

# The Turkish economy and the challenge of technology: a trade perspective

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## Abstract

This article provides an analysis of Turkish trade deficits from the perspective of technology, with particular focus on the period that began with the new millennium. It draws special attention to the technological structure of Turkish exports *vis-à-vis* Turkey's major trade partners and illustrates how Turkish trade deficits are primarily structural in nature and essentially caused by weak technology as compared with Turkey's partners. Turkish products lack competitiveness, particularly in the case of relatively higher technology goods. The future prospects for Turkey are discussed in relation to the present level of the country's technology infrastructure, and it is emphasized that, if Turkey is to achieve a better trade balance and a prominent share of world exports in the future, merely increasing its business sector's weak R&D expenditures will not be sufficient, as the country needs also to provide a sufficient number of researchers in order to increase its technological capacity. Moreover, in the case of both R&D expenditures and researchers, quality as well as quantity is required, with the number and quality of the latter in particular being crucial both for innovating and for absorbing foreign technology.

*Keywords:* Turkish exports; trade deficits; technology; competitiveness; research and development.

## Introduction

The Turkish economy has in recent years become more open to the world, with a present trade volume of 50 percent of its GDP as compared to around 40 percent during the first decade of the 2000s. Nonetheless, the economy is quite vulnerable, with continuous large trade deficits of around 10 percent of its GDP. These have been at least partly financed by hot money—i.e., short-term

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rent-seeking international funds—thus making the Turkish economy quite fragile when faced with external and internal economic and political shocks. Moreover, the fact that, owing to Turkey's international commitments, it is not possible to protect domestic industries by imposing tariff and non-tariff barriers makes it necessary for the Turkish economy to become more competitive in world markets. During the 1990s, there were two significant developments that have had important repercussions for this situation and for the Turkish economy as a whole. First, Turkey became a member of the World Trade Organization (WTO) in 1995, agreeing to abide by the rules of the WTO Agreement. Second, beginning on the last day of 1995, Turkey became a member of the European Union (EU) Customs Union. These two events have significantly constrained Turkey's policy flexibility, especially in the field of foreign trade, by ending protective tariffs and direct export incentives.

In the recent past, Turkey could survive high trade deficits thanks to excess liquidity in world financial markets. However, this may not prove to be the case in the future, which is likely to grow increasingly complex and even problematic in many ways, particularly when the ever increasing technology-driven competition in globalizing world markets are taken into consideration. In fact, Turkey's persistent large trade deficits, together with its accelerating decline in exports relative to the world, are currently a serious point of concern.

The aim of this paper is to critically analyze the present level of competitiveness of Turkish exports, particularly with respect to technology, and to investigate the economy's prospects in a technologically more competitive future. First, a short review of developments in the structure of global trade will be provided, focusing on the perspective of developing countries. After setting the scene for the Turkish economy by summarizing the recent course of events, Turkey's competitiveness from the viewpoints of commodities and trade partners will be examined; then, as a follow-up to this, the degree of diversification of Turkish exports and its significance will be considered. Next, the article will investigate Turkey's present position *vis-à-vis* the technology intensiveness of its exports, innovation trends in Turkey and its leading trade partners, and the acquisition of technology through imports, along with a detailed look at Turkish competitiveness in terms of technology. Then, in the fifth section, the question of Turkey's readiness for the challenge of technology in future trade will be discussed. Finally, the last section will provide an overview along with some concluding remarks.

## Trade and development in perspective

Over time, developing countries have come to realize that achieving economic development is not possible solely through the exportation of primary

products. Consequently, especially during the period from 1950 to 1970, many of them chose to adopt new trade policies in the form of “import substitution.” Many developing economies that adopted the import substitution policy, such as South Korea and Taiwan, have succeeded in producing competitive goods. However, import substitution policies were not successful everywhere. For example, the so-called “lost decade” of the 1980s in Latin America was arguably caused by failed import substitution policies, although later it was also strongly argued that it was basically a result of excessive borrowing in the 1970s and mismanagement of the resulting debt crisis by both borrowers and creditors, not to mention the oil shock of the late 1970s.<sup>1</sup>

In the meantime, international financial institutions have advocated neoliberal policies and liberal trade policies, with developing countries being encouraged throughout the 1980s and 1990s to rely on market-oriented policies. The so-called “Washington Consensus,” which originally targeted Latin America, has served almost as a manual for neoliberal policies, asserting a relationship between trade liberalization and economic development.<sup>2</sup> However, a significant number of countries, especially in East Asia, did not follow liberal policies, but instead exhibited significant achievements by switching to export-led growth policies. The economies that adopted this strategy first rapidly developed labor-intensive manufactures to replace traditional primary goods exports, and subsequently capital- and skill-intensive products followed suit. The success of export-led growth strategy became evident as early as the 1970s.<sup>3</sup> The first great leap was made by South Korea, Hong Kong, Taiwan, and Singapore—the so-called “four Asian tigers.”<sup>4</sup> According to Rodrik,<sup>5</sup> all the successful development models of the 20th century were based on managed trade regimes: the import substitution model of the 1960s, the export-led industrialization of East Asian countries, and later the state capitalism of China. It must be emphasized that these policy paradigms were not solely related to trade policies, but were part and parcel of economic policies as a whole.

These rapid developments, starting especially in the East Asian economies, together with revolutionary improvements in information and communication

1 See, e.g., Joseph E. Stiglitz and Andrew Charlton, *The Right to Trade: A Report for the Commonwealth Secretariat on Aid for Trade* (London: Commonwealth Secretariat, 2012).

2 For a critical analysis, see Charles Gore, “The Rise and Fall of the Washington Consensus as a Paradigm for Developing Countries,” *World Development* 28 (2000): 789–804.

3 See Hollis Chenery, Sherman Robinson, and Moshe Syrquin, *Industrialization and Growth: A Comparative Study* (Oxford: Oxford University Press, 1986).

4 For example, according to the World Bank database, the merchandise exports of South Korea increased by 35.6 percent per year during the period of 1970–1980, and by 14.0 percent per year during the period of 1980–1990. Moreover, the average GDP growth rate of the South Korean economy was 9.0 percent during 1970–1980 and 9.7 percent during 1980–1990.

5 Dani Rodrik, *The Global Governance of Trade as if Development Really Mattered* (Geneva: UNDP, 2001).

technologies, paved the way for the reorganization of world trade.<sup>6</sup> The rapidly expanding industrial capabilities of many developing countries, particularly in Asia, have enabled the industrialized world's transnational companies (TNCs) to outsource some of their standard activities at lower costs, thereby leading to a shift from producer-driven to buyer-driven global commodity chains, which came to be known as global value chains (GVCs).<sup>7</sup> GVCs have encouraged developing economies to take part in them and thus move to the upper technological echelon. Although GVCs have opened a new and wider path for industrialization and participation in the global manufactures trade, they initially made TNCs more powerful owing to intense competition among suppliers. Over time, the TNCs of the developed world came to concentrate mostly on product development and marketing, leaving the rest to their partners in developing economies. Moreover, after the global crisis of 2008–2009, cost pressures on TNCs led to an increasing outsourcing of business processes, knowledge processes, and information technology to developing countries.<sup>8</sup> Suppliers have become bigger and more sophisticated and capable; they have become not only key input suppliers, but also suppliers of pre-production and post-production services, leading to a power shift towards manufacturers in emerging economies like China, India, Brazil, and Turkey.<sup>9</sup> Presently, technology is more intertwined with trade and development than ever, and as a result trade and development policies require greater coherence.

### Recent developments in the Turkish economy

Just prior to the new millennium, the world economy witnessed regional crises in East Asia in 1997 and Russia in 1998. The Turkish economy was adversely affected, especially by the Russian crisis. This was then followed by the most severe crisis to date, the 2000–2001 banking crisis. When this crisis crashed the economy, Turkey had already been involved in an International Monetary Fund (IMF) stand-by arrangement since December 1999. The subsequent financial turmoil and sharp depreciation of the Turkish lira led to drastic

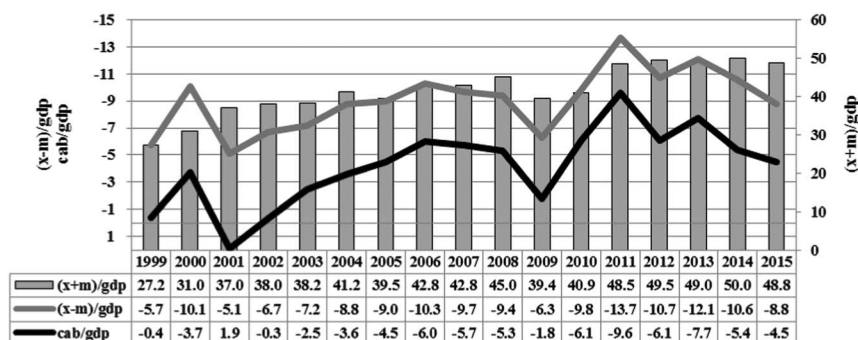
6 See Gary Gereffi, John Humphrey, Raphael Kaplinsky and Timothy J. Sturgeon, "Introduction: Globalization, Value Chains and Development," *IDS Bulletin* 32 (2001): 1–8.

7 Ibid. and Gary Gereffi, "Global Value Chains in a Post-Washington Consensus World," *Review of International Political Economy* 21 (2014): 9–37.

8 See especially Gary Gereffi and Karina Fernandez-Stark, "The Offshore Services Value-Chain: Developing Countries and the Crisis," in *Global Value Chains in a Post-crisis World: A Development Perspective*, ed. Olivier Cattaneo, Gary Gereffi, and Cornelia Staritz (Washington, DC: The World Bank, 2010): 335–372.

