Income per capita = Output per worker (labor productivity) x (Employment/Population)

• Growth rate income per capita = Growth rate of labor productivity + growth rate employment ratio

• Growth rate of labor productivity = Within sectors productivity growth (technical progress) + different sectors’ capacity to absorb employment (reallocation effect)

• Traditionally reallocation into manufacturing was important

• This is not what is happening in today’s developing economies. What sectors are workers going into? Implications
Significant variation in labor productivity levels and growth rates
Convergence in labor productivity: smaller productivity growth rates for richer economies in 2000
A 1 p.p. increase in manufacturing labor productivity growth is associated with a 0.41 p.p. increase in aggregate labor productivity growth in ADB regional members.
Decomposition of labor productivity growth: in most economies, the within component was more important than the structural transformation component.
People’s Republic of China

Sectoral contributions to the Within Effect

India

Thailand
Summing Up

• Great heterogeneity within Asia

• There has been significant (positive) structural change, and this is what “explains” productivity growth

• Most (overall) productivity growth has been due to within sectors productivity growth, though the structural change component was significant in, for example, Lao PDR, Cambodia, Bangladesh, PNG, Indonesia, and Viet Nam

• **Structural Change** effect: Employment shifted out of agriculture: (i) in some cases to manufacturing (e.g., Viet Nam); (ii) in many other cases to services (trade and other activities specifically)

• **Overall**, Asia’s employment is shifting to services, particularly Wholesale, retail trade, restaurants and hotels (+4.5%) and Other activities (+3.9%)

• Looking into the future, this raises concerns with these sectors having relatively low productivity levels and growth rates (Baumol)
II. Innovation and the Fourth Industrial Revolution

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Innovation – 4IR

• The 4IR refers to the application of digital technologies, automation and artificial intelligence across a range of sectors

• The revolutionary character of the 4IR resides in the *fusion of technologies* in different areas (past examples, *mechatronics*: electronics + mechanical engineering); *nanobiotechnology*: physics + chemistry + biology)
Frontier technologies identified by various organizations

4IR, defined by frontier technological breakthroughs, blurs the lines between the physical, digital, and biological spheres.

**What defines 4IR is the fusion of these technologies**

**It matters because it poses challenges for developing economies**

Source: UNESCAP
Innovation – 4IR

• These technologies have a large potential to transform the global economy in the future through, for example, their effect on employment and income distribution

• The fact that the 4IR is about the fusion of physics, chemistry, digital, means that the technological threshold is relatively high: it requires both general and sector-specific foundational capabilities that many developing countries may not have
Patents and the 4IR technologies in our database

- **Patents** are one indicator for innovation, which has the advantage that it is available very widely.

- The database provides indicators for the number of patent families in 4IR, as well as the shares of 4IR patent families in total patenting of an economy: (i) patent flows through GVCs; and (ii) patenting in Fourth Industrial Revolution (4IR) technologies.

- How is developing Asia performing in the 4IR technologies?
Cumulative Patent Families
Collection of patent applications covering the same or similar technical content

Note: some patent families may appear in more than one technology field
Cumulative patent families by regional ADB member in 2019:
concentration in a few members

<table>
<thead>
<tr>
<th>Region</th>
<th>Cumulative number of patent families in 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>People's Republic of China</td>
<td>40000</td>
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<tr>
<td>Republic of Korea</td>
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<td>Japan</td>
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<td>Taipei, China</td>
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<td>Pakistan</td>
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</table>
Shares of 4IR fields in the 4IR patenting of regional members

- Connectivity
- Home
- Consumer goods
- IT hardware
- Data management
- Software
- Services
- Data security
- Vehicles
- User interfaces
- Core AI
- Industrial
- Power supply
- Geo positioning
- Infrastructure
- Healthcare
- Safety
- 3D support systems
- Agriculture

Share in total number of 4IR patent families of regional ADB members
RTA in 4IR technologies
Share of an economy’s 4IR patents in all its patents over the same share at the global level
Summing Up

• Significant concentration of 4IR patenting in Rep. Korea, PRC, Japan, and Taipei, China even though the latter two economies may not have RTA (in 4IR technologies)

• Weak 4IR performance (patent filing) by most regional members

• Needed: (i) efforts at mastering the use of “some” of these technologies (imports); and (ii) efforts at producing them by economies already using them
III. Global Value Chains

https://innovatransformation.adbi.org
Global Value Chains

• Global Value Chains (GVCs) are often considered a quicker and easier way to integrate into the global economy and to industrialize than traditional trade.

