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Empirical Analysis of Structural Change in Turkish Exports

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The Central Bank of the Republic of Turkey

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1. Introduction

Turkish exports has experience high growth rates since 2001, which is well above its historical average. While the average yearly growth rate of exports is 11.2 percent between 1948 and 2000, it reaches to 20.9 percent in the 2001-2006 period. Historically, the evolution of exports in Turkey can be divided into five sub-periods: (i) the period in which the protective policy is the dominant strategy in foreign trade (early 1930s till 1960s); (ii) the period of import substitution policy (1960s and 1970s); (iii) the period of financial liberalization and export subsidy policy in order to support export-led growth strategy (1980s); (iv) capital account liberalization episode (1990s); and (v) the adoption of floating exchange rate regime (from 2001 onwards).

Turkey launched its customs union agreement (CU) with EU in 1996, the single most important trade agreement of Turkey since the beginning of its liberalization in the early 1980s. However, Turkish economy was also hit by major economic and financial crises in the 1994-2001 period. The sources of these crises vary: 1994 and 2001 crises originated from the domestic economy and political problems, while 1997 and 1998 crises were affected from Asian and Russian crisis, respectively. Besides, two major earthquakes disrupted Turkish economy in 1999. All of these crises were characterized by recession and sharp currency depreciation. As a response to the 2001 crisis Turkish policymakers have initiated an extensive reform program under the supervision of IMF. The program primarily aimed to reduce public deficit, reform the banking sector, implement floating exchange rate regime and decrease inflation rate to single digits. After following a modest course in the 1990s, Turkish exports experienced the most exceptional upward trend in its history despite real appreciation of the Turkish lira. However, the sustainability and the sources of the surge in export growth are included in the main issues of the researchers' and policymakers' agenda. It becomes important to understand the structural transformation and the sources of this change in the Turkish exports to design effective public policies.

There are several studies on Turkish exports and competitiveness indicators that worth mentioning. Among these studies Yükseler and Türkan (2006) is particularly very informative in understanding the structure of Turkish production and foreign trade. They extensively analyzed Turkish exports and provided very rich set of indicators. Among their conclusions, increase in import dependence of Turkish exports is chiefly important for our purpose. In our study, we followed their methodology in constructing similar figures for Turkey and few new EU member countries. A study by Sönmez (2005) also argues that implementation of inward processing regime increased import dependence of Turkish exports.

There are also empirical studies investigating the relationship between Turkish exports and main macroeconomic variables by using different econometric approaches.[1] While Şahinbeyoğlu and Ulaşan (1999) and Saygılı *et al.* (1998) found that there are statistically significant relationships between exports and real effective exchange rate as well as foreign income, Aydın *et al.* (2004) disagree on the significance of real exchange rate. Instead, exports are determined by unit labor costs, export prices and national income in their study. Sarıkaya (2004), similarly, demonstrates the importance of real unit wage rates on determining exports instead of real exchange rates after 1999. Thereby, he concludes that, improvement in labor productivity can compensate negative impact of real exchange rate appreciation on attaining sustainable export growth.

Within this framework, this paper broadly examines the strong performance of Turkish exports, particularly after 2001, by analyzing different indicators used in the literature and employing an econometric technique. As a first step, the main trends and structure of Turkish foreign trade in the post-1980 period are examined. Next, the structural changes in Turkish exports are analyzed descriptively. For this purpose, the study looks at the indicators for country and commodity composition of trade and import dependency of exports. Besides, competitiveness of Turkey in the global economy is examined on the basis of convergence to the world market and comparative analysis with emerging economies.

In the last section, the structural change in both export supply and demand functions of Turkey are examined by employing Kalman filter method. Kalman filter approach, where parameters of the export functions can be estimated as time varying coefficients, allows one to study structural changes in these equations without imposing any predetermined breaking points in time.

