From Import Substitution to Integration into Global Production Networks: The Case of the Indian Automobile Industry

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This paper examines the growth trajectory and the current state of the Indian automobile industry, paying attention to factors that underpinned its transition from import substitution to integration into global production networks. Market-conforming policies implemented by the government of India over the past 2 decades, which marked a clear departure from protectionist policies in the past, have been instrumental in transforming the Indian automobile industry in line with ongoing structural changes in the world automobile industry. India has emerged as a significant producer of compact cars within global automobile production networks. Compact cars exported from India have become competitive in the international market because of the economies of scale of producing for a large domestic market and product adaptation to suit domestic market conditions. Interestingly, there are no significant differences in prices of compact cars sold in domestic and foreign markets. This suggests that the hypothesis of "import protection as export promotion" does not hold for Indian automobile exports.

Keywords: automobile industry, foreign direct investment, global production networks, India
JEL codes: F13, F14, L92, L98

I. Introduction

The global landscape of the automobile industry has been in a process of notable transformation over the past 3 decades. Until about the late 1980s, automobile production remained heavily concentrated in the United States, Japan, and Western Europe (known as the "triad"). While the leading automakers headquartered in the triad had assembly plants in many developing countries, most of these plants served domestic markets under heavy tariff protection. Since then the industry has become increasingly globalized, driven by a combination

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of technological advances in the industry, changes in global demand patterns, and widespread trade and investment reforms in the developing world (Shapiro 1994, Humphrey and Memedovic 2003, Klier and Rubenstein 2008, Bailey et al. 2010, Kierzkowski 2011, Amighini and Gorgoni 2014, Traub-Merz 2017).[1] On the supply side, production standards have become increasingly universal, accompanied by a palpable shift in production process from generic to modular technology. Consequently, parts and components production has grown rapidly to cater to multiple assemblers. On the demand side, growth prospects for vehicle sales are increasingly promising in emerging market economies, whereas the principal automobile markets in the triad have been rapidly approaching a point of saturation in recent years. These structural changes in the global automobile industry have led automakers to set up new assembly bases in countries with large domestic markets to serve regional markets. With this regional focus, carmakers tend to consolidate their assembly facilities within a region and decide which models to produce at which locations (country), at what prices and quality standards, and for which markets (either regional or global). The process of trade and investment liberalization across the world has facilitated this global spread, creating cost-efficient plants aimed at global markets.

This massive transformation in the structure, conduct, and performance of the world automobile industry has opened opportunities for countries in the periphery to join the global automobile production network. However, an important unresolved question is whether the government in these countries should follow the conventional "carrot and stick" (activist) approach to promote export orientation of indigenous industries with significant domestic value added or a "market-conforming" approach in which multinational enterprises (MNEs) play the leading role in integrating domestic industry into global production networks (GPN).

The purpose of this paper is to contribute to this policy debate by examining the emergence of India as a significant production hub within global automobile networks. The Indian automobile industry is an ideal case study of this subject given the government's long history of protecting domestic industry and the significant structural changes following liberalization reforms that were initiated in the early 1990s and gathered momentum from about 2000. For over a half a century from the late 1940s, the Indian automobile industry remained a canonical example of a high-cost industry that evolved and survived under heavy trade protection. However, over the past 2 decades, the industry has shown promising signs of gaining significant capabilities and global competitiveness through integration into GPNs. Most of the world's leading automakers now have well-established production bases in India. According to data reported by the International Organization of Motor

[1]In 2000, 74% of total world car production (in terms of number of cars) took place within the triad. This declined to 39% by 2017 (OICA 2017).

Vehicle Manufacturers (OICA), India's ranking among automobile producing countries increased from 16th to 6th between 1999 and 2017, and its share in global passenger car production (in terms of number of cars) increased from 1.3% to 5% (OICA 2017).

A study of the automobile industry is also relevant for the policy debate in India given its contrasting growth experience compared to other major manufacturing industries in the country. India's economic growth has been primarily driven by the service sector while manufacturing growth has been sluggish. Manufacturing accounts for only about 17% of India's gross domestic product (GDP) compared to about 30% for the People's Republic of China (PRC). Engagement in GPNs has been the prime mover of manufacturing export expansion in the PRC and other high-performing East Asian economies. However, the manufacturing sector in India remains generally cutoff from GPNs (Athukorala 2019, Joshi 2017, Krueger 2010). The automobile industry is an exception—over the past 2 decades it has recorded impressive growth and export expansion through global production sharing.

To preview the paper's key findings, the analysis suggests that market-conforming policies over the past 2 decades, which marked a notable departure from protectionist policies of the past, have played a key role in transforming the Indian automobile industry. Learning and capacity development through foreign market participation and entry of parts and components producers to set up production bases in India has been the key factor behind the country's emergence as a production base within automobile GPNs. Interestingly, there are no significant differences between prices of cars sold in domestic and foreign markets. This suggests that the competitiveness of Indian cars sold in foreign markets is not rooted in the prevailing tariffs on completely built-up units (CBUs) in India. Rather, this competitiveness seems rooted in the economies of scale of producing for a large domestic market and product adaptation to suit domestic market conditions under a natural protection arising from the bulky nature of the product (unlike most electronics and electrical products). An important question in the present context of economic globalization, therefore, is whether trade protection has outlived its purpose.

The rest of the paper is organized as follows. Sections II and III set the background by providing a survey of the evolution of the Indian policy regime relating to the automobile industry and by describing the entry of the main players in the industry. Section IV examines the growth and composition of automobile production, with emphasis on the experience following the policy transition from import substitution to global integration since the early 2000s. Section V analyzes the extent of India's engagement in automobile GPNs in terms of the MNEs' involvement in domestic industry, export expansion, and international sourcing of components. Section VI provides a comparative perspective on automobile and electronics industries with a view to highlighting the importance of differences in the underlying policy regimes and product characteristics as possible explanations for India's contrasting performance in these industries. Section VII supplements the analytical narrative in the previous sections with an econometric analysis of the determinants of automobile exports from India using the gravity modeling approach. The final section summarizes the main findings and policy implications.

II. Policy Context

The automobile industry has figured prominently in India's industrialization strategy since its independence in 1947 (Bhagwati and Desai 1970). The ensuing 6 decades can be divided into four subperiods in terms of the policy regime affecting the automobile industry.

The period from late 1940s to mid-1970s was characterized by progressive regulation, protection, and indigenization. In 1948, automobiles and tractors were included in the list of industries subject to "central regulation and control," which involved banning imports of CBUs and increasing tariffs on component imports (Arthagnani 1967, 1424). From 1953, only companies with plans to manufacture components and CBUs were permitted to operate, and the existing assemblers of imported completely knocked down (CKD) units were required to terminate operations within 3 years. The Industrial Policy Resolution of 1956 permitted private sector initiative and enterprise in the automobile industry subject to state control through industrial licensing. This was in sharp contrast to industry policy in other capital-intensive industries (such as iron and steel, machinery, and electronics), of which the prime responsibilities for capability development rested with state-owned enterprises (SOEs). Further regulations introduced in the first half of the 1970s required all production expansion plans to have government approval subject to local content requirements while capping foreign ownership of Indian automobile companies at 40% (Kathuria 1987).

The period from the early 1980s to 1990 saw some easing of restrictions, with emphasis on technological upgrading through foreign collaboration and a relatively liberal import policy for capital goods and components (D'Costa 1995, 2009). The government loosened its tight grip on industrial licensing in favor of increased competition and greater participation of foreign capital. Automakers were permitted to adjust their product mix and produce a range of related products instead of only one type of product as decreed by industrial licensing. In 1982, the Indian government for the first time became an investor in a car project when it created Maruti Udyog Limited as a joint venture (80% government owned) with Suzuki Motors of Japan. Restrictions on capacity expansion of all automobile assemblers were lifted. However, local content and technology transfer requirements and reservation of the production of some automobile components for small and medium-sized enterprises (SMEs) continued to remain in force.