9 Gereffi, "Global Value Chains." These developments have also been changing the global world order; see, e.g., Aylin Ege and A. Yavuz Ege, "The World into the 21st Century: Globalization, Market Capitalism and Sustainability," *METU Studies in Development* 43 (2016): 129–156.

Figure 1: Turkey: Current account balance (cab), total merchandise trade (x + m) and net trade (x - m) as ratios to GDP (%)



Source: Calculated from Treasury data.

Note: x refers to merchandise exports and m represents merchandise imports, both in value terms.

Source: *Aylık Ekonomik Göstergeler* [multiple issues], Ankara: T.C. Başbakanlık Hazine Müsteşarlığı.

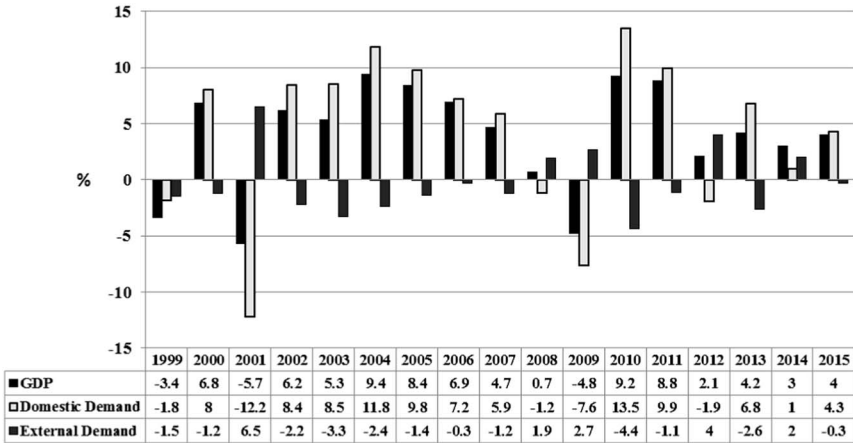
consequences in the real economy, causing a 5.7 percent decline in GDP in 2001. Although exports declined only very slightly, the rate of decrease in imports was more drastic as a result of the lira's depreciation and the decline in domestic demand, and the trade deficit still amounted to more than 5 percent of GDP. The following years witnessed certain positive developments in the economy that led to relatively high GDP growth. Throughout the 2000s, Turkey's trade volume steadily increased, ultimately reaching around 50 percent of its GDP (Figure 1). These developments were, effectively, supported by the increase in global liquidity flowing toward emerging economies.

The United States' financial crisis began to erupt in 2007, after which it went global, reaching its climax in 2008–2009. This also affected the Turkish economy very adversely, causing a 4.8 percent decline in 2009's GDP, yet the trade deficit remained high despite a significant decline in domestic demand (Figures 1 and 2).

The overvalued Turkish lira and high domestic interest rates attracted foreign funds, which beginning in 2010 had begun to increase again on a global scale. This created high domestic demand-led growth rates, as had also been the case prior to 2008–2009. Consequently, both the trade and current account deficits surged considerably, which was further aggravated by increasing oil prices during 2010–2011 (Figure 2).

Beginning in 2012, GDP growth became modest, with the source of growth alternating between domestic and external demand. Additionally, oil prices started to decrease toward the end of 2014, but trade and current account deficits continued at considerably high levels.

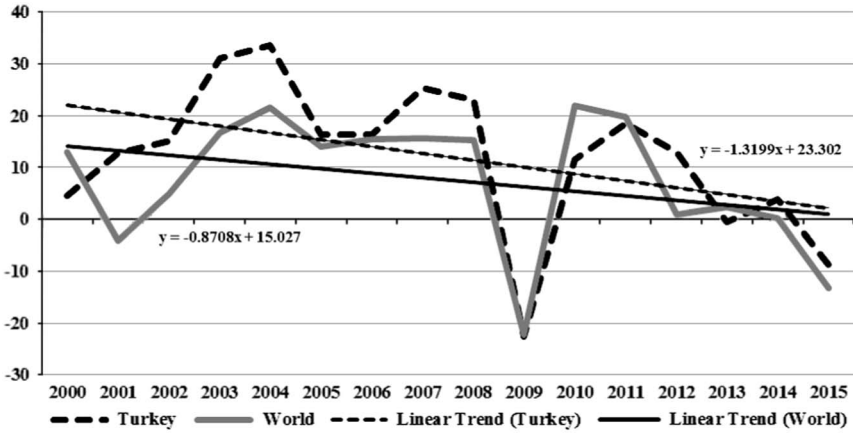
Figure 2: GDP growth rate and contributions of domestic and external demands to GDP (%)



Source: Calculated from Treasury data.

Source: *Aylık Ekonomik Göstergeler* [multiple issues], Ankara: T.C. Başbakanlık Hazine Müsteşarlığı.

Figure 3: Growth of Turkish and world exports (%)



Source: Calculated from WTO data.

Sources: World Trade Organization (WTO), *International Trade Statistics* [multiple issues] Geneva: WTO and World Trade Organization (WTO), *World Trade Statistical Review 2016* (Geneva: WTO, 2016).

The share of Turkish exports had been increasing before plummeting in 2009, together with world exports as a whole, as shown in Figure 3. Despite a strong bounceback in subsequent years, the path of Turkish exports exhibited an erratic but overall downward-sloping trend, one that converged with the global trend. Yet the slope of Turkish exports was steeper, dropping more rapidly than world exports (Figure 3).

## Turkey's competitiveness in terms of commodities and with respect to partners

Turkey's top export commodities are presented in Table 1 from the viewpoint of certain performance criteria as well as in terms of technology intensiveness. Their share in the total exports of the country in 2015 was 76 percent. However, the net trade in these commodities reflected a deficit of 38,763 million US dollars, which comprised 61.1 percent of Turkey's total trade deficit for the year.

From the point of view of technology intensiveness, twelve commodity sectors out of twenty can be classified as primary commodities, labor-intensive and resource-based manufactures, or both. Three of those that are labor-intensive and resource-based manufactures—namely, “pearls, precious stones, precious metals and articles thereof” (HS71<sup>10</sup>); “articles of apparel and clothing accessories, knitted or crocheted” (HS61); and “articles of apparel and clothing accessories, not knitted or crocheted” (HS62)—are identified by the Balassa and Lafay indices<sup>11</sup> as being the most specialized and most competitive industries among the twenty total sectors. They rank third, fourth, and seventh respectively in terms of their share in total exports, and each of them also has much higher trade surpluses as compared to the other sectors. Two of them, HS71 and HS62, have recently been increasing their share in world markets, whereas HS61 suffers from a demand problem despite having a high market share (4 percent). The six commodity sectors that are either primary commodities or labor-intensive and resource-based manufactures—namely, “edible fruits and nuts; peel of citrus fruit or melons” (HS08); “furniture” (HS94); “salt; sulphur; earths and stone; plastering materials, lime and cement” (HS25); “preparations of vegetables, fruit or other parts of plants” (HS20); “carpets and other textile floor coverings” (HS57); and “other made up textile articles; sets; worn clothing and textile articles; rags” (HS63)—have a degree of specialization and are competitive in world markets, as indicated by the Balassa and Lafay indices. All of these sectors have trade surpluses. The performance of HS57 is particularly remarkable: it has a very large share in world exports (13.7 percent) and quite a high rate of annual growth (11.7 percent). The remaining three commodity sectors are “mineral fuels, minerals, oils and products of their distillation” (HS27); “cotton, cotton yarn and cotton textiles” (HS52);

10 HS = Harmonized System.

11 In mathematical terms, the Balassa index  $X_{c,i} = (X_{c,i}/X_c)/(X_{w,i}/X_w)$  and the Lafay index  $i = (1000/(X_c + M_c)) * [(X_{c,i} - M_{c,i}) - (X_c - M_c) * (X_{c,i} + M_{c,i}) / (X_c + M_c)]$ , where  $c$  is the country under examination,  $i$  represents a specific industry,  $X$  are exports,  $M$  are imports, and  $w$  is the set of all exporting countries. The Balassa and Lafay indices are complementary: while the Balassa index gives the degree of specialization of exports of a single national industry, the Lafay index shows the industry's competitiveness by taking into account both exports and imports.