The paper proceeds as follows: Section 2 broadly discusses the structure of Turkish foreign trade. Section 3 rigorously analyses the structural change in exports by examining different trade indicators. Finally, section 4 proceeds to Kalman filtering, while section 5 offers summary remarks and conclusions.

[1] Şahinbeyoğlu and Ulaşan (1999) and Saygılı, *et al.*(1998) used co-integration method. Aydın, *et al.* (2004) and Sarıkaya (2004) used both co-integration and VAR methods.

2. Turkish Economy in the Post-1980 Period

Before proceeding with the analysis of structural change we would like to overview developments in the Turkish economy. Thus, this section is motivated by the investigation of the main trade and competitiveness indicators of Turkey in the post-1980 period. We also studied the relative performance of Turkish economy compared to a selected group of developed and developing countries. The section starts with the analysis of exports, imports, openness and trade balance of Turkey, and continues with competitiveness indicators and real GDP growth. Lastly, the section ends with a brief overview of changes in export and import price and quantity indices for Turkey.

2.a. Turkish Exports, Imports, and Trade Balance

Trade openness rate of Turkey has been increasing since the liberalization of the Turkish economy at the beginning of 1980s. The ratio of trade volume to GDP increased from 15.7 percent in 1980 to 53.4 percent in 2006 (Table 2.1, Figure 2.1). A similar pattern is also observed especially for other emerging economies. In that respect, these developments in Turkey cannot be considered as an exception. As expected, the lowest openness rates were observed for the large developed countries due to size of their domestic markets such as US with 20.7 percent and Japan with 22.8 percent in 2006. Some small liberal economies, such as Singapore and Malaysia have historically very high openness rates, which were 365 percent and 191 percent respectively in 2006. Firms in these countries uses significant amount of imported goods in their production. In fact, some firms may import semi-finished goods just for re-exporting purposes. According to WTO figures 45.8 percent of Singapore and 93.1 percent of Hong Kong's exports are re-exports in 2005 (WTO, 2006).

Trade deficit figure of Turkey also follows an interesting path. Turkey suffered high trade deficits and current account problems at the end of 1970s and early 1980s. Trade deficit accounted more than 7 percent of the GDP in this period. Structural adjustment programs and liberalization of Turkish trade at the beginning of 1980s were followed by improvements in trade deficit until 1988. After the beginning of capital account liberalization in 1989, ups and downs in trade balance mostly followed boom and burst cycles of the real GDP growth until 2001. However, 2001 crises followed by fast economic growth and widening trade deficits. Trade deficit reached to 12.8 percent of the GDP in 2006.

Turkey is not the only country suffering from high trade deficit problem. Countries in the EU accession process, such as Czech Republic, Romania, and Poland, also had large trade deficit in 2000s. Yet, in some of these countries, such as Czech Republic and Poland, trade deficits either

decreased or turned into surplus at the end of 2006. This may indicate that any potential negative effect of EU accession process is temporary.

Table 2.1: Ratios of Trade Volume and Balance to GDP (1980-2006)[1]

	Trade Volume/GDP				Trade Balance/GDP			
	1980	1990	2001	2006	1980	1990	2001	2006
Brazil	18.2	11.2	22.4	24.1[2]	-1.2	2.3	0.5	5.6[2]
China	21.8	34.9	43.1	65.4[2]	-0.4	3.5	2.1	2.6[2]
Czech Rep.	--	82.8[3]	113.0	133.3	--	-1.5[3]	-5.0	1.4
Poland	52.6	47.6	47.8	70.7	-3.1	6.1	-4.0	-1.5
Romania	69.2	38.9	64.1	65.2	-4.8	-8.9	-7.4	-12.2
Russia	--	42.3[4]	50.8	47.6	--	6.1[4]	15.7	14.1
Singapore	357	301	299	365[2]	-25.4	-4.4	20.1	32.4[2]
S. Korea	62.9	51.4	60.1	71.4	-7.4	-1.0	2.8	3.3
Malaysia	96.1	125.1	179.1	191.5[2]	9.8	5.7	20.9	25.4[2]
Mexico	20.1	31.3	52.6	60.3	-1.6	-0.3	-1.5	-0.7
Germany	46.2	50.1	55.0	71.4	0.9	4.6	4.6	6.8
Japan	23.4	16.3	17.1	22.8[2]	0.2	2.3	1.7	2.1[2]
UK	40.2	40.0	42.1	44.3	0.6	-3.3	-4.1	-6.5
US	17.0	15.3	18.4	20.7	-0.9	-1.9	-4.2	-6.3
Turkey[5]	**15.7**	**23.4**	**50.0**	**53.4**	**-7.3**	**-6.2**	**-6.9**	**-12.8**