Table 1. **Tariff Rate on Automobile Imports in India (%)**

	Commercial Vehicles (HS 8702/04)	Cars and Utility Vehicles (HS 8703)				Parts and Components (HS 8708)
		General	Used Vehicles	New CBU	CKD	
1990	53	150	QR	QR		40
1992	60	65	QR	QR		65
1995	50	50	QR	QR		n.a.
1996	50	50	QR	QR		52
1997	40	40	QR	QR		40
1998	40	40	QR	QR		n.a.
1999	40	40	QR	QR		40
2000	35	35	QR	QR		38.5
2001	35		105	60	35	35
2002	30		105	60	30	30
2003	25		105	60	25	25
2004	20		105	60	20	30
2005	15		100	60	15	15
2006	12.5		100	60	12.5	12.5
2007	10		100	60	10	12.5
2008–2011[a]	10		100	60	10	10
2011–2012	10		100	60	10[b]/30[c]	8.57
2012–2013	10		100	60/75[d]	10[b]/30[c]	10
2013–2016[a]	10		125	60/100[d]	10[b]/30[c]	10

CBU = completely built-up, CKD = completely knocked down, HS = Harmonized System, n.a. = not available. QR = quantitative restrictions

Notes: Data for HS code 8708 are on a calendar-year basis. Other data are based on the Indian fiscal year: 1 April in the reporting (given) year to 31 March in the following year.

[a]No change in tariffs during these subperiods.

[b]Contains engine, gearbox, and transmission mechanism not in preassembled condition.

[c]Contains engine, gearbox, or transmission mechanism in preassembled form.

[d]For vehicles valued above $40,000.

Sources: Data for 1990,1992, and HS 8708 (all years) are from UNCTAD-TRAINS database (calendar-year based), and other data are from the Society of Indian Automobile Manufacturers (SIAM 2016).

As part of the liberalization reforms initiated in 1991, several reforms were introduced incrementally. First, licensing requirements were abolished for commercial vehicles and automobile component production in 1991 and for passenger vehicles in 1993. Second, automatic approval for foreign holding of up to 51% of equity was announced in 1991 in several sectors including automobiles. Third, importation of capital goods and automobile components were placed in 1997 under open general license. Fourth, the import tariff rates for CKD units and parts and components were brought down from 65% in 1992 to 35% during 2000–2001 (Table 1).

The liberalization reforms during the 1990s, however, were halfhearted. Import of cars and utility vehicles continued to remain under import licensing (quantitative restrictions) (Table 1). An indigenization requirement was reintroduced in 1995 making it compulsory for all new joint ventures to indigenize ownership up to 70%–75% over a period of 5–7 years. Effective December 1997, joint ventures involved in passenger vehicle production were required to sign a memorandum of understanding stipulating, among other things, to stop importing CKD or semi-knocked down kits for "mere assembly", increase the share of domestically procured components to at least 50% of the components used within 3 years and 70% within 5 years, and balance export earnings with the value of imported components during the 3-year memorandum of understanding period (Pursell 2001).

The early 2000s witnessed major policy initiatives aimed at integrating the Indian automobile industry into GPNs. In 2001, as part of the membership commitments under the World Trade Organization, all quantitative import restrictions on used vehicles and CBUs were removed while tariffs were imposed (Table 1), and the local content requirement for automobile production was abolished. Full foreign ownership was permitted for firms both in automobile and components production, enabling several MNEs to enter the industry by setting up wholly owned subsidiaries. Import tariffs on commercial vehicles, CKD, and components were progressively reduced, from 35% during 2001–2002 to about 10% by the end of the decade. Since 2011–2012, CKD in preassembled form attracted a higher duty of 30% while those not in preassembled form attracted a lower tariff of 10%. Excise duties on cars were also progressively reduced from 40% during the 1990s to 32% in 2002 and 25% in 2004. The excise duty on smaller cars was reduced further to 17% in 2006. During the period 2008–2017, excise duties for small cars varied in the range of 9%–13.5% and bigger cars in the range of 21%–28%.

III. Entry of Main Players

Table 2 summarizes information on the timing and mode of entry of MNEs in the Indian automobile industry. The wholly owned subsidiaries of General Motors and Ford Motor Company started the assembly of CKD trucks and cars in India in the late 1920s. Both companies left India in 1954 following the imposition of stringent import restrictions and local content requirements. During the first half of the 1940s, Hindustan Motors and Premier Automobiles set up production plants under license agreements with Morris Motors and Chrysler, respectively. Ashok Motors (later renamed Ashok-Leyland) started manufacturing Austin cars and Leyland commercial vehicles in 1948. Tata Engineering and Locomotive Company started manufacturing commercial vehicles in 1954 in collaboration with Daimler-Benz. Mahindra & Mahindra, another important player in the commercial vehicles segment, started production of jeeps in 1955. Bajaj Tempo began producing light commercial vehicles in 1958 under license from Vidal and Sohn Tempo-Werk of Germany (Arthagnani 1967).

Until the mid-1980s, there were only two key firms in the passenger car segment (Hindustan Motors and Premier Automobiles), while all other firms

Table 2. **Profile of Main Players in the Indian Automobile Industry**

Company	Mode of Entry	Year of Entry
Ford Motor Co. of Canada	100% subsidiary	1926, left in 1954
General Motors	100% subsidiary	1928, left in 1954
Hindustan Motors	License agreement with Morris Motors	1942
Premier Automobiles	License agreement with Chrysler	1944
Ashok Motors/Ashok Leyland	License agreement with Austin Motor Company and Leyland	1948
TELCO/Tata Motors	JV with Daimler-Benz	1954
Mahindra & Mahindra	License agreement with Willys Jeep	1955
Bajaj Tempo/Force Motors	License agreement with Vidal and Sohn Tempo-Werk of Germany	1958
Standard Motor Products	License agreement with Standard-Triumph	1949, left in 2006
Suzuki	JV with Maruti	1983
Mercedes-Benz	JV with TELCO	1995
PAL Peugeot	JV with Premier Automobiles	1995
Daewoo Motors	JV with DCM	1995
Honda Siel	JV with Shriram	1995
Ford	JV with Mahindra & Mahindra	1996
General Motors	JV with Hindustan Motors	1996
Hyundai	100% subsidiary	1996
Toyota Kirloskar	JV with Kirloskar	1997
Fiat	JV with Tata Motors	1997
Skoda (Volkswagen)	100% subsidiary	2001
Renault	JV with Mahindra	2005
Nissan	100% subsidiary	2005
BMW	100% subsidiary	2007
Isuzu Motors	100% subsidiary	2012

JV = joint venture, TELCO = Tata Engineering and Locomotive Company.
Note: Data are based on calendar years.
Source: Assembled from various internet sources.

manufactured commercial vehicles. The arrival in 1983 of Suzuki Motors as the Indian government's joint venture partner in Maruti Udyog Limited (later renamed Maruti Suzuki) was an important landmark in the history of the Indian automobile industry (Hamaguchi 1985).[2] At that time, the government was concerned about its oil import bill, and Suzuki, a world leader specializing in small fuel-efficient cars, was an ideal joint venture partner (D'Costa 2004). Following the entry of Suzuki, other major Japanese automobile manufacturers (Toyota, Mitsubishi, Nissan, and Mazda) arrived, perceptibly changing the stature of the Indian automobile industry.