Table 1. Top 20 sections of commodity exports of Turkey (2015, HS)

Rank	HS code and Industry	Exports 2015 (US\$ mio)	Share in Total Exports 2015 (%)	Average Annual Change (%) (2006-2015)	Contribution to Export Growth (2006-2015) (%)	Net Trade 2015 (US\$ mio) (*)	Share in World Exports 2015 (%)	Technology Intensiveness (**)	Structural Performance (2011-2015) (***)	Specialization	
										Balassa Index/RCA Index	(Lafey Index)
1	87 Vehicles other than railway or tramway rolling-stock, and parts thereof	17 463	12.1	4.4	6.5	-81	1.3	Medium and low-skill and technology-intensive manufactures	Star	1.5	2
2	84 Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	12 333	8.6	7.3	6.8	-13 254	0.6	Medium-skill and technology-intensive manufactures	Star	0.7	-2
3	71 Pearls, precious stones, precious metals, and articles thereof	11 264	7.8	22.4	11.0	7 081	1.9	Labor-intensive and resource-based manufactures	Star	2.1	3
4	61 Articles of apparel and clothing accessories, knitted or crocheted	8 926	6.2	2.8	2.3	8 066	4.0	Labor-intensive and resource-based manufactures	Traditional product	4.6	3
5	85 Electrical machinery and equipment and parts thereof	8 278	5.8	3.0	2.3	-9 360	0.3	Medium and high-skill and technology-intensive manufactures	Traditional product	0.4	-1
6	72 Iron and steel	6 556	4.6	0.5	0.3	-8 219	2.0	Low-skill and technology-intensive manufactures	Snail	2.3	-1
7	62 Articles of apparel and clothing accessories, not knitted or crocheted	5 916	4.1	2.6	1.4	4 125	2.6	Labor-intensive and resource-based manufactures	Star	3.0	2
8	73 Articles of iron or steel	5 465	3.8	5.6	2.5	2 723	2.0	Low-skill and technology-intensive manufactures	Star	2.2	1
9	39 Plastics and articles thereof	5 358	3.7	10.3	3.7	-6 910	1.0	Medium-skill and technology-intensive manufactures	Star	1.1	-1
10	27 Mineral fuels, minerals oils and products of their distillation	4 518	3.1	2.7	1.1	-33 325	0.2	Primary commodities, and labor-intensive and resource-based manufactures	Emerging product	0.3	-2
11	08 Edible fruits and nuts; peel of citrus fruit or melons	4 355	3.0	6.9	2.3	3 890	4.3	Primary commodities	Traditional product	4.9	1
12	94 Furniture	2 753	1.9	10.7	1.9	1 377	1.1	Labor-intensive and resource-based manufactures	Star	1.3	1
13	76 Aluminum and articles thereof	2 370	1.6	7.5	1.3	-964	1.5	Primary commodities and Low-skill and technology-intensive manufactures	Star	1.7	0
14	25 Salt; sulphur; earths and stone; plastering materials, lime and cement	2 253	1.6	14.1	1.8	1 861	5.4	Primary commodities, and labor-intensive and resource-based manufactures	Star	6.3	1



Table 1. (Continued)

Rank	HS code and Industry	Exports 2015 (US\$ mio)	Share in Total Exports 2015 (%)	Average Annual Change (%) (2006-2015)	Contribution to Export Growth (2006-2015) (%)	Net Trade 2015 (US\$ mio) (*)	Share in World Exports 2015 (%)	Technology Intensiveness (**)	Structural Performance (2011-2015) (***)	Specialization	
										Balassa Index/RCA Index	(Lafey Index)
15	20 Preparations of vegetables, fruit or other parts of plants	2 187	1.5	20.7	2.1	2 073	3.8	Primary commodities	Star	4.5	1
16	40 Rubber and articles thereof	2 165	1.5	6.9	1.1	-360	1.3	Primary commodities and medium-skill and technology-intensive manufactures	Emerging product	1.5	0
17	57 Carpets and other textile floor coverings	2 009	1.4	11.7	1.5	1 906	13.7	Labor-intensive and resource-based manufactures	Star	15.6	1
18	63 Other made up textile articles; sets; worn clothing and textile articles; rags	1 899	1.3	-0.1	-0.02	1 703	3.1	Labor-intensive and resource-based manufactures	Traditional product	3.6	1
19	52 Cotton, cotton yarn and cotton textiles	1 703	1.2	2.7	0.4	-562	3.1	Primary commodities, and labor-intensive and resource-based manufactures	Emerging product	3.5	0
20	54 Man-made filaments	1 564	1.1	4.7	0.6	-533	3.5	Labor-intensive and resource-based manufactures	Star	4.0	0
	Total of 20	109 335	76.0	5.8	51.1	-38 763	1.0				
	Total of all products	143 839	100.0	5.9	68.2	-63 395	0.87				

Source: Compiled and calculated from Turkstat, ITC and UNCTADSTAT.

(\*) The product-specific net trade values given in this column should be examined with caution, taking into consideration that these are not value of exports net of imported inputs. Please see Figure 1 for the definition of net trade within the context of this paper.

(\*\*) UNCTAD. Trade and Development Report. New York and Geneva: United Nations, 2002.

(\*\*\*) Star: a product that is growing faster than world trade in real terms; traditional product: its market share is high but its world demand is declining or growing at below the world average rate; snail: the world demand for this product has been stagnating or declining and its market share is also low; emerging product: its market share is low in a high-growth sector (ITC).

Sources: Türkiye İstatistik Kurumu (TÜİK), [www.tuik.gov.tr](http://www.tuik.gov.tr); International Trade Centre (ITC), "Trade Competitiveness Map," <http://tradecompetitivenessmap.intracen.org/>; and United Nations Conference on Trade and Development (UNCTADSTAT), "Reports," [http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx?CS\\_ChosenLang=en](http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx?CS_ChosenLang=en).

and “man-made filaments” (HS54). HS27 has no competitive power: it basically encompasses the fuels for which Turkey is a major net importer in large amounts. Although both HS52 and HS54 have some degree of specialization, they lack competitive power, as is suggested by their Lafay index values.

According to the Balassa and Lafay index values, Turkey is neither specialized nor competitive in “nuclear reactors, boilers, machinery and mechanical appliances; parts thereof” (HS84) and “electrical machinery and equipment and parts thereof” (HS85), and it is not competitive in “plastics and articles thereof” (HS39). There are large trade deficits in all three areas. However, the market prospects for HS84 and HS39, both of which are medium-skill and technology-intensive products, are quite promising. In HS85, which is a medium- and high-skill and technology-intensive product, Turkey’s world market share is a mere 0.3 percent.

Turkey’s best performance in a comparatively more technology-intensive product sector is “vehicles other than railway or tramway rolling-stock, and parts thereof” (HS87), which covers primarily road vehicles and their parts. These are medium- and low-skill and technology-intensive manufactures, and they rank first among the top twenty, with a share of 12.1 percent of total exports from Turkey in 2015. Although HS87’s net trade in 2015 is just below par, its contribution to export growth was 6.5 percent for the period of 2006–2015 as a whole.<sup>12</sup> Among the remaining four items out of twenty, only “articles of iron or steel” (HS73) shows any significant stance, with its considerable trade surplus and relative competitive power.

It is apparent that the net positive contributions to Turkey’s trade balance originate primarily from labor-intensive and resource-based manufactures and primary commodities. This aspect of Turkish exports points to the relative technological weakness of the Turkish economy.

Turkey’s competitive position among its trade partners also deserves analysis. The country’s top twenty partners in terms both of total merchandise trade as well as of certain critical comparative indicators are presented in Table 2. This table covers almost 69 percent of Turkey’s total trade, and it reflects 87 percent of Turkey’s total trade deficit. Nearly one-fourth of Turkey’s total merchandise trade is conducted with the top three economies in Table 2; i.e., Germany, China, and Russia. Turkey also has the largest trade deficits with the very same countries.<sup>13</sup>

12 For a detailed study from a political economy perspective, see Erol Taymaz and Kamil Yılmaz, *Political Economy of Industrial Policy in Turkey: The Case of Automotive Industry*, Working Paper No: 2016-1 (Istanbul: Sabancı University-TÜSIAD Competitiveness Forum, 2016). [http://ref.sabanciuniv.edu/sites/ref.sabanciuniv.edu/files/e\\_taymazk\\_yilmaz\\_wp\\_v1.pdf](http://ref.sabanciuniv.edu/sites/ref.sabanciuniv.edu/files/e_taymazk_yilmaz_wp_v1.pdf).

13 These amounted to 74.4 percent of the total trade deficit in 2015.

Table 2. Top 20 merchandise trade partners of Turkey (2015)

Rank	Country	Total Trade of Turkey (2015)			Net Trade of Turkey (2015)			Market Type (2011-2015) (**)	UNIDO Competitiveness Rank (2014)
		(US \$ mio)	Share in Turkish Trade (%)	Average Annual Change (%) (2006-2015)	(US \$ mio)	Share in Net Trade (%) (*)	Average Annual Change (%) (2006-2015)		
1	Germany	34 769	9.9	4.0	-7 935	12.5	5.1	Declining+	1
2	China	27 288	7.8	11.6	-22 459	35.4	3.2	Dynamic	5
3	Russia	23 990	6.8	1.5	-16 813	26.5	1.6	Declining	31
4	USA	17 537	5.0	5.0	-4 746	7.5	16.5	Dynamic+	3
5	Italy	17 526	5.0	1.4	-3 752	5.9	7.9	Declining+	10
6	UK	16 098	4.6	3.4	5 015	-7.9	12.9	Declining+	15
7	France	13 443	3.8	1.4	-1 753	2.8	-4.4	Declining	11
8	Spain	10 331	2.9	3.5	-846	1.3	25.2	Declining+	19
9	Iran	9 760	2.8	4.3	-2 432	3.8	-6.7	Declining	67
10	Iraq	8 847	2.5	12.9	8 253	-13.0	15.7	Dynamic	132
11	Switzerland	8 121	2.3	5.7	3 230	-5.1	-200.4	Dynamic+	6
12	South Korea	7 626	2.2	8.3	-6,489	10.2	7.4	Declining+#	4
13	United Arab Emirates	6 690	1.9	12.4	2 673	-4.2	5.6	Dynamic	41
14	India	6 264	1.8	14.8	-4 963	7.8	15.5	Declining+#	43
15	Netherlands	6 069	1.7	2.9	-241	0.4	-195.1	Declining+	8
16	Belgium	5 705	1.6	4.4	-589	0.9	-6.7	Declining+	7
17	Saudi Arabia	5 590	1.6	6.3	1 355	-2.1	-200.7	Dynamic	38
18	Romania	5 414	1.5	0.8	217	-0.3	-195.8	Dynamic+	37
19	Poland	5 307	1.5	8.7	-648	1.0	6.2	Dynamic+	23
20	Ukraine	4 570	1.3	1.0	-2 327	3.7	2.1	Declining+#	58
Total of 20		240 945	68.6	4.7	-55 250	87.2	0.3		
Others		110 128	31.4	6.0	-8 145	12.8	64.4		
Turkey (Total of All Countries)		351 073	100.0	5.1	-63 395	100.0	1.8		30

Source: Compiled and calculated from Turkstat; competitiveness data compiled from UNIDO statistics data portal; market type data from ITC. # calculated from ITC.