(1) USD figures. It includes goods trade only.
(2) 2005 figure.
(3) 1993 figure.
(4) 1994 figure.
(5) GDP is taken from SPO database.
Source: IMF IFS, SPO Databases.

Table 2.2: Average Growth Rates of Exports and Imports (1980-2006) [1]

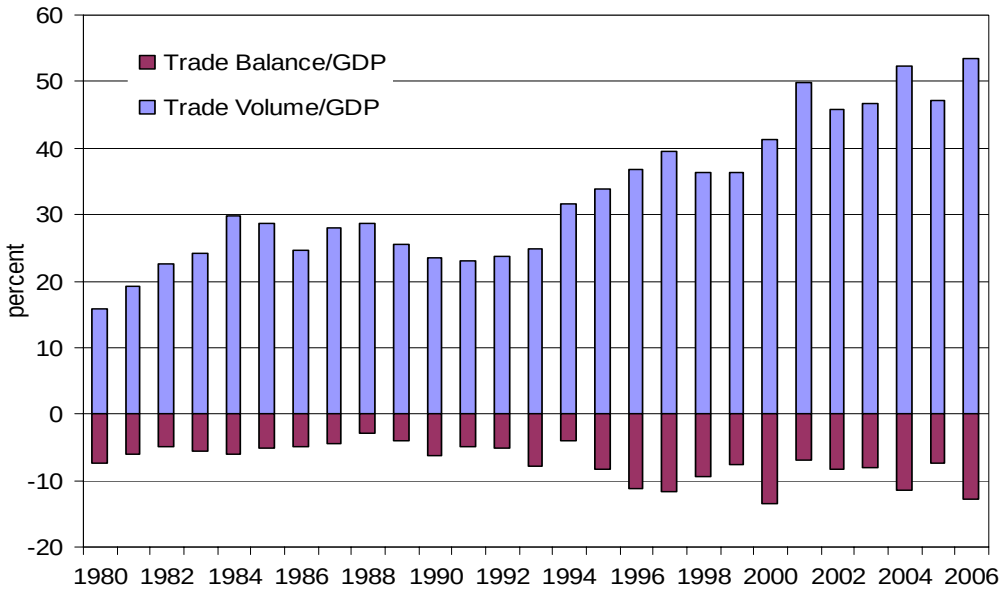
	Exports			Imports		
	1980-89	1990-2000	2001-06	1980-89	1990-2000	2001-06
Brazil	8.5	4.4	16.5[4]	0.2	10.7	5.7[4]
China	10.8[2]	17.3	25.1[4]	16.4[2]	14.4	24.0[4]
Czech Rep.	--	10.7[3]	21.9	--	11.8[3]	19.4
Poland	-0.3	9.8	21.8	-2.0	12.8	16.8
Romania	1.2	-0.1	20.9	-2.2	3.3	25.5
Russia	--	7.7[3]	19.4	--	-1.9[3]	24.2
Singapore	12.4	11.6	8.7[4]	10.8	10.6	6.9[4]
South Korea	15.4	10.0	11.1	11.6	9.7	11.3
Malaysia	8.4	13.4	7.6[4]	10.0	12.9	7.0[4]
Mexico	11.8	15.2	7.1	9.8	15.8	6.6
Germany	7.2	4.4	13.0	5.5	5.7	11.4
Japan	10.4	4.9	5.0	6.7	5.5	7.7
UK	5.8	5.9	7.9	7.5	5.2	10.3
US	7.0	7.2	4.8	8.5	8.9	7.2
Turkey	**17.8**	**8.2**	**19.8**	**12.0**	**11.9**	**16.1**

(1) USD figures. It includes trade of goods.
(2) 1983-1989 period.
(3) 1994-2000 period.
(4) 2001-2005 period.
Source: IMF IFS Database.