The other joint ventures established in the 1990s included Mercedes-Benz with Tata Engineering and Locomotive Company (1994), General Motors with Hindustan Motors (1994), Peugeot with Pal Automotives (1994),

[2]As already noted, the government initially owned 80% of the joint venture's equity, but this share was reduced over the years. Maruti Suzuki became fully foreign owned when the Indian government sold the remaining 18% of its shares in 2007. The company continued to remain the largest small and compact car producer in India. In 2016, Maruti Suzuki accounted for 51% of the annual global vehicle production of Suzuki Motors Corporation (1.5 million out of 2.9 million units) (OICA 2017).

Daewoo with Toyota (1995), Honda Motors with Siel Ltd. (1995), Ford with Mahindra & Mahindra (1996), Fiat with Tata Motors (1997), and Toyota with Kirloskar Group (1997). Hyundai and Volvo entered the Indian market by setting up fully owned subsidiaries in 1996 and 1997, respectively.

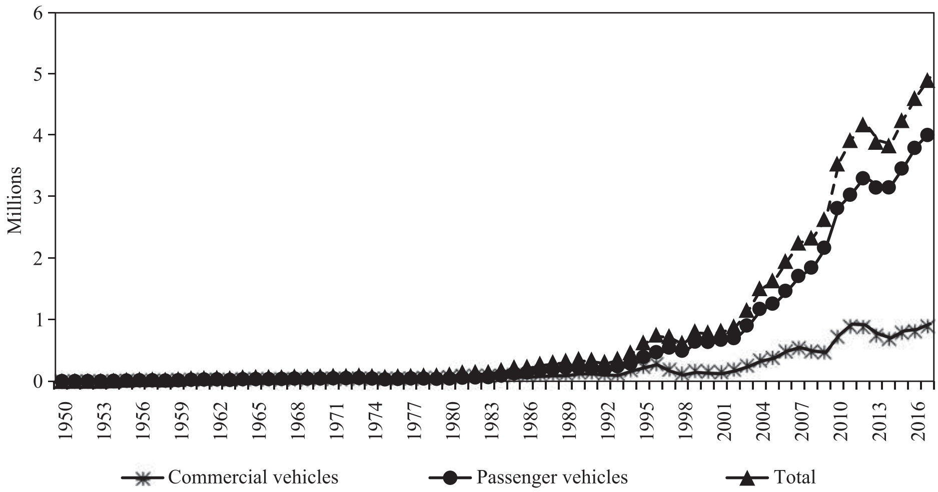
Following the abolition of ownership restrictions in 2000, the dominant mode of entry changed from license agreements and joint ventures to wholly owned subsidiaries. Hyundai was the first automobile MNE to establish a 100% subsidiary in the country. Volkswagen, Nissan, BMW, and Isuzu Motors followed suit. Companies that first entered as joint ventures, such as Honda, Ford, Fiat, and Renault severed links with their local partners and established 100% subsidiaries (Foy 2012).

Following the entry of Japanese carmakers in the 1980s, several Tier 1 automobile parts suppliers (such as Denso, Aisin Seiki, and Toyota Boshoku) set up operations in India. However, operations of foreign-owned automobile parts producers faced constraints until early 2000s because of local content requirements for automobile assembly and the SME reservation policy. Following the removal of these restrictions in 2001, many more global automobile parts producers arrived (such as Robert Bosch, Delphi, Magna, Eaton, Visteon, and Hyundai Mobil). As we will discuss below, the Tier 1 automobile parts market play a pivotal role in the expansion of the Indian automobile industry as intermediaries between the local automobile parts makers and automobile producers. Automobile parts suppliers account for almost two-thirds of the value of the average car. Therefore, the competitive advantage of a carmaker depends crucially on its ability to maintain a harmonious relationship with its parts suppliers (Klier and Rubenstein 2008, Dyer 2000). In fact, Japanese carmakers consider a long-standing constructive relationship with their parts suppliers as "legitimate semi-insiders" a key factor of their success (Sako 2004).

IV. Growth and Composition of Production

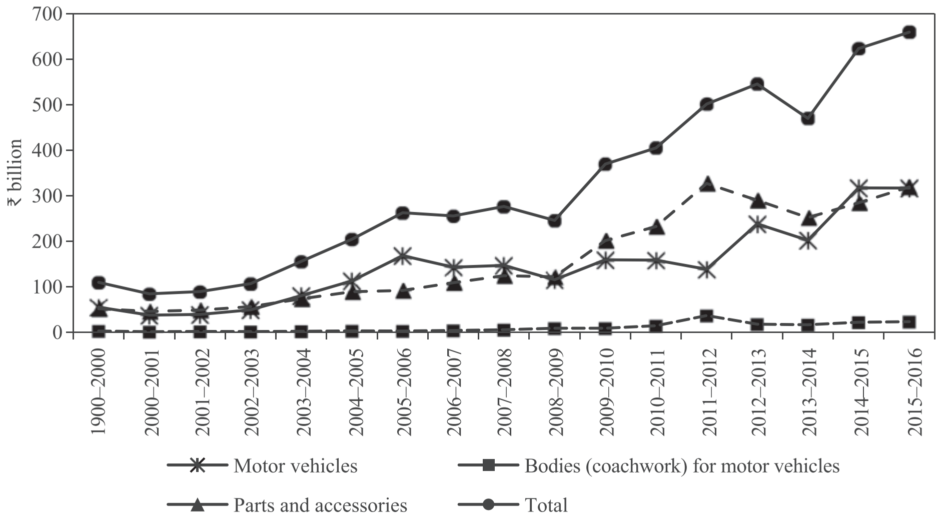
Figure 1 shows the trends in passenger and commercial vehicle production during the period 1950–2017. Total production remained at fewer than 100,000 units until the mid-1980s. The production of passenger vehicles gradually increased during the second half of the 1980s, picked up pace during the 1990s, and then grew much faster since the early 2000s. Production of passenger vehicles crossed the 1 million mark in 2004 while that of commercial vehicles remained below 1 million throughout the ensuing years. The share of passenger vehicles in the total number of vehicles produced stood at 82% in 2017, up from 56% in 1985. Real gross output (value added) in the automobile industry, which includes final assembly, manufacture of bodies (coach work), and parts and components production, grew at an average annual rate of 18.5% during 2000–2015, compared to about 6% during the previous 2 decades (Figure 2).

Figure 1. **Vehicle Production in India**



Source: Constructed using data from the Society of Indian Automobile Manufacturers (SIAM 2016).

Figure 2. **Real Output (value added) of the Automobile Industry**



Sources: Nominal value-added data are from the Annual Survey of Industries (ASI), Central Statistical Organization (CSO); and nominal values are deflated using the gross domestic product deflator for transport equipment obtained from the National Accounts Statistics, CSO.

During 1999–2016, compact cars accounted for over 80% of passenger vehicles, followed by midsize cars (engine size of 4,001 millimeters [mm] to 4,500 mm) with 18%, and large cars (engine size of over 4,500 mm) accounting for the balance. Maruti Suzuki (with a market share of 51%) and Hyundai (27%)

Table 3. **Passenger Car Production in India: Shares of Automakers (%) and Total Number of Vehicles Produced**

	Compact (up to 4,000 mm)		Midsize (4,001–4,500 mm)		Large (>4,500 mm)
	2009	**2014**	**2009**	**2014**	**2009**
Maruti Suzuki	50.8	51.3	37.5	16.4	0.0
Hyundai	33.6	27.5	17.6	14.7	0.8
Tata Motors	9.4	5.6	9.9	0.7	0.0
Nissan	0.0	4.9	0.0	12.0	0.0
Honda	0.6	3.7	17.3	20.8	18.3
Volkswagen	0.0	1.8	0.0	18.4	0.6
Ford	0.5	1.8	10.6	2.5	0.0
Toyota Kirloskar	0.0	1.8	0.0	9.0	18.8
General Motors	3.7	1.1	1.4	1.8	9.5
Fiat	0.9	0.3	0.0	0.0	21.6
Renault	0.0	0.1	0.0	0.2	0.0
Mahindra & Mahindra	0.0	0.1	2.3	0.5	0.0
BMW	0.0	0.0	0.0	0.0	5.3
Hindustan Motors	0.0	0.0	3.4	0.0	0.0
Mercedes-Benz	0.0	0.0	0.0	0.0	6.5
Skoda	0.4	0.0	0.0	3.1	18.5
Total	100	100	100	100	100
Number	1,614,539	2,021,676	265,993	372,876	52,088

mm = millimeters.