Note: (\*) A negative sign represents a surplus.

(\*\*) Dynamic market: Partner country's annual import growth > annual growth of world market; Declining market: Partner country's annual import growth < annual growth of world market; (+) Turkey's annual export growth to partner country > partner country's annual import growth from the world.

Sources: TÜİK; competitiveness data from United Nations Industrial Development Organization (UNIDO), "UNIDO Statistics Data Portal," <https://stat.unido.org/>; market type data is from International Trade Centre (ITC), "Trade Competitiveness Map."

Turkey's biggest trade partner is Germany, which ranks first in the United Nations Industrial Development Organization (UNIDO) competitiveness list (see Table 2); Germany's share represents almost one-tenth of Turkey's total trade. The annual growth of Germany's imports from Turkey was higher than its annual import growth from the world during the period of 2011–2015; i.e., Turkey's penetration into the German market was more successful than the rest of the world's penetration into the same market. However, Turkey's trade deficit with Germany increased by 5.1 percent annually over the very same period. Moreover, Turkey's deficit with Germany was accumulated primarily in high- and medium-skill and technology-intensive manufactures. Turkey's largest trade deficit is with China, which ranks second in Turkey's total trade. While China is a dynamic market, Turkey has been gaining no advantage from this. High- and medium-skill and technology-intensive manufactures are major contributors to the deficit with China. Turkey's trade deficit with Russia, on the other hand, is mostly in the fuel trade.

Turkey ranks higher than seven of twenty countries in terms of UNIDO competitiveness ranking; four of these are declining markets. Turkey's deficits with these four countries are essentially in either primary commodities and labor-intensive and resource-based manufactures such as fuels (HS27), or in low-skill and technology-intensive manufactures such as iron and steel (HS72). Eight economies out of twenty are listed in Table 2; these are dynamic, and Turkey was able to benefit from their dynamism in only half of the eight—namely, the United States of America, Switzerland, Romania, and Poland. Turkey has not been successful enough to penetrate the remaining four dynamic markets—namely, China, Iraq, the United Arab Emirates, and Saudi Arabia.

### **Degree of diversification of Turkish merchandise exports: what they indicate and their significance**

Product diversification is important for several reasons. First and foremost, it is a well-known fact that a more diverse structure of exports reduces vulnerability to external economic and political risks. Neto and Romeu, for instance, found that product diversification attenuated the trade collapse in Latin American countries during the 2008–2009 crisis.<sup>14</sup>

Many studies have indicated a link between growth and diversification.<sup>15</sup> Export diversification is linked to economic growth via the growth of exports.

14 Nelson Camanho da Costa Neto and Rafael Romeu, "Did Export Diversification Soften the Impact of the Global Financial Crisis?" Working Paper 11/99 (Washington, DC: International Monetary Fund, 2011). <https://www.imf.org/external/pubs/ft/wp/2011/wp1199.pdf>.

15 See, e.g., Paul R. Krugman, "Increasing Returns, Monopolistic Competition, and International Trade," *Journal of International Economics* 9 (1979): 469–479; Sheila Amin Gutiérrez de Piñeres and Michael

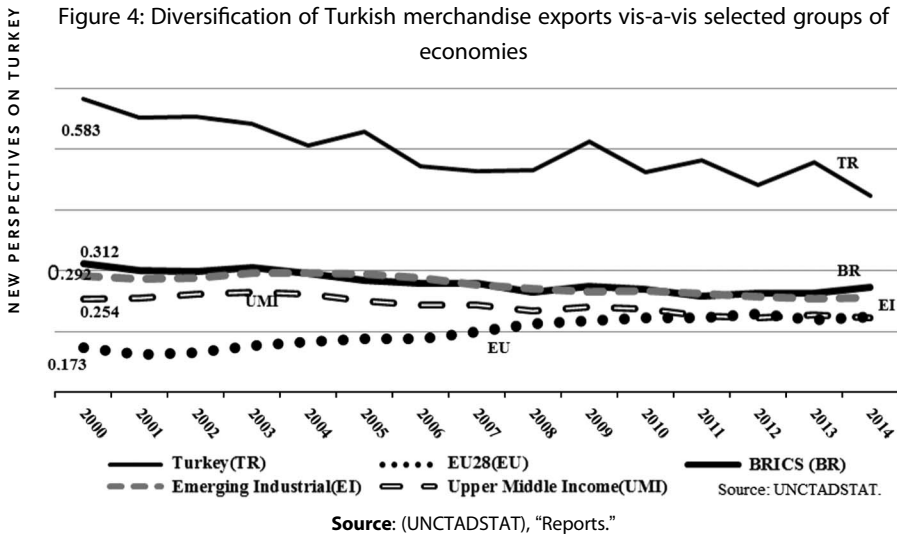
Hence, diversification of exports, and particularly diversification in manufactured goods, is considered to be an indicator of climbing the ladder of development.

A seminal paper by Imbs and Wacziarg<sup>16</sup> showed that, along the development path, sectoral diversification initially increases—probably as a result of the dynamic evolution of relative productivity and a fall in transport costs—but, beyond a certain level of per capita income, it begins to concentrate again; i.e., the sectoral distribution of economic activity has an inverted u-shaped pattern with regard to per capita income. It was Imbs and Wacziarg themselves who first sought an answer to the question of the level of income beyond which concentration begins again, and they found that it was at around 9000 in 1985 PPP US dollars.<sup>17</sup> At the same time, their empirical work indicates that it is the interaction between income per capita and openness that determines the stages of diversification. According to Cadot et al., the level is 25,000 in constant 2005 US dollars.<sup>18</sup> It seems that Turkey still has quite a distance to cover to begin to concentrate again, and thus it should continue to move in a way of development that goes together with better diversification opportunities and a more productive use of funds, as has been shown by Acemoglu and Zilibotti.<sup>19</sup> Figure 4 below shows the export diversification index values<sup>20</sup> for Turkey and certain country<sup>21</sup> groupings. The index values for Turkey indicate that the structure of Turkish exports has clearly improved in converging with the world structure and to the selected groups, although a significant distance remains to be covered. Over a period of 14 years, Turkey's index value dropped by 27.4 percent, from 0.583 to 0.423.

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Ferrantino, "Export Diversification and Structural Dynamics in the Growth Process: The Case of Chile," *Journal of Development Economics* 52 (1997): 375–391; Fahim Al-Marhubi, "Export Diversification and Growth: An Empirical Investigation," *Applied Economics Letters* 7 (2000): 559–562; and Florian Kaulich, *Diversification vs. Specialization as Alternative Strategies for Economic Development: Can We Settle a Debate by Looking at the Empirical Evidence?*, ISID Working Paper 03/2012 (Vienna: UNIDO, 2012). [http://epub.wu.ac.at/5232/1/WP032012\\_Ebook.pdf](http://epub.wu.ac.at/5232/1/WP032012_Ebook.pdf).

- 16 Jean Imbs and Romain Wacziarg, "Stages of Diversification," *American Economic Review* 93 (2003): 63–86.
- 17 Imbs and Wacziarg, "Stages of Diversification," 77.
- 18 Olivier Cadot, Céline Carrère, and Vanessa Strauss-Kahn, "Trade Diversification, Income, and Growth: What Do We Know?" Development Policies Working Paper No. 33 (Clermont-Ferrand: Fondation pour les Etudes et Recherches sur le Développement International, 2011), 6.
- 19 Daron Acemoglu and Fabrizio Zilibotti, "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth," *Journal of Political Economy* 105 (1997): 739–745.
- 20 The index values indicate greater divergence from the world pattern when they are closer to 1, as the diversification index measures the absolute deviation of the export structure of a country from the world structure.
- 21 The groups to be compared are chosen because Turkey is among both UNIDO's emerging industrial economies and the World Bank's upper middle income economies; because Turkey is a candidate for full membership in the EU, which is also a major trade partner of Turkey; and because BRICS covers a prominent group of emerging economies (Brazil, Russia, India, China, and South Africa), some of whom are among Turkey's major trade partners.