Export and import growth rate of Turkey can be classified in three sub-periods (Table 2.2, Figure 2.2). The first period is 1980s where the initial effects of trade liberalization in 1980s caused fast export and import growths. In that period, on average, exports grew by 17.8 percent while imports grew by 12.0 percent. At the interim period (1990s) both export and import growth rates

slowed down. However, trade deficit widened due to faster growth of imports than exports. After the financial crisis in 2001, with the help of the recovery in the economy, both export and import growth rates accelerated to 19.8 percent and 16.1 percent, respectively. Yet, if we exclude the crisis year, 2001, the average growth rate of exports and imports increase to 21.2 and 26.4 percents, respectively. The difference between exports and imports growth rates (5.2 basis points) may explain the fast deterioration of Turkish trade balance in the post-2001 period.

Figure 2.1: Turkey's Ratio of Trade Volume and Trade Balance to GDP (Percent, 1980-2006)



Source: IMF IFS and SPO Database

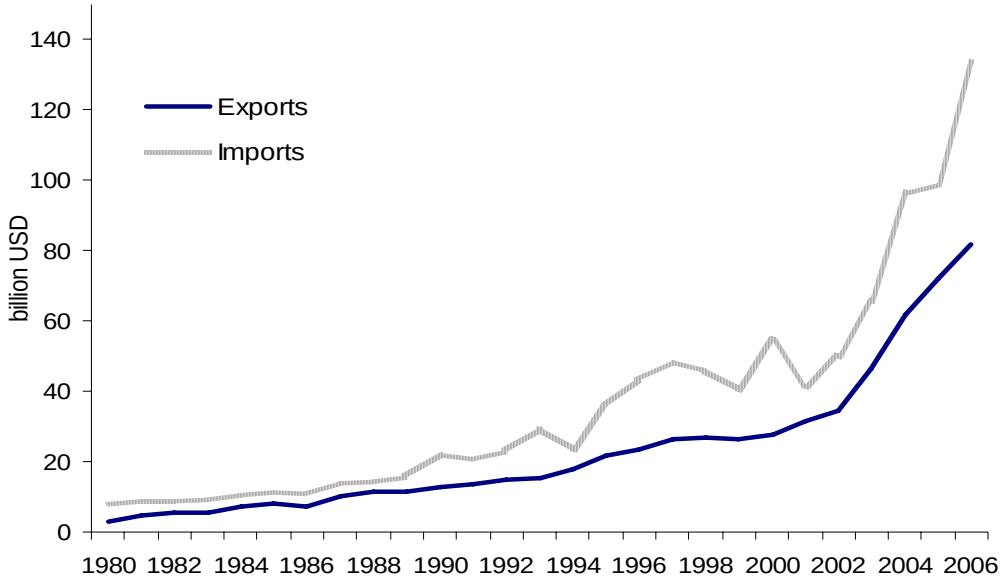
Comparison of the recent trends in Turkish exports with exports of other economies reveals a similar pattern in new EU member Eastern European states, as well as Russia, Brazil, China, and Germany. In particular, the coincidence of export boom in Turkey and Eastern European countries is noteworthy and its implications may deserve further study.