Notes: Data are based on the Indian fiscal year: 1 April in the reporting (given) year to 31 March in the following year.

Source: Compiled from the Society of Indian Automobile Manufacturers (SIAM 2016).

dominate the compact car segment (Table 3).[3] By contrast, the market structure for midsize cars is less concentrated, with the following carmakers accounting for more or less similar market shares: Honda (21%), Volkswagen (18%), Maruti Suzuki (16%), Hyundai (15%), and Nissan (12%). In commercial vehicles, Tata Motors accounts for the largest share in light commercial vehicles (43%) and medium and heavy commercial vehicles (54%), with the next largest players being Mahindra & Mahindra (39.8%) and Ashok Leyland (29.2%), respectively.

Notwithstanding the entry of foreign parts suppliers, domestic firms still account for the bulk (about 80% during 1997–2017) of locally procured automobile parts and components.[4] As expected, within the components industry, most (if not all) firms with foreign partners are Tier 1 suppliers who work closely with automobile producers. Most of the fully Indian firms are operating at the Tier

[3]The term "compact cars" is used here to refer to cars with ignition engine capacity of less than 1,500 cubic centimeters (cc). In automobile production statistics, this category of cars is recorded under two subcategories: compact <1,000cc (ignition engine capacity of less than 1,000cc) and compact >1,000cc (ignition engine capacity between 1,000cc and 1,500cc).

[4]Estimated using data from the Center for Monitoring the Indian Economic Prowess database. Foreign firms are defined as those with a foreign equity share of 25% or more.

2 and Tier 3 levels (Dash and Chanda 2017, Saripalle 2016). Undoubtedly, the domestic content requirements and SMEs reservation policy imposed during the import substitution era have played a role in the continued dominance of local firms in the automobile components segment. However, it is important to note that the "direct" output shares of Tier 1 firms (20%) grossly understate their role in globally integrating the Indian automobile industry. As already noted, these firms play a vital role in linking Tier 2 and Tier 3 suppliers with automakers.

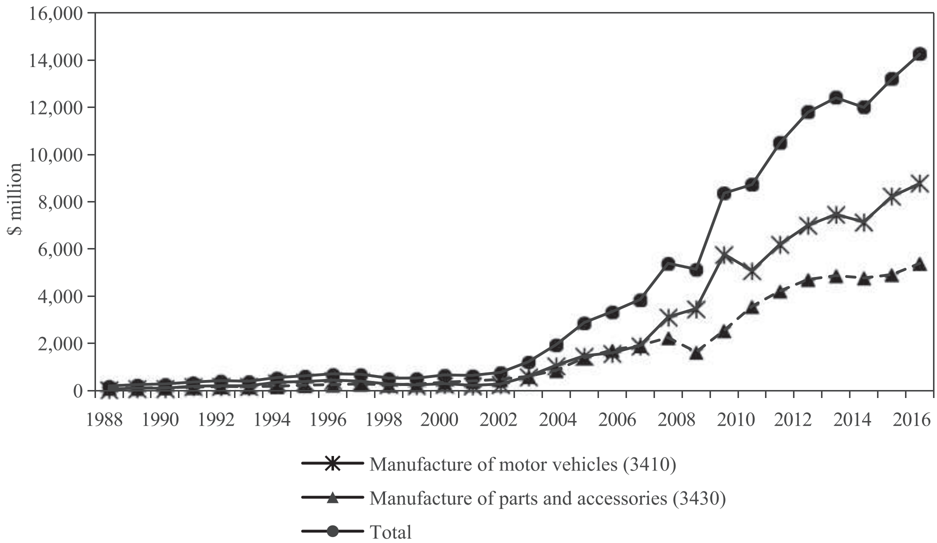
Some automobile MNEs have begun to use India as an export platform within their GPNs. For example, Toyota Kirloskar Auto Parts, a joint venture between Toyota and a local manufacturer, is exporting gearboxes from India to assembly plants in various countries, including Argentina, South Africa, and Thailand. Toyota Indonesia, which specializes in multipurpose vehicles, has integrated its production system with its operations in India, importing engine components from Indonesia and exporting gearboxes and automobile parts. Suzuki India has developed a two-way sourcing network encompassing its plants in India, Indonesia, and the PRC.

Hyundai has its largest overseas production base in India, with industrial clusters in Bengaluru, Chennai, Delhi, and Mumbai. Hyundai Motors India is playing an important role in expanding the parent company's presence in neighboring Southeast Asian countries. It exports a compact car designed in India (Santro) as semi-knocked down and CBUs to Pakistan, Bangladesh, Nepal, and Sri Lanka. Interestingly, Santro was launched in the Republic of Korea under the name Visto, with body panels, engine, and transmission components entirely imported from India. This is the first-known case in the history of the Indian passenger car industry of reverse technology transfer: a car designed by an MNE in India subsequently becoming part of the parent company's domestic production base (Park 2004).

V. Export Performance

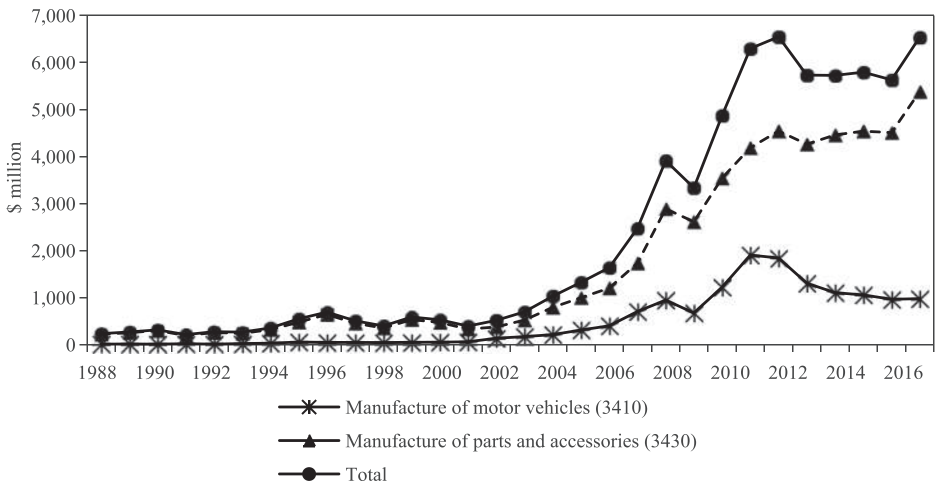
India's exports of CBUs increased from about \$225 million in 2001 to \$8.8 billion in 2017, while exports of parts and accessories increased from \$408 million to \$5.5 billion between these 2 years (Figure 3). The pattern is quite different on the import side with parts and accessories growing significantly faster than assembled vehicles during the same period (Figure 4). In 2017, the import value of assembled vehicles stood below \$1 billion compared to about \$5.4 billion of imports of parts and accessories. While assembled motor vehicles constitute the bulk of India's automobile exports (parts and components plus final assembly, which was 62% in 2017), parts and accessories account for the lion's share of total automobile imports (82% in 2017). This pattern is consistent with the emergence of India as an assembly center of automobiles.