Researchers have also been attracted by the decomposition of diversification into extensive and intensive margin growth, i.e., broadly speaking, the increase in product lines and the increase in the amount exported through existing product lines. It has been widely observed that intensive margin growth dominates the overall growth of exports. Cadot et al. stated that 14–40 percent of trade growth is usually attributable to the extensive margin,<sup>22</sup> as other studies have shown as well. Among recent studies, Brenton and Newfarmer found that 80.4 percent of export growth in the period of 1995–2004 was due to intensive margin growth; this was 65.2 percent for low-income countries and 85.9 percent for high-income countries.<sup>23</sup> A recent World Bank report on Turkish trade reported that 65 percent of export growth in the period of 2002–2011 was from intensive margin growth.<sup>24</sup>

In contrast to this matter, geographical diversification has attracted little attention in the economic literature.<sup>25</sup> The aforementioned World Bank report on Turkish foreign trade found that only 15 percent of the export growth of the firms in the period of 2002–2011 was due to entrance into new markets.<sup>26</sup>

22 Cadot et al., "Trade Diversification," 7.

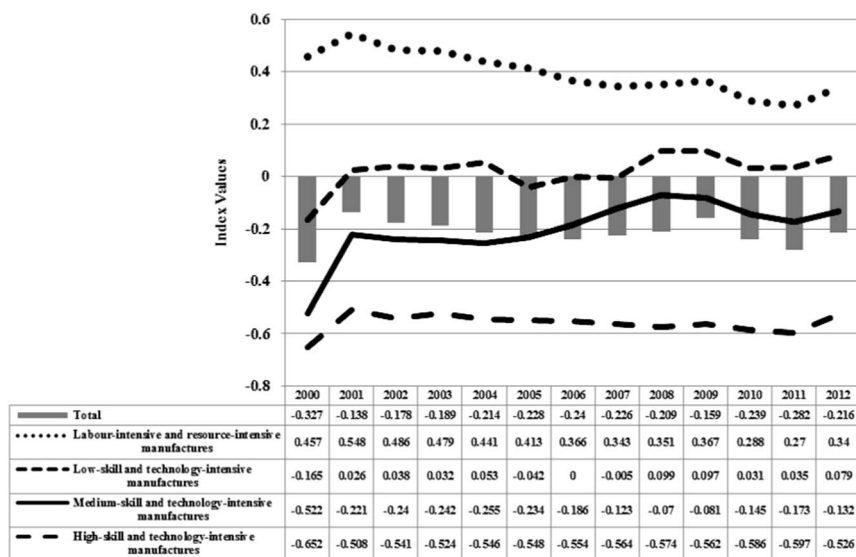
23 Paul Brenton and Richard Newfarmer, "Watching More Than the Discovery Channel: Export Cycles and Diversification in Development," Policy Research Working Paper No. 4302 (Washington, DC: World Bank, 2007), 7.

24 World Bank, *Trading up to High Income: Turkey Country Economic Memorandum* (Washington, DC: World Bank, 2014), 6–7.

25 See Kaulich, "Diversification vs. Specialization," 54.

26 World Bank, "Trading Up," 7.

Figure 5: Turkey's Merchandise Trade Specialization Index (2000-2012)



Source: UNCTADSTAT.

Source: (UNCTADSTAT), "Reports."

## Where does Turkey stand?

### *Levels of technology intensiveness and the Turkish merchandise trade*

As shown in Figure 5, which represents Turkey's 2000–2012 merchandise trade specialization index<sup>27</sup> for different levels of skill and technology, Turkey's significant negative trade balance is the consequence of high- and medium-skill and technology-intensive trade. There are some positive developments in the trends of all categories, excluding high-skill and technology-intensive manufactures and excepting a slight upward move toward the end of the period. While Turkey's dependence on labor-intensive and resource-intensive manufactures shows a significant decline through the period under investigation, there were positive developments in the performances of both low- and medium-skill and technology-intensive manufactures; the latter, however, remains in the negative zone. The overall picture indicates that Turkey is far from being a high-skill and technology-intensive economy, but it has covered some distance toward becoming a medium-skill and technology-intensive economy. Nevertheless, Turkey remains

27 It compares the net trade of a certain product or product group to total trade for this product or product group. The range of values is between -1 and 1; a positive value indicates that the economy in question is a net exporter; i.e., it specializes in the production of that specific product or product group, whereas a negative value indicates that it imports more than it exports the specific product or product group.

Table 3. Innovation Index

	2008	2014	2015	Growth Rate (%) (2008-2015)
Turkey	38.0	39.2	51.2	5.14
Germany	126.1	125.2	121.3	0.16
Italy	78.6	83.0	82.9	1.53
UK	106.1	110.9	115.5	1.98
France	108.9	106.3	109.0	0.76
Spain	77.0	74.0	69.3	-0.76
Switzerland	160.8	151.6	151.8	-0.08
EU 28	100	100	100	0.74
China	26	38	40	8.1
Russia n	41	36	38	0.6
USA	129	119	119	0.4
South Korea	105	121	123	3.8
India	34	32	32	1.0

Source: Calculated from the European Innovation Scoreboard 2016.

**Source:** European Commission, *European Innovation Scoreboard 2016* (Belgium: European Commission, 2016).

an economy the majority of whose exports are essentially confined to labor- and resource-intensive, low-skill, and technology-intensive manufactures.

### Innovation trends in Turkey and its leading trade partners

Table 3 below provides Innovation Index values for Turkey and its major trade partners, based on data from the European Innovation Scoreboard (EIS).<sup>28</sup> Turkey's progress in this regard was quite outstanding; its performance in terms of the annual growth rate of the innovation index is second only to Serbia among all listed European countries. Turkey certainly made a great leap in 2015, moving up from the group of "modest innovators" to that of "moderate innovators." The 2016 report states that, although there were improvements in nearly all dimensions, the sharp increase in Turkey's 2015

28 European Commission, *European Innovation Scoreboard* (Belgium: European Commission, 2016). The Innovation Index (II) is a summary of the performance of a range of different indicators. It mainly covers three groups of indicators: enablers (factors external to the firms; namely, human resources, research systems, and finance and support), firm activities (firm investments, linkages and entrepreneurship, and intellectual assets), and outputs (firms' innovation activities and the effects of innovation on the economy). The II has 25 components altogether. Each indicator is normalized to take a value between 0 and 1, and the II is the unweighted average of all indicators. We have further normalized the resulting index values by setting the EU28 values as 100.0. The table has two parts: the values in the upper part are based on 25 indicators, whereas the values in the lower part are based on 12 indicators, mainly owing to data availability, as stated by the 2016 report itself.



performance is due primarily to the relatively strong performance in firms' non-R&D innovation expenditures (43 percent)<sup>29</sup> and sales share of new product innovation (24 percent).<sup>30</sup>

However, the gap between Turkey and the leading figures—such as Switzerland, Germany, the United States, and South Korea—remains very large. Moreover, the annual innovation growth rates of China and South Korea are quite outstanding as well.

### Acquiring technology through imports: diversification of Turkish merchandise imports

In a seminal paper, Krugman showed that even countries with identical tastes, technologies, and factor endowments benefit from trade owing to an increased choice of goods.<sup>31</sup> However, when an economy imports new products, domestic producers of close substitutes have to improve their performance in order to compete, and in this situation less productive firms are eventually forced to exit the market.<sup>32</sup> As a consequence, average productivity increases. This may also happen after a tariff reduction. In 1984, Turkey implemented a broad and drastic import liberalization program in order to significantly reduce both tariff and non-tariff barriers, and when Levinsohn investigated the impact of this development on Turkish industry, he found strong support for his imports-as-market-discipline hypothesis; i.e., forcing firms to behave more competitively leads them to become more productive through competitive imports.<sup>33</sup> In a more recent study by Yılmaz and Özler examining the effects of declining protection rates on the productivity of Turkish manufacturing industry for the period of 1983–1996, it was found that the productivity gains were statistically significant, especially in import-competing sectors.<sup>34</sup>

29 This indicator measures non-R&D innovation expenditure as a percentage of total turnover. Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas (EIS 2016 report).

30 European Commission, *European Innovation Scoreboard*, 81, 94. Note, however, that future Turkish performance needs to be observed with caution so as to determine whether this is a continuous move forward.

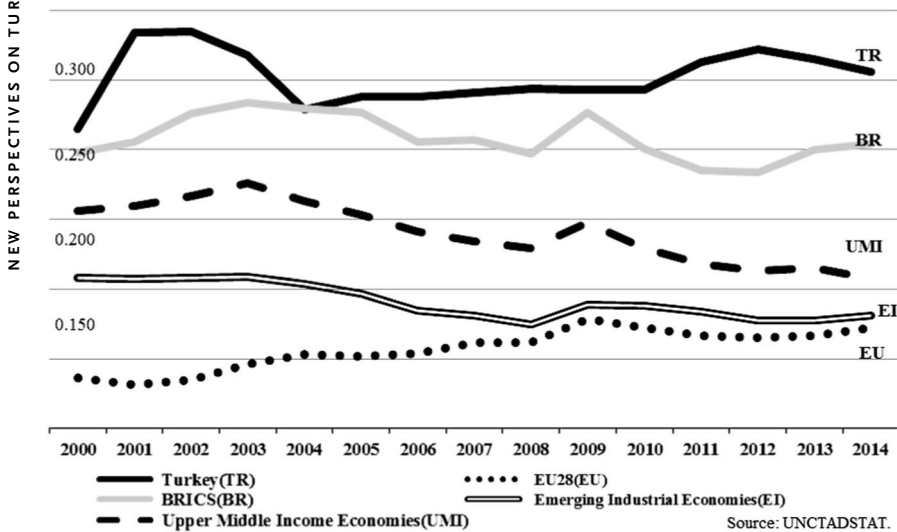
31 Paul R. Krugman, "Increasing Returns, Monopolistic Competition, and International Trade," *Journal of International Economics* 9 (1979): 469–479.

32 For an extension of Krugman's model, see Marc J. Melitz, "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica* 71 (2003): 1695–1725.

33 James Levinsohn, "Testing the Imports-as-market-discipline Hypothesis," *Journal of International Economics* 35 (1993): 16–20.

34 Kamil Yılmaz and Şule Özler, "Productivity Response to Reduction in Trade Barriers: Evidence from Turkish Manufacturing Plants," *Review of World Economics* 145 (2009): 349–355. For an econometric

Figure 6: Diversification pattern of Turkish imports vis-a-vis selected economic groups



Source: (UNCTADSTAT), "Reports."