2.b GDP Growth Rate

In terms of period averages, long-term growth rate of output in Turkey was roughly 4.2 percent in the 1980-2006 period (Table 2.3). However, financial crises in 1990s and 2001 created boom-and-bust cycles in the economy such that fast growth in one year was followed by negative growth in the consecutive year. In general, we observe significant slowdown in the growth rates of developing economies in the sample during the 2000s with the exception of former communist countries and China. Energy exports of Russia, investment boom in and FDI flows to China, and EU

accession process for the others seem to help these countries to achieve high growth in the 2000s. Except Romania, all these economies were able to sustain their fast economic growth without developing major balance of payments problem.

Figure 2.2: Turkey's Value of Exports and Imports (Billion USD, 1980-2006)



Source: IMF IFS Database

Table 2.3: Average Growth Rates of Output (1980-2006)

	1980-89	1990-2000	2001-6		1980-89	1990-2000	2001-6
Brazil	3.0	2.4	2.2[(1)]	Malaysia	5.8	7.3	4.7
China	9.7	9.8	9.5[(1)]	Mexico	1.5[(2)]	3.6	2.3
Czech Rep.	--	3.1[(3)]	4.0	Germany	1.8	3.1	1.0
Poland	1.2[(2)]	3.1	3.5	Japan	3.8	1.3	1.4
Romania	1.4[(2)]	-2.1	6.1[(5)]	UK	2.3	2.3	2.5
Russia	--	-3.8[(3)]	6.1	US	3.0	3.2	2.5
Singapore (4)	7.1	7.9	3.9[(1)]	**Turkey**	**4.0[(6)]**	**4.1[(6)]**	**4.6**
South Korea	7.6	6.4	4.6				

(1) 2001-2005 period.
(2) 1981-1989 period.
(3) 1994-2000 period.
(4) GDP volume index is used (2000=100).
(5) 2001-2004 average.
(6) State Planning Organization data.
Source: IMF IFS Database.

2.c Competitiveness Indicators

2.c.i REER, Unit Labor Cost and Productivity Developments

In the international economic literature the real effective exchange rate (REER) is considered as a demand-side competitiveness indicator. Appreciation of REER of a country is often interpreted as a relative loss of price competitiveness of its domestic producers. Recent studies, on the link between

REER and exports, reveal that REER is not the most significant determinant of exports in Turkey. Aydın *et al.* (2004) finds empirical evidence, which supports the relationship between REER and imports rather than exports. Sarıkaya (2004) shows that, in the long run, the positive effect of decrease in real wages dominates the negative effect of appreciation in REER. Put differently, he points out the importance of real wages in determining exports in Turkish export growth. Within this framework, Turkish lira preserved its strong position throughout the 2002-2006 period. Accordingly, the average real appreciation of the Turkish lira during this period was 15.5 percent compared to 2000 in terms of PPI based REER index.[2] However, analyzing REER of a country without considering the REER developments of its major competitors may be inaccurate and misleading. In this context, 6 of the 9 major trade competitor of Turkey experienced steady trend of real appreciation between 2002 and 2006 (Table 2.4). In particular, the real appreciation of domestic currencies in Brazil, Russia and Czech Republic are more evident than Turkey. Furthermore, Singapore, Malaysia and China also experienced real depreciation in the same period while real appreciation in the Euro area was 18.8 percent between 2002 and 2005. All in all, it appears that Turkey did not lose its price competitiveness relative to its international rivals, since majority of these countries also suffered from real appreciation.