Figure 3. **Automobile Exports, 1988–2017**



Note: Data based on International Standard Industrial Classification (ISIC). ISIC codes are in parentheses.
Source: Constructed with United Nations Comtrade data accessed using the World Bank's World Integrated Trade Solution.

Figure 4. **Automobile Imports, 1988–2017**



Note: Data based on International Standard Industrial Classification (ISIC). ISIC codes are in parentheses.
Source: Constructed with United Nations Comtrade data accessed using the World Bank's World Integrated Trade Solution.

The export–output ratio (the share of exports in total domestic production) for passenger vehicles is significantly higher (in the range of 15% to 20%) than for commercial vehicles (in the range of 8% to 13%) (Table 4). Within the passenger

Table 4. **Number of Vehicles Exported as a Share of the Number of Vehicles Produced (%)**

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Passenger vehicles	18.9	15.2	16.2	17.2	19.3	19.3	18.8	20.0	18.6
Passenger cars	22.9	18.2	19.8	22.4	23.7	22.4	n.a.	n.a.	n.a.
Utility vehicles	1.0	1.1	1.2	1.2	5.9	10.0	n.a.	n.a.	n.a.
Commercial vehicles	7.9	10.1	9.9	9.6	11.0	12.3	13.1	13.4	10.8

n.a. = not available.
Notes: Data are based on the Indian fiscal year: 1 April in the reporting (given) year to 31 March in the following year.
Source: Compiled from the Society of Indian Automobile Manufacturers (SIAM 2016).

vehicles segment, export orientation for passenger cars is significantly higher (in the range of 18%–24%) than for utility vehicles.

Passenger vehicles dominate the composition of automobile exports. The share of passenger vehicles in total vehicle exports increased from 31% in 1988 to 84.5% in 2017. A striking feature of passenger vehicle exports is their heavy concentration in compact cars. Cars belonging to this size category accounted for over 80% of passenger vehicle exports from India, compared to a global average of a mere 15% during 2000–2015. In Thailand, the largest car exporter in the region, compact cars accounted for only 38% of total passenger vehicle exports during this period. Between 2000 and 2015, India's share in world exports of compact cars increased from 0.7% to 5.6%, whereas India accounted for only about 1.4% of world passenger vehicle exports in 2015.[5]

Data on the geographic profile of compact car exports covering the top 25 destinations are given in Table 5. Markets in middle-income countries account for 45% of exports while high-income countries account for 37%. Among the middle-income group, the top individual country destinations include South Africa (16.4%), Algeria (7.6%), Eswatini (5.2%), and Mexico (3.8%). Among high-income countries, the top destinations include the United Kingdom (UK) (10.3%), Spain (4.5%), the United Arab Emirates (3.9%), Australia (3.9%), the Netherlands (3.6%), Italy (2.7%), and Germany (2.1%). In contrast to popular perception, the markets for Indian cars are not restricted only to developing countries. The high concentration of exports in South Africa and the UK is underpinned by the investment of Indian automobile companies in these countries. For example, Tata Motors acquired Jaguar Land Rover in the UK. Tata Motors and Mahindra & Mahindra have begun to penetrate markets in African countries from their bases in South Africa. Tata has invested over $700 million to set up a production base in South Africa. Mahindra & Mahindra exports automobiles to Botswana, Eswatini, Namibia, Zambia, and Zimbabwe using South Africa as the center of its operations in the region (Nyabiage 2013).

[5]Figures reported in this section, unless otherwise stated, are calculated from the United Nations Comtrade database (using export data at the 6-digit level of the Harmonized System).

Table 5. **Top 25 Destinations for India's Exports of Compact Cars, 2011–2014**

Countries	$ Million	Number	Share in Value (%)
(a) High-income countries			
United Kingdom	115.4	14,890	10.3
Spain	50.8	6,322	4.5
United Arab Emirates	43.7	4,444	3.9
Australia	43.7	4,578	3.9
Netherlands	40.8	4,933	3.6
Italy	30.8	4,293	2.7
Germany	23.7	3,374	2.1
Israel	17.1	2,153	1.5
Saudi Arabia	15.6	1,709	1.4
Chile	15.1	2,462	1.3
Bahrain	11.3	1,168	1
Ireland	8.9	896	0.8
Total	416.9	51,222	37.0
(b) Middle-income countries			
South Africa	184.3	24,196	16.4
Algeria	85.6	13,609	7.6
Eswatini	58	2,252	5.2
Mexico	43.1	7,194	3.8
Indonesia	21.7	3,251	1.9
Lebanon	18.8	2,438	1.7
Colombia	18.2	3,829	1.6
Libya	15.8	2,643	1.4
Tokelau	14.9	1,652	1.3
Angola	14.6	1,747	1.3
Peru	13	2,178	1.2
Turkey	11.8	1,263	1.1
Panama Republic	8.7	1,180	0.8
Total	508.5	67,432	45.3
(c) Low-income countries	198	26,386	17.6

Source: Compiled from data provided by the Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce, Government of India.

Having shown that India has been successful in carving out a niche in compact cars in both high- and middle-income countries, a pertinent question is how do Indian compact cars compare with those of competitors in terms of price? To address this question, we compare India's export unit values with those of the US for compact cars (Table 6).[6] The US is used here as the comparator country because of the availability of comparable data, and the comparison is appropriate given that India has a significant market presence in developed countries where it faces direct competition from carmakers in advanced countries, including the US.

[6]Unit values have well-known limitations as price proxies (particularly for manufactured goods), including spuriously capturing price changes associated with quality and brand changes as true price changes (Lipsey, Molineri, and Kravis 1991). Mindful of these limitations, we have used unit values here and in the next paragraph solely for making an overall comparison of price levels, rather than for analyzing intertemporal variations in prices.

Table 6. **Unit Value of Compact Car Exports from India and the United States, 2003–2013 ($)**

	Compact <1,000cc Cars		Compact >1,000cc Cars	
Year	**India**	**US**	**India**	**US**
2003	3,872	4,697	5,697	8,776
2004	4,437	4,946	4,622	8,618
2005	4,284	5,390	5,601	9,100
2006	3,877	5,500	9,828	13,012
2007	3,779	5,580	5,753	15,061
2008	3,888	5,952	6,135	15,274
2009	6,475	6,324	6,869	15,326
2010	5,200	7,454	6,946	15,164
2011	5,740	7,402	6,849	15,318
2012	5,494	7,873	7,395	15,763
2013	5,743	7,986	7,347	15,232

cc = cubic centimeters, US = United States.
Note: Data are based on the calendar year.
Sources: Unit values for India are estimated using data (at the 8-digit level of the Harmonized System) from the Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce, Government of India. Unit values for the US for the same product description are obtained from the US Census Bureau.

We find that Indian unit values are significantly lower than for the US. Thus, price competitiveness seems to be an important factor behind India's export success in this segment of the global automobile market.

It is also pertinent to compare unit-value realization from domestic sales with unit-value realization from exports. This comparison will help us understand the importance of tariff protection as a determinant of India's attractiveness as a production base for automakers, that is, whether tariff protection helps exporting firms maintain international competitiveness by relying on excessive profits earned domestically at tariff-ridden prices (Krugman 1984).