The productivity growth caused by increased varieties of imported inputs is mostly realized through declining input prices and access to higher-quality inputs and new technologies, with imports of capital equipment forming another channel through which technology may transfer.<sup>35</sup> Keller, however, has argued that a certain type of skill is required to be capable of successfully adopting imported technology,<sup>36</sup> and Acharya and Keller found that, although imports are often a major channel in technology transfer, some countries benefit more from foreign technology than others, indicating that there are important differences in absorptive capacity, which could be related to domestic R&D investments or levels of education.<sup>37</sup>

Figure 6 gives the import diversification index values for Turkey and certain country groupings.<sup>38</sup> Starting in 2005, the structure of Turkish imports shows a

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study pointing to the importance of absorptive capacity or a "technological gap" for benefiting from foreign technology channels in Turkey, see Hülya Ülkü and M. Teoman Pamukçu, "The Impact of R&D and Knowledge Diffusion on the Productivity of Manufacturing Firms in Turkey," *Journal of Productivity Analysis* 44 (2015): 79–95.

35 Cadot et al., "Trade Diversification," 19–22.

36 Wolfgang Keller, "International Technology Diffusion," *Journal of Economic Literature* 42 (2004): 773–775.

37 Ram C. Acharya and Wolfgang Keller. "Technology Transfer Through Imports," Working Paper No. 13086 (Cambridge, MA: National Bureau of Economic Research, 2007), 23–24. <http://www.nber.org/papers/w13086>.

38 See the section on export diversification for more information about both the index and the groups of countries and their relevance.

trend diverging from the world pattern, then making another upward move in 2011, with 2013 being a year of downturn toward the world average. The 2014 level was still 15.5 percent higher than the 2000 level. Turkish imports are less diversified than those of BRICS, which is also distant from the converging patterns of the EU, EI (Emerging Industrial) economies, and UMI (Upper Middle Income) economies. This pattern of Turkish imports can be interpreted as indicating that the Turkish economy is less open to technology transfers through imported goods relative to most of its peers and trade partners.

### A closer look at Turkish competitiveness in terms of technology

In terms of technology intensity, there have been some recent setbacks in both trade and production (see Figure 7). Despite the significant increase in per capita manufactured exports in current US dollars, as represented by the bubble size,<sup>39</sup> the share of manufactured exports among total exports began to drop from 2005, while the share of medium- and high-tech products among total manufactured exports has stagnated during the same span of time.

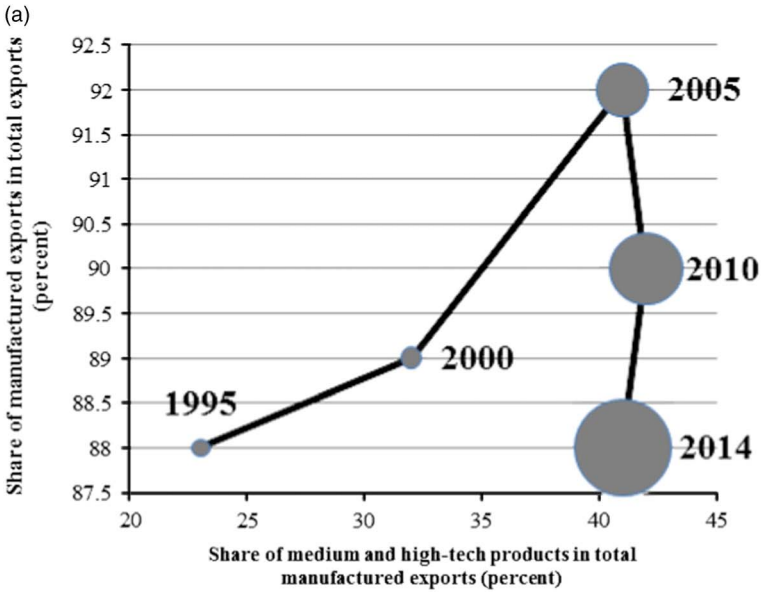
In terms of production structure, the picture is somewhat gloomier.<sup>40</sup> The per capita manufactured value added in 2005 US dollars increased from 1,063 US dollars in 1995 to 1,799 US dollars in 2014—an increase of only about 1.7 times over approximately two decades. Moreover, the share of manufacturing value added in GDP dropped from 22 percent in 1995 to 16 percent in 2014, and in an almost continuous way. The share of medium- and high-tech value added in total manufacturing value added has recently shown some signs of weakness as well: although it increased almost continuously between 1995 and 2010, from 28 percent to 32 percent, in 2014 there was a decline of two percentage points relative to 2010.

Table 4 displays, from a technology perspective, the exports of Turkey and those major trade partners with whom it has a considerable trade deficit. In terms of both medium- and high-tech manufacturing value added and exports, Turkey's rank does not lie at a point of outstanding importance. With its share of 1.05 percent of world manufactures exports, Turkey ranks above only Ukraine and Iran; however, both of these countries' medium- and high-tech manufacturing value added shares in their total manufacturing value added

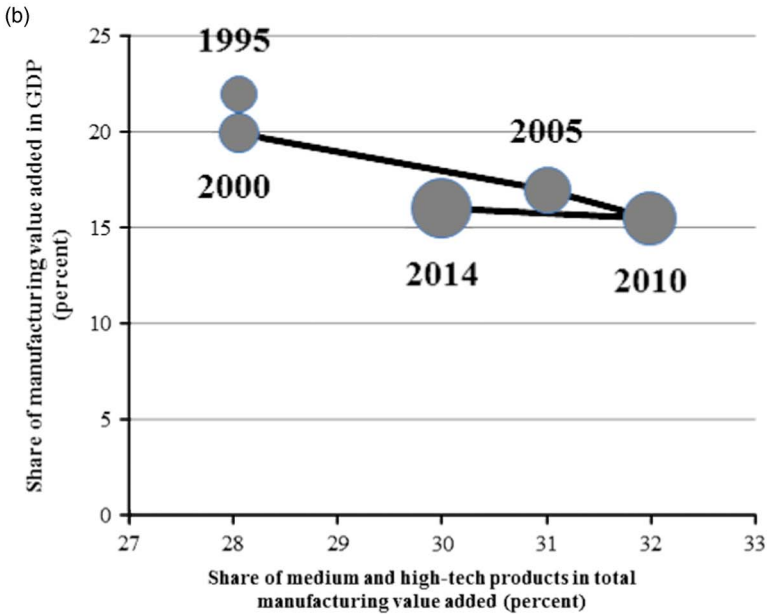
39 Increasing continuously, per capita manufactured exports in current US dollars surged from \$320 in 1995 to \$1,823 in 2014—almost six times higher than its initial value, as shown in Figure 7a.

40 Turkish industry has essentially been a follower of the developed world, and at a slow pace, ever since 1980, when neoliberal policies were first introduced; see Erol Taymaz and Ebru Voyvoda, "Marching to the Beat of a Late Drummer: Turkey's Experience of Neoliberal Industrialization since 1980," *New Perspectives on Turkey* 47 (October 2012): 83–113. For another critical view of Turkey's industrial policy, see Fikret Şenses, "Turkey's Experience with Neoliberal Policies since 1980 in Retrospect and Prospect," *New Perspectives on Turkey* 47 (October 2012): 11–31.

Figure 7: Trade and production structures in Turkey



Note: Bubble size represents per capita manufactured exports.



Note: Bubble size represents per capita manufacturing value added.

Source: UNIDO, "UNIDO Statistics Data Portal" and T.C. Başbakanlık Hazine Müsteşarlığı,

*Aylık Ekonomik Göstergeler.*

Table 4. Technology-intensive exports of Turkey and its major negative net trade partners (2013)

	MT + HT MVA Share in Total Manufacturing (%)	MT + HT Manufactured Exports Share in Total Exports (%)	HT Manufactured Exports Share in World Exports (%)	MT Manufactured Exports Share in World Exports (%)	MT + HT Manufactured Exports Share in World Exports (%)	Country's Share in World Manufactured Exports (%)
China	44.0	56.3	2.86	3.67	6.53	16.83
Russia	27.7	9.5	0.04	0.22	0.26	1.73
Germany	59.9	63.9	0.97	3.90	4.87	10.11
South Korea	83.1	70.4	0.65	1.42	2.07	4.29
India	40.8	23.8	0.08	0.34	0.42	2.20
USA	50.6	46.5	1.13	2.71	3.84	8.15
Italy	42.2	49.1	0.17	1.17	1.34	3.63
Iran	43.9	6.2	0.00	0.02	0.02	0.21
Ukraine	33.9	32.9	0.01	0.10	0.11	0.39
France	47.1	57.2	0.58	1.12	1.70	3.92
TURKEY	32.7	35.6	0.01	0.27	0.28	1.05

Note: MVA: manufacturing value added; MT: medium technology; HT: high technology.

Source: Compiled and calculated from UNIDO, Industrial Development Report 2016 (2015) and ITC.