• But, for developing economies they also present the risk of being ‘trapped’ in low value-added stages of production.

• Moreover, since the Global Financial Crisis and with the ongoing pandemic, questions remain over the role of GVCs as a development escalator.

➢ How have regional ADB members performed in GVCs?
Larger ADB regional members report lower values of the GVC index
ADB regional members serve value chains in diverse ways

Backward GVC integration in 2019
Forward GVC integration in 2019
ADB regional members are moving to different parts of the value chain
ADB regional members have increased their share of global value-added

![Graph showing annual average growth rate of the value-added share of global exports vs change in GVC integration for various countries.]

- Countries: AUS, BAN, BHU, BRU, CAM, FIJ, HKG, IND, INO, JPN, KAZ, KGZ, LAO, MAL, MLD, MON, NEP, PAK, PRC, PHI, KOR, SIN, SRI, TAP, THA, VIE.
Summing Up

• Regional ADB members are strongly integrated into GVCs, but in diverse ways
  • Different positioning within GVCs

• Dynamics of GVC integration are highly heterogeneous
  • Economies increasing and decreasing GVC integration
  • Economies enhancing forward and backward linkages within GVCs

• Regional ADB members have been able to increase their share of global value-added in exports
  • Some by raising the domestic value-added content of exports (e.g., PRC)
  • Some by increasing the scale of their production
IV. Economic Complexity

https://innovatransformation.adbi.org
Economic Complexity

• Complexity is an attribute of both products and economies
  • The complexity of a product captures the uniqueness of the capabilities needed to successfully export it
  • The complexity of an economy reflects the number and kinds of products that it can export successfully
  • The set of products exported successfully indicates the capabilities present in the firms located in the economy

➢ How complex are ADB members?
➢ And how has complexity changed over time?
Most ADB regional members had below average complexity in 2007, but have increased levels over time.

<table>
<thead>
<tr>
<th>Economic Complexity Index</th>
<th>Complexity in 2007</th>
<th>Change in Complexity, 2007-2019</th>
<th>Average Complexity in 2007 (all economies)</th>
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</table>
Regional ADB members have moved towards less standard production (more unique), and in most cases diversifying production.
Regional ADB members lag behind non-regional members across sectors, but perform better than non-ADB members
ADB regional members have improved complexity levels across a range of sectors, though not in the most complex sectors.
Summing Up

- Many ADB regional members have lower than average economic complexity levels
  - This is true across different sectors
- With few exceptions, complexity levels are increasing in ADB members
  - Reflecting more unique production and increased diversification
- Upgrading of economic complexity by ADB regional members has taken place across many sectors
  - Upgrading has generally been stronger than in other regions
  - But largest gains have been in low complexity sectors
Overall Summary
What does the ADB-ADBI database on Structural Transformation and Innovation tell us about growth and development in Asia?

• Productivity growth has been driven by within sector improvements, with structural change often towards low productivity services
• Few ADB regional members show competitiveness in the production or use of 4IR technologies
• ADB regional members are capturing more of the gains from GVCs, but these gains are captured by a small number of economies
• ADB regional members have improved their complexity levels across a broad range of sectors

➤ The direction of change in ADB regional members has often been positive, but challenges are appearing for many economies
  ➤ Related to a diminished role for GVCs, exclusion from 4IR technologies and weak manufacturing performance
Thank you

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Glad to answer your questions