For this price comparison we computed the unit value of domestic sales of two major automobile producers in India—Hyundai and Maruti Suzuki—and export unit values of total compact car exports from India (Table 7). To facilitate the comparison, it is important to note that Hyundai mostly exports cars in the compact >1,000 cubic centimeters (cc) segment while Maruti Suzuki exports both types of compact cars (that is, cars with ignition engine capacity of less than 1,000cc and between 1,000cc and 1,500cc). It is evident that the export unit value of exports is not significantly different from the domestic unit value for Hyundai, and the domestic unit value for Maruti Suzuki is approximately the weighted averages of export unit values for the two types of cars. Allowing for spikes, which possibly reflect limitations of unit values as a proxy for price (footnote 7), it appears overall that domestic prices are approximately equal to export prices, implying that tariff protection is virtually redundant as a determinant of India's attractiveness as

Table 7. **Unit Value of Domestic Sales and Exports of Compact Passenger Cars**

	Unit Value Realization from Domestic Sales ($)		Unit Value Realization from Export Sales ($)	
	Hyundai	Maruti Suzuki	Compact <1,000cc Cars	Compact >1,000cc Cars
2003	n.a.	4,910	3,933	4,816
2004	n.a.	5,348	4,535	6,275
2005	n.a.	5,540	4,118	7,905
2006	n.a.	5,424	3,713	5,926
2007	n.a.	6,367	3,960	6,755
2008	7,089	5,271	4,549	6,876
2009	7,102	6,414	6,547	7,001
2010	7,079	6,612	5,103	7,096
2011	6,779	6,671	5,818	7,248
2012	6,796	6,922	5,410	7,391
2013	7,676	6,188	5,825	7,557
2014	6,434	6,081	6,238	7,754
2015	7,505	6,095	5,783	7,486

cc = cubic centimeters, n.a. = not available.
Notes: Data are based on the Indian fiscal year: 1 April in the reporting (given) year to 31 March in the following year.
Sources: Unit values of domestic sales are computed using firm-level data from the Center for Monitoring the Indian Economy database. Unit values of exports are computed using export data (8-digit Indian Trade Classification) from the Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce, Government of India.

a production base of compact cars. Ex-showroom prices gathered from various newspaper clippings also indicate a similar pattern. For example, the average ex-showroom price for Maruti Alto, the major brand exported in the compact car segment, was about $5,710 in 2012. Similarly, the ex-showroom price for Hyundai, the most exported brand in the 1,000cc–1,500cc car segment, was about $7,320 in 2013. In sum, the cost competitiveness of Indian cars sold in foreign markets does not seem to be rooted in tariff protection.

VI. Comparison with Electronics and Electrical Goods

Electronics and electrical goods account for the bulk of manufacturing exports from the PRC and other East Asian economies, which have integrated well into GPNs. The PRC has emerged as the global hub of electronics assembly in the world (Athukorala 2014). However, these products account for only a tiny share of India's exports (Athukorala 2019). An important question in this context, therefore, is what are the specific conditions which have made it possible for India's automobile industry to successfully integrate into GPNs but not the electronics industry? We argue that the divergent outcomes are related to both differences in the policy regime and industry characteristics.

Under planning for industrialization in India during the first 3 decades of independence, electronics and electrical machinery remained reserved for the public sector and the private SME sector. Until the late 1980s, foreign collaboration was not permitted in these sectors other than in 100% export-oriented ventures (Subramanian and Joseph 1988). In contrast, government policy was more accommodative of a private sector role and MNE participation in the automobile industry, even during the heydays of import substitution (section II). This long history of opening up for the private sector and allowing MNE participation presumably set the stage for global integration of the automobile industry following the liberalization of reforms initiated in the early 1990s and which gathered momentum from about the start of the new millennium.

Turning to industry characteristics, both electronics and automobiles have production processes conducive to global production sharing: discrete (separable) stages of production with different scales, skills, and technological needs and that can be located in different sites. However, unlike electronics, automobiles are bulky and have a low value-to-weight ratio and hence transport cost is a key determinant of market price. There is also a need to design the product to suit the tastes and budget of the consumer. Therefore, there is a natural tendency for car assembly plants to locate in countries with large domestic markets (Lall, Albaladejo, and Zhang 2004).

Once automakers choose to set up assembly plants in a given country, parts and component producers follow them because of two reasons. First, and perhaps more important, most automobile parts are also bulky and characterized by low value-to-weight ratios, which make it too costly to use air transport to ensure the timely delivery required by the final assembler's just-in-time production schedule.[7] Second, there is an asymmetrical market power relationship between component makers and automakers within the global automobile industry—products of many automobile parts manufacturers are used in vehicles made by a handful of carmakers. Electronics parts such as integrated circuits and semiconductors, by contrast, are used in many industries. Thus, there is an incentive for automobile parts makers to set up factories next to the assemblers to secure their position in the market (Klier and Rubenstein 2008, Dyer 2000).

Once a complete production base (involving both final assembly and component assembly and/or production) is established in a given (large) country, exporting to third countries becomes a viable option for automakers. Scale economies gained from domestic expansion makes exporting both parts and components and assembled vehicles profitable as part of their global profit maximization strategy. Adapting products to suit domestic demand conditions and lower transportation costs compared to exporting from the home base also become important drivers of exporting to regional markets from the new production base.

[7]By contrast, air shipping is the mode of transport for over two-thirds of electronics exports from Malaysia, the Philippines, Singapore, and Thailand to the US (Hummels 2009).

In electronics, the value-to-weight ratio of the final products and most components is generally much higher than in the automobile industry. Therefore, the industry has the flexibility to locate various slices and/or tasks of the production process in different sites based on relative cost advantages, provided the reduction in production cost more than offsets the "service link" cost (Lall, Albaladejo, and Zhang 2004; Jones and Kierzkowski 2004). The term service link refers to arrangements for connecting and coordinating activities in each country with what is done in other countries within the production network. Service link costs are determined by the overall investment climate of a given country encompassing foreign trade and investment regimes and the quality of trade-related infrastructure and logistics. India's average manufacturing wage is much lower than in the PRC and other major East Asian countries (Athukorala 2019). As labor costs are rising sharply in the PRC, India has an opportunity to make inroads into GPNs. The experience in the PRC clearly demonstrates that the availability of a large labor pool is an advantage, particularly for final goods assembly within GPNs, which require production in factories that employ a large number of workers. However, notwithstanding significant trade and investment policy reforms over the past 2 decades, India has not been able to meet the service link standards required for electronics to fit into GPNs.[8]

VII. Determinants of Exports: Gravity Model Analysis

In this section, we undertake an econometric analysis of the determinants of automobile exports. The analysis uses the standard gravity modeling framework, which has now become the workhorse for modeling bilateral trade flows (Head and Mayer 2014). The export equation is estimated separately for compact $<1{,}000$cc cars, which accounted for the largest share of total automobile exports during the 1990s, and compact $>1{,}000$cc cars, which started to gain a bigger share of the export mix from the early 2000s.

A. The Model

After augmenting the basic gravity model by adding several explanatory variables, which have been found to improve its explanatory power in previous studies (Head and Mayer 2014, van Bergeijk and Brakman 2010), the empirical model is specified as

$$\begin{aligned} EXP_{jt} = f(&L(GDP)_{jt}, L(POP)_{jt}, L(PRD)_{jt}, L(RER)_{jt}, L(TAR)_{it}, L(MPC)_{it}, \\ &DP2000, DHI_{jt}, DUMI_{jt}, DLMI_{jt}, DFTA_{it}, DEU_{jt}, DNAFTA_{jt}, \\ &DSACU_{jt}, TREND_t, \delta_t, \varepsilon_{jt}) \end{aligned}$$

[8]For details, see Athukorala (2019) and the studies cited therein.

where i stands for India, j is India's trade partner, t is year, and L denotes the natural logarithm. The notation δ_t represents partner fixed effects, which captures time-invariant, partner-specific variables such as distance from India, business language, and a common border, and precludes the need to explicitly control for these factors. ε_{jt} is a stochastic error term, assumed to have a normal distribution. The variables are defined below, with the postulated signs of the coefficient for explanatory variables given in parentheses.