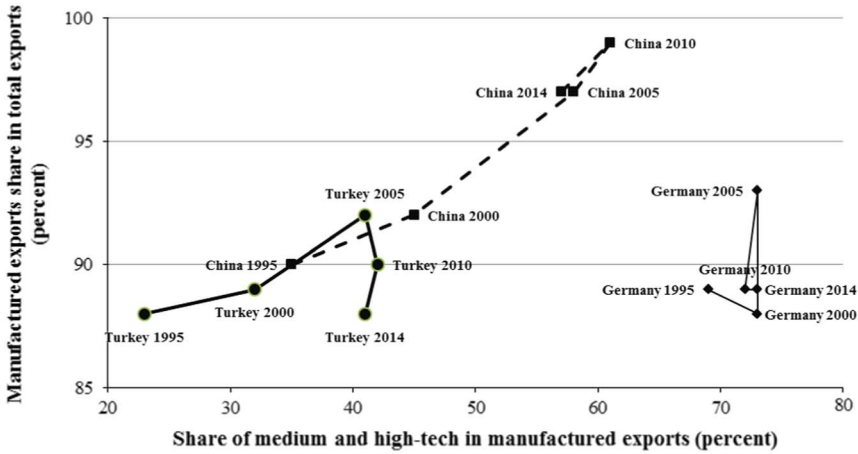
Sources: United Nations Industrial Development Organization (UNIDO), *Industrial Development Report 2016: The Role of Technology and Innovation in Inclusive and Sustainable Industrial Development* (Vienna: UNIDO, 2015) and ITC, "Trade Competitiveness Map."

are higher than Turkey's. Turkey is in a much better situation in the area of medium-tech manufactures relative to high-tech ones; in terms of its high-tech manufactured exports' share of world exports, it is as weak as Ukraine and Iran. In fact, Turkey's trade deficits against Iran, Ukraine, and Russia lie essentially in primary commodities and labor-intensive and resource-based manufactures; namely, fuels or low-skill and technology-intensive manufactures, such as iron and steel products.

Turkey's share of medium- and high-tech manufactured exports among world exports was a mere 0.28 percent in 2013, but this was still higher relative to Russia, Ukraine, and Iran. In contrast, the performances of countries that have a major trade surplus with Turkey are superior to Turkey in terms of the same indicator. These countries are, for the most part, the leading exporters of medium- and high-tech products, and they have much larger shares in world manufactured exports as compared to Turkey (see Table 4).

Turkey's top two merchandise trade partners are China and Germany (see Table 2). Their trade structures are depicted in Figure 8, *vis-à-vis* Turkey's trade structure for the period of 1995–2014. In terms of medium and high-tech exports, Germany is far ahead of both China and Turkey, with its

Figure 8: Trade structure in Turkey, China and Germany, selected years, 1995-2014



Source: UNIDO Statistics data portal and Treasury statistics.

Sources: UNIDO, "UNIDO Statistics Data Portal" and T.C. Başbakanlık Hazine Müsteşarlığı, *Aylık Ekonomik Göstergeler*.

medium- and high-tech exports accounting for over 70 percent of its total manufactured exports, as well as being quite stable during most of the period under investigation. China's performance has also been quite outstanding: its medium- and high-tech exports share in its total manufactured exports has been around 60 percent over the last decade, as against Turkey's 40 percent. Although Turkey showed a significant performance during the period 1995–2005, by pushing the share of medium- and high-tech exports up from 23 percent to 41 percent, it lay stagnant around the latter magnitude in the period of 2005–2014. Furthermore, in 2013, Turkey's medium- and high-tech manufactured exports consisted almost entirely of medium-tech products, whereas the share of high-tech products in total medium- and high-tech manufactured exports was almost 20 percent for Germany and a notable 44 percent for China.

In 2015, 70.8 percent of Turkey's trade deficit accumulated in five commodity sectors and 10 countries (see Table 5). For the countries listed in Table 5, the deficit commodities are as follows: fuels and others (HS27), with 30.85 percent; boilers and others (HS84), with 15.57 percent; electrical and electronic equipment (HS85), with 13.26 percent; iron and steel (HS72), with 8.88 percent; and aircraft and others (HS88), with 2.24 percent. These observations suggest that serious efforts are needed in terms of both policymaking and implementation so as to narrow such trade deficits. While technological upgrading of the Turkish manufacturing industry is required to

Table 5. First 12 industry-partner country combinations in Turkey's trade deficit (2015, HS)

Rank	HS code and Industry	Technology Intensiveness (*)	Partner Country	Trade Deficit	
				US \$ mio	% of Total
1	27 Mineral fuels, mineral oils and product of their distillation	Primary commodities, and labor-intensive and resource-based manufactures	Russia	-12 874	20.31
2	85 Electrical, electronic equipment	Medium and high technology-intensive manufactures	China	-6 924	10.92
3	84 Boilers, machinery; nuclear reactors, etc	Medium skill and technology-intensive manufactures	China	-5 111	8.06
4	27 Mineral fuels, mineral oils and product of their distillation	Primary commodities, and labor-intensive and resource-based manufactures	Iran	-4 898	7.73
5	72 Iron and steel	Low-skill and technology-intensive manufactures	Russia	-2 712	4.28
6	84 Boilers, machinery; nuclear reactors, etc	Medium-skill and technology-intensive manufactures	Germany	-2 457	3.88
7	84 Boilers, machinery; nuclear reactors, etc	Medium-skill and technology-intensive manufactures	Italy	-2 301	3.63
8	27 Mineral fuels, mineral oils and product of their distillation	Primary commodities, and labor-intensive and resource-based manufactures	India	-1 783	2.81
9	72 Iron and steel	Low-skill and technology-intensive manufactures	Ukraine	-1 604	2.53
10	85 Electrical, electronic equipment	Medium and high technology-intensive manufactures	South Korea	-1 484	2.34
11	88 Aircraft, spacecraft, and parts thereof	High-skill and technology-intensive manufactures	USA	-1 418	2.24
12	72 Iron and steel	Low-skill and technology-intensive manufactures	China	-1 314	2.07
Total of 12				-44 880	70.80
Total Net Trade of Turkey				-63 395	100.00

Source: Calculated from Turkstat.

(\*) UNCTAD. Trade and Development Report. New York and Geneva: United Nations, 2002.

Sources: TÜİK and UNCTAD, *Trade and Development Report* (New York and Geneva: United Nations, 2002).

increase its competitiveness, it is also necessary to increase the efficiency of resource utilization, as well as seriously considering replacing imported inputs, particularly energy inputs, with domestic ones.

### Where does Turkey stand in regards to the future?

There is a significant gap between Turkey and the majority of its trade partners in terms of technology advancement capacities (see Table 6). In terms of capacity for innovation, in 2012–2013 Turkey ranked twelfth among the thirteen countries listed in Table 6, with a grade of 3.7, indicating that the weighted average of Turkish companies' capacity to innovate is just over half-way between zero and the maximum grade in terms of innovative capacity. Turkey's grade is just above Iran's and slightly below the joint grade of Russia and Spain; however, it is much lower than the grades of such leading countries as the United States, Switzerland, Germany, and the United Kingdom.

As Fagerberg has quite succinctly expressed, the most efficient way to improve competitiveness, especially in the longer term, is to support innovation in and diffusion of technology.<sup>41</sup> R&D expenditures are the most cited indicators relating to innovation and technological advancement. Several R&D indicators are given in Table 6, where the Turkish ratio of total R&D expenditures to GDP is higher than that of both India and Iran and quite close to the figures seen for Russia, Spain, and Italy. However, sectoral disaggregation on an institutional basis reveals a somewhat different picture, indicating that Turkey has the lowest ratio for the business enterprise sector. This last point has serious implications, since it is precisely the business sector that is expected to transform technological knowledge into the production line. The same table also contains figures for the number of researchers per million people; in this respect, Turkey's performance is, again, better than those of India, Iran, and even China.

Figure 9 provides the medium- and high-technology content of merchandise exports against the ratio of R&D expenditures to GDP for Turkey and those countries that have significant trade surpluses with Turkey. The three countries in question—Russia, India, and Iran, which are below the regression line and close to the origin—are Turkey's basic fuel (HS27) providers. The others are mainly providers of medium- and high-technology products.

Although ratios are of course important in making international comparisons, the situation turns out to be more concrete and striking when the figures are given in absolute terms, as in Figure 10. In terms of total funds made available for R&D and the number of researchers, India shows quite a different picture, while

41 Jan Fagerberg, "Technology and Competitiveness," *Oxford Review of Economic Policy* 12 (1996), 49.



Table 6. Some indicators of technology advancement capacity of Turkey vis-à-vis its major trade partners

	R&D Expenditures						Number of Researchers in R&D (per million population) (2014) (2)
	Capacity for Innovation (2013-2014) (1) (*)	Total		As % of GDP (2013) (4)			
		As % of GDP (2014) (2) (**)	As % of GDP (2005-2012) (3)	Government Sector	Business Enterprise Sector	Higher Education Sector	
Germany	5.6	2.8	2.9	0.43	1.91	0.51	4 459
China	4.2	2.1	2.0	0.32	1.51	0.15	1 113
Russia	3.8	1.2	1.1	0.34	0.68	0.10	3 102
USA	5.9	2.7 (2013)	2.8	0.35	1.96	0.39	4 019(2012)
Italy	4.3	1.3	1.3	0.19	0.68	0.35	2 007
UK	5.3	1.7	1.7	0.12	1.05	0.43	4 252
France	4.8	2.3	2.3	0.29	1.44	0.46	4 201
Spain	3.8	1.2	1.3	0.23	0.66	0.35	2 641
Iran	3.5	0.3 (2012)	0.7	na	na	na	691
Switzerland	5.9	3.0 (2012)	2.9	0.02	2.05	0.83	4 481(2012)
South Korea	4.7	4.3	4.0	0.47	3.09	0.41	6 899
India	4.0	0.8 (2011)	0.8	na	na	na	157
Turkey	3.7	1.0	0.9	0.10	0.45	0.40	1 157

Source: (1) World Economic Forum and INSEAD, (2) Cornell University, INSEAD, and WIPO, (3) UNDP Human Development Report 2015, (4) Eurostat.

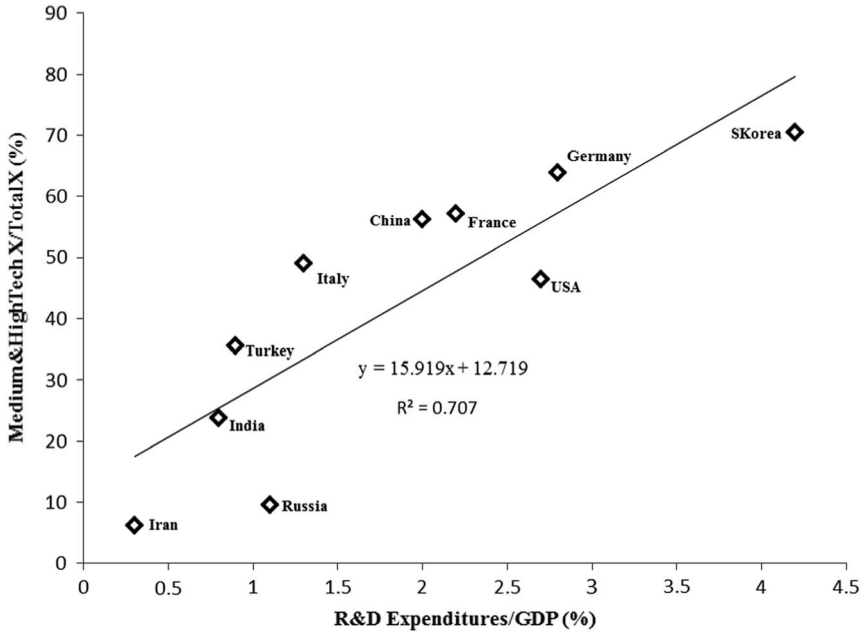
Notes: (\*) 2013-2014 weighted average of the capacity of companies to innovate; graded from 1 (not at all) to 7 (to a great extent).

(\*\*) Figures have been rounded off.

na: not available.

**Sources:** World Economic Forum and Institut Européen d'Administration des Affaires (INSEAD), *The Global Information Technology Report* (Geneva: World Economic Forum and INSEAD, 2015); Cornell University, INSEAD, and World Intellectual Property Organization (WIPO); *The Global Innovation Index 2016: Winning with Global Innovation* (Ithaca, Fontainebleau, and Geneva: WIPO, 2016; and United Nations Development Program (UNDP), *Human Development Report 2015* (New York: UNDP, 2015).

Figure 9: Medium and high technology content of merchandise exports and R&D expenditures/GDP in Turkey and its major negative net trade partners (2013)



Note: (\*) 2011 data for India and 2012 data for Iran is for 2012.

Source: Tables 4 and 6, and Eurostat.

Source: Tables 4 and 6 and European Commission, Eurostat, <http://ec.europa.eu/eurostat/>.

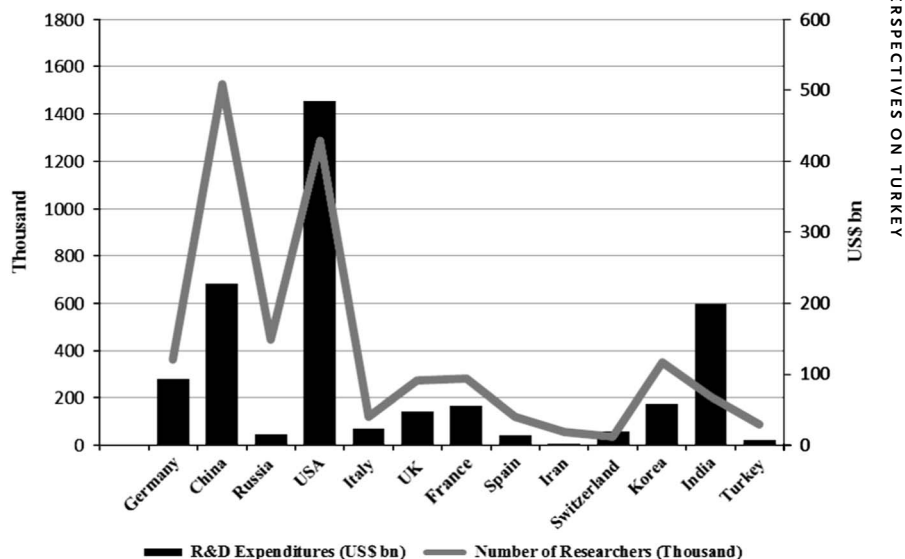
Turkey is left in a position better than only Iran. Also striking is the fact that there is a huge gap between Turkey and the majority of its trade partners in terms of both absolute magnitudes of R&D funds and the number of researchers.<sup>42</sup>

What is more, increasing the volume of R&D expenditures is not enough on its own: it requires a sufficient number of qualified researchers to either absorb or innovate technology and convert it into industrial production. Hence, in meeting the global technology challenge, both quality and quantity are of the utmost importance in terms of human capital. It is quite widely accepted that the contribution of (qualified) human capital to a country's technological capacity is crucially important. For instance, Murphy and Schleifer have shown that it is in countries of high human quality that high-quality production is realized.<sup>43</sup> Similarly, Aiginger has pointed out that

42 Qualitative differences relating to the usage of both funds and of researchers are an area that certainly deserves further study.

43 Kevin M. Murphy and Andrei Shleifer, "Quality and Trade," *Journal of Development Economics* 53 (1997): 1–15.

Figure 10: R&D expenditures and number of researchers in Turkey and its major trade partners (2014) (\*)



Source: Calculated from Table 7 and World Bank database.

(\*) Mostly 2014 data were employed depending on the availability, see Table 7.

Sources: Table 6 and World Bank, "World Development Indicators," <http://wdi.worldbank.org/table/2.1>.

economies with higher shares of skilled labor, advanced production technology, knowledge-intensive activities, and modern communication technologies will produce products of higher quality.<sup>44</sup> In a more recent study, covering 178 countries for the period of 1962–2010, Henn et al. showed that human capital, institutional quality, and resource allocations are critical, especially for increasing quality in the manufacturing sector.<sup>45</sup> The existence of a contemporary education system compatible with the requirements and challenges not only of the present but also the future is much more than just a necessity for Turkey, especially when we take into consideration the poor PISA (Program for International Student Assessment) performances of young Turkish students.<sup>46</sup>

44 Karl Aiginger, *Europe's Position in Quality Competition*, Working Paper No. 4 (Brussels: European Commission, 2000), 49–51.

45 Christian Henn, Chris Papageorgiou, and Nikola Spatafora, "Export Quality in Developing Countries," Working Paper 13/108 (Washington DC: International Monetary Fund, 2013), 14–16.

46 Organisation for Economic Co-operation and Development (OECD), *PISA 2012 Results in Focus: What 15-year-olds Know and What They Can Do with What They Know* (Paris: OECD, 2014).

## Overview and concluding remarks

Persistent large trade deficits, together with the recently accelerating decline in exports relative to the world, are a serious point of concern for the Turkish economy. This study has approached the matter from the perspective of trade deficits, focusing on export performance with a special emphasis on the technology dimension, and it has shown that the large Turkish trade deficits are mostly structural in nature and essentially the result of trade in sectors where Turkey is technologically weak.

Almost one-fourth of Turkey's total merchandise trade is with Germany, China, and Russia. Turkey's largest trade deficits are also with the very same countries, accumulating primarily in high- and medium-skill and technology-intensive manufactures, apart from fuel in the case of Russia.

Net positive contributions to Turkey's trade balance originate largely from labor-intensive and resource-based manufactures. Turkey's dependence on these products showed a significant decline in the 2000s, and while there have also been positive developments in the performances of both low- and medium-skill and technology-intensive manufactures, this latter remains in the negative zone. The overall picture indicates that Turkey is far from being a high-skill and technology-intensive economy, but it has nonetheless covered some distance toward becoming a medium-skill and technology-intensive economy.

The diversification index values for Turkey also indicate that the structure of Turkish exports has clearly improved in terms of converging with the world structure, although in this regard, too, it still has significant distance to cover.

The pattern of Turkish imports can be interpreted as indicating that the Turkish economy, relative to most of its peers and trade partners, is less open to technology transfers through imported goods, as is suggested by the import diversification index values. Even so, recent empirical studies have found that there have been some productivity gains, especially in the case of import-competing industries.

Neither the present levels of R&D expenditures nor the number of researchers will move the Turkish economy to a technological standard sufficient for successful competition in future world markets. It is also critical that Turkey increase the R&D expenditures ratio for the business enterprise sector, as it is precisely the business sector that will transform technological knowledge into the production line.

It must be emphasized, however, that it is not enough simply to increase the volume of R&D expenditures; it also requires a sufficient number of qualified researchers to either absorb or innovate technology and, further, to convert technology into industrial production. As such, in order to meet the global technology challenge, both quality and quantity are of supreme importance in terms of human capital. It is also imperative that a contemporary education system compatible with the requirements and challenges of both the present and the future be developed.

Overall, a new paradigm is essential for the restructuring of the Turkish manufacturing sector in line, especially, with the requirements of the future world. Industrial policy needs to be redesigned and coordinated together with trade policy: both should be part and parcel of each other. The basic policy package must aim at transforming the economic structure, particularly the structure of and the quality of production in Turkish industry, with special emphasis on improving efficiency in resource utilization in general and in energy in particular, something that will also call for technological upgrading.

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