EXP	Bilateral exports, $ million.
GDP	Gross domestic product of trade partner, $ million (+)
POP	Midyear population (+)
PRD	Automobile production (gross output), $ million (+)
RER	Bilateral real exchange rate index (2010 = 100) (+)
TAR	Nominal applied import tariff rate (%) (− or +)
MPC	Import of vehicle parts and components, $ million (+)
D2000	A dummy variable to capture policy shifts from 2000, 1 for the years after 2000 and 0 otherwise (+)
DHI	A dummy variable that takes a value of 1 if a partner country belongs to the group of high-income countries and 0 otherwise (+)
DUMI	A dummy variable that takes a value of 1 if a partner country belongs to the group of upper-middle-income countries and 0 otherwise (+)
DLMI	A dummy variable that takes a value of 1 if a partner country belongs to the group of lower-middle-income countries and 0 otherwise (+)
DFTA	A binary dummy that takes a value of 1 if both India and its trade partner belong to the same free trade agreements (+)
DEU	A binary dummy variable that takes a value of 1 if a partner country is a member of the European Union or 0 otherwise (+ or −)
DNAFTA	A binary dummy variable that takes a value of 1 if a partner country is a member of the North American Free Trade Agreement and 0 otherwise (+ or −)

DSACU A binary dummy variable which takes a value of 1 if a partner country is a member of the Southern African Customs Union or 0 otherwise (+ or −)

TREND A linear time trend to capture secular changes in exports over time (+ or −)

Among the explanatory variables, *GDP* and *POP* of partner countries capture external demand for Indian automobile exports, and *PRD* captures Indian supply capability. Bilateral real exchange rate (*RER*), measured as the domestic currency price of the trading partner's currency adjusted for relative prices between the two countries, is included to capture the relative profitability of exporting compared to selling in the domestic market.

The variable *TAR* represents India's nominal import tariff rate for CBU imports. According to the Lerner symmetry theorem, import tariffs act as an export tax by reducing the relative profitability of exporting compared to selling in the domestic market (Lerner 1936). However, the theory of import protection as export promotion postulates that producing for a protected domestic market helps achieve scale economies that, in turn, enhance export competitiveness (Krugman 1984). Therefore, the sign of the regression coefficients can be positive or negative.

MPC is a proxy for the positive effect on export performance of procuring parts and components within automobile GPNs. *D2000* is included to capture the impact of an acceleration of reforms in the early 2000s aimed at integrating the Indian automobile industry into GPNs compared to the early years (first 9) of reforms (see section II). *DFTA* represents the impact of tariff concessions offered under various trade agreements, while *DEU*, *DNAFTA*, and *DSACU* aim to capture the impact of major trade blocs in which India is not a member.[9] The three income group variables (*DHI, DUMI*, and *DLMI*) are specified based on the World Bank country classification and using the low-income country group as the base dummy. These three variables are included to test whether the stage of development of destination countries has a distinctive effect on export demand in addition to their GDP levels. Finally, *TREND* captures secular changes in exports over time.

As a robustness check, we estimate the above export equation by including four time-invariant variables, which are commonly used in gravity models in place of country-pair fixed effects (δ_j). The variables are *DST*, the geographical distance between New Delhi and capital city of partner countries; *BDR*, a common border dummy (1 if India and the partner share a common land border and 0 otherwise); *CLK*, a colonial economic link dummy (1 for India–UK bilateral exports and 0

[9]It is possible to include these variables along with partner fixed effects, as they are defined with respect to the year and the partner. The time subscripts in these variables refer to the years during which the trade blocs have been in operation.

for other country); and *CML*, a common language dummy (1 if India and the partner use a common business language and 0 otherwise). The expected sign of the regression coefficient is negative for *DST* and is positive for the other three variables.

B. Data and the Estimation Method

The dataset covers 196 trading partner countries during the period 1988–2015. Export data are from the United Nations Comtrade database. Data on value of output for motor vehicles are from the Annual Survey of Industry conducted by the Central Statistical Office of India. Data on *GDP*, *POP*, and the variables used for computing *RER* (bilateral exchange rate and GDP deflator for India and partner countries) are from the World Bank's World Development Indicators. Data on *TAR* and the information used for constructing *DFTA*, *DEU*, *DNFT*, and *DSACU* are from the World Bank's World Integrated Trade Solution and Global Preferential Trade Agreement databases. Following recent trade flow analyses using the gravity model, we use nominal US dollar values for *EXP*, *GDP*, *MPC* to avoid estimation biases associated with deflating (Head and Mayer 2014). Within the gravity modeling framework, *TREND* serves as a deflator of the nominal US dollar series used.

The estimation method used is the Poisson pseudo maximum likelihood (PPML) estimator (Santos Silva and Tenreyro 2006, 2010). PPML is a multiplicative estimator that has the advantage of retaining 0 export values. It also yields consistent coefficient estimates in the presence of heteroscedasticity. The PPML requires that the dependent variable enters in level (nonlog) form, but the coefficient estimates of the independent variables, used in log form, can still be interpreted as elasticities.

C. Results

Table 8 presents estimates of the export equation with country-pair fixed effects. Alternative estimates with the standard time-invariant variable in place of country-pair fixed effects are reported in the Appendix for comparison.

Looking first at the equation for compact <1,000cc cars, the coefficient of the trade partner's GDP is statistically significant, with the coefficient indicating that a 1% increase in the partner country's GDP on average is associated with an increase in India's exports by 0.11%, other things being equal. The coefficient for population has the perverse (negative) sign and is significant only at the 10% level. Taken together, the results for *GDP* and *POP* seem to suggest that the stage of development as measured by per capita income, rather than the absolute market size measured by GDP or population, is more relevant for explaining changes in India's

Table 8. **Determinants of India's Bilateral Exports (*EXP*): Gravity Model Estimation Results**

	Compact <1,000cc Cars	Compact >1,000cc Cars
log *GDP*	0.105*** (0.027)	−0.002 (0.033)
log *POP*	−0.069* (0.036)	−0.011 (0.042)
log *PRD*	0.934*** (0.235)	−0.043 (0.289)
log *RER*	−0.042 (0.065)	0.173*** (0.068)
log *TAR*	−0.886*** (0.268)	0.108 (0.229)
log *MPC*	0.396** (0.227)	1.417*** (0.327)
D2000	1.141*** (0.427)	3.010*** (0.648)
DHI	1.234** (0.625)	0.418 (0.761)
DUMI	1.035*** (0.327)	0.589 (0.473)
DLMI	1.309*** (0.428)	0.200 (0.594)
DFTA	0.513 (0.397)	0.969** (0.484)
DEU	−1.376*** (0.291)	2.920*** (0.571)
DNFT	0.769 (1.237)	3.057** (1.277)
DSACU	3.150*** (0.157)	4.336*** (0.256)
TREND	−0.067 (0.042)	−0.014 (0.048)
Partner fixed effects	Yes	Yes
Observations	4,393	4,411
R-squared	0.776	0.775

cc = cubic centimeters.
Notes: Robust standard errors clustered by trading partner are in parentheses. ***, **, and * indicate statistical significance of the regression coefficients at 1%, 5%, and 10%, respectively. See footnote 3 for the definition of the two types of compact cars.
Source: Authors' estimates.

export patterns over time.[10] This finding is also consistent with the coefficient estimates of the three dummy variables classifying destination countries by income groups (*DHI*, *DUMI*, and *DLMI* with low-income countries as the base dummy). The coefficients of these three variables, which are highly statistically significant, show that the geographic profile of compact car exports has a bias toward high- and middle-income partner countries relative to low-income partners.

[10]Note that change in per capita *GDP* is equal to change in *GDP* minus change in *POP*.

The coefficient of *PRD* is positive and highly significant, suggesting that a 1% increase in domestic production is associated with a 0.93% increase in exports. The result for the import tariff variable (*TAR*) suggests that a 1% reduction in India's import tariff rate is associated with an 0.89% increase in exports. Similarly, there is evidence that a 1% increase in imports of parts and components (*MPC*) is associated with a 0.4% increase in exports. According to the coefficient of *D2000*, export earnings during the period after 2000 are on average 1.14% higher compared to the previous years covered in the analysis. Overall, the results for these four variables confirm the importance of supply-side reforms in the emergence of India as a dynamic player within global compact car markets.

Interestingly, the coefficient of *RER* is not statistically different from zero, suggesting that relative profitability of exporting compared to selling domestically is not a significant determinant of the export decisions of Indian automobile firms. This is understandable because exporting decisions of firms operating within GPNs depend on the parent firm's locational decision at the global level, rather than on the relative profitability of selling in the domestic market of a given country. As discussed, Indian subsidiaries of compact automobile producers (in particular, Suzuki and Hyundai) have gained a competitive edge within the global automobile networks.

Turning to the equation for compact >1,000cc cars, the coefficients of the three main gravity variables—*GDP*, *POP*, and *PRD*—are not statistically different from zero. The coefficient of *TAR* is also not statistically significant. These results are understandable because India has emerged as an important player in this segment only in recent years and production is still predominantly for the middle-income domestic market. The results for *MPC* and *D2000* are consistent with those for compact cars. Providing easy access to intermediate inputs and broadening of reforms to facilitate carmakers to integrate within global production seem equally important for the export expansion of both types of compact cars.

Unlike in the case of compact <1,000cc cars, the bilateral real exchange rate (*RER*) coefficient is statistically significant for compact >1,000cc cars and has the expected sign. The coefficient suggests that a 1% depreciation of the *RER* is associated with a 0.17% increase in exports. This somewhat intriguing contrast presumably suggests some export spillover from predominantly domestic-oriented production in response to changes in relative profitability of exporting compared to selling in the domestic market. This finding is also consistent with a comparison of results for *DFTA* between the two equations. The coefficient for this variable is statistically significant with a positive sign only for compact >1,000cc cars. The highly significant and positive coefficient of *DSACU* in both equations is consistent with our observation (section V) that India-based carmakers expand exports to countries in the Southern African Customs Union using South Africa as the entry point.

The inferences made so far in this section are generally consistent with an estimation of the export equations that includes a time-invariant gravity variable instead of country-pair fixed effects (compare Table 8 with the Appendix). However, the overall fit of the two alternative export equations is much lower (measured by R-squared) compared to their fixed effects counterparts. The upshot is that export patterns are significantly influenced by unobservable destination country-specific effects over and above the four observable time-invariant variables we have included in the equations. This justifies our choice of the fixed effect estimates as the preferred econometric evidence.

In alternative estimates, colonial dummy (*CLK*) is highly significant with the expected positive sign in both equations. This result indicates the importance of colonial links in explaining the growing importance of the UK as the largest destination among developed countries for automobile exports from India (section V). Interestingly, geographic distance (*DST*), which has been commonly found as a key determinant of trade patterns in applications of the gravity model to aggregate trade flows, is not a significant determinant of automobile exports from India. It could be that consideration of "natural" trade cost associated with distance to market is overwhelmed by other specific considerations relating to MNE's production sharing within GPNs.

VIII. Concluding Remarks

From about the early 2000s, the Indian automobile industry has undergone a remarkable transformation from domestic market-oriented production that prevailed for over a half century to global integration. During the past 2 decades, most major automobile MNEs have set up wholly owned subsidiaries in India to produce for the growing domestic market as well as to use India as a production base for global markets of compact cars. Several global Tier 1 parts and component suppliers have also established production facilities in India. As a result, the country has emerged as a major assembly center for compact cars. Our analysis shows that Indian compact cars are highly price competitive in the international market.

Our analysis also suggests that simply granting trade protection in the absence of enabling conditions for foreign technology transfer is not an effective strategy to build a globally competitive automobile industry. Learning and capacity development through foreign market participation and entry of parts and components producers to set up production bases has been the key factor behind India's emergence as a production base within automobile GPNs. Market-conforming policies in the automobile sector over the past 2 decades, which constituted a notable departure from the protectionist policies in the past, have played a key role in transforming the Indian automobile industry.

Both car manufacturing and component production in India are dominated by foreign firms, with local firms mostly involved as suppliers of parts and components. However, this does not seem to make a case for government intervention to promote local interest; increased involvement of foreign firms in both car assembly and parts production has been a universal phenomenon driven by a structural shift in the global automobile industry, from the traditional multimarket mode of production to a globally integrated system of production. In the new era of a "world car," strategic alliances forged between key players in the industry and firms of different national origin have become the norm for cross-border operations. This by no means implies that Indian companies do not have the ability to move up the production ladder as they acquire expertise and technological capabilities over time. There are already indications that this is happening.

Trade protection, in the form of quantitative restriction and tariffs on imported cars, was presumably important in the early stage for attracting foreign firms to set up production bases in India. An important question in the present context of industry globalization is whether trade protection has outlived its purpose. Interestingly, there are no significant differences in prices of cars sold in the domestic and foreign markets. This suggests that the competitiveness of Indian cars sold in foreign markets is not rooted in the prevailing high tariffs in India.

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Appendix. **Determinants of India's Bilateral Exports (*EXP*): Gravity Model Estimation Results without Partner Fixed Effects**

	Compact <1,000cc Cars	**Compact >1,000cc Cars**
	0.125***	0.036
log *GDP*	(0.049)	(0.033)
	−0.123**	−0.104**
log *POP*	(0.071)	(0.057)
	0.890***	0.190
log *PRD*	(0.300)	(0.345)
	−0.064	0.137***
log *RER*	(0.073)	(0.055)

Continued.

Appendix. *Continued.*

	Compact <1,000cc Cars	**Compact >1,000cc Cars**
	−0.498***	0.051
log *TAR*	(0.292)	(0.237)
	0.433**	1.144***
log *MPC*	(0.205)	(0.342)
	0.365***	2.936***
D2000	(0.045)	(0.626)
	1.161**	2.940***
DHI	(0.595)	(0.589)
	1.787***	2.222***
DUMI	(0.476)	(0.610
	1.261***	3.098***
DLMI	(0.512)	(0.652)
	0.413	0.862**
DFTA	(0.387)	(0.482)
	1.818***	1.781***
DEU	(0.406)	(0.439)
	0.251	1.958***
DNAFTA	(0.827)	(0.550)
	0.427	2.636***
DSACU	(1.096)	(0.9333)
	−0.068	−0.004
TREND	(0.052)	(0.045)
	−0.395	−0.273
log *DST*	(0.444)	0.273)
	−0.716	−0.435
BDR	(1.238)	(0872)
	3.329***	4.378***
CLK	(0429)	(0.455)
	0.230	−0.866
CBD	(0.548)	(0.871)
Partner fixed effects	No	No
Observations	4,393	4,411
R-squared	0.185	0.365

cc = cubic centimeters.

Notes: Robust standard errors clustered by trading partner are in parentheses. ***, **, and * indicate statistical significance of the regression coefficients at 1%, 5%, and 10%, respectively. See footnote 3 for the definition of compact cars.

Source: Authors' estimates.