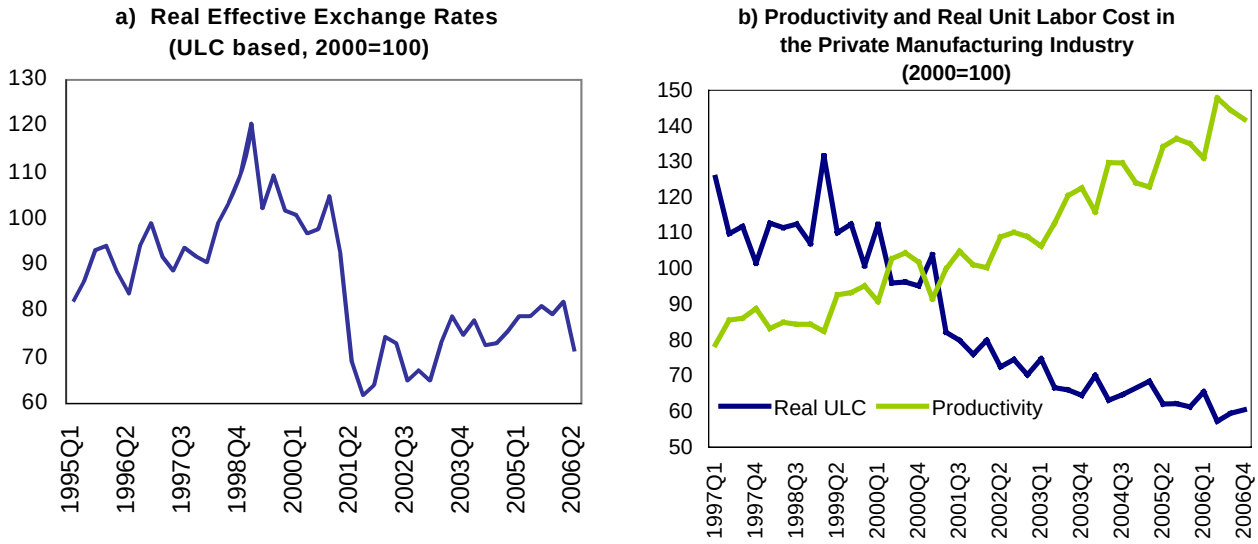
Table 2.4: Real Effective Exchange Rates (2000=100)

	Average								1996-
	1996-9	2002-6	2001	2002	2003	2004	2005	2006*	2006
Brazil	80.6	127.0	124.0	137.1	142.1	139.8	114.0	101.8	107.3
China	99.8	95.2	104.3	101.9	95.2	92.7	92.5	93.9	98.2
Czech Rep.	95.5	121.8	106.4	118.7	116.8	118.3	125.2	130.1	108.8
Poland	89.6	103.5	112.7	108.1	96.3	96.2	107.4	109.6	99.0
Romania	85.2	108.3	101.5	102.3	99.1	101.6	119.9	118.6	98.5
Russia	128.0	138.7	120.2	123.6	127.3	137.3	149.2	156.2	129.7
Singapore	106.7	94.3	100.5	97.9	94.3	93.3	92.1	93.9	99.9
Malaysia	111.5	98.6	104.9	105.0	99.2	94.9	95.2	98.6	104.0
Mexico	127.5	103.7	91.2	88.7	104.3	112.2	107.3	106.1	79.5
Turkey	93.2	115.5	84.4	101.8	110.8	115.8	125.1	123.9	103.3
EURO Area	121.7	114.3	101.8	104.7	115.1	118.6	118.8	-	114.9

* January-December for Turkey, January-October for other countries
Source: IMF,IFS and OECD

[2] The PPI based REER is obtained by deflating the nominal effective exchange rate with price indices. According to the definition used by International Monetary Fund (IMF), the real effective exchange rate is computed as the weighted geometric average of the price of the domestic country relative to the prices of its trade partners. In this computation, IMF country weights based on trade in manufactures, primary commodities and tourism services over 1988-1990 are used.

Figure 2.3: Competitiveness Indicators of Turkey



Source: CBRT, TURKSTAT, IFS

Labor productivity and real wages are known as supply-side competitiveness indicators. As a result of boost in machinery and equipment investment due to the use of external resources, labor productivity increased exponentially between 2001 and 2006. The upward trend in labor productivity together with decreasing real wages increased competitiveness and therefore the export performance of Turkey. According to the OECD labor productivity figures, Turkey and Slovakia have the highest labor productivity increase in our sample countries (Table 2.5). Moreover, relative unit labor cost index, which also measures relative competitive position of countries, points out Turkey's vigorous position among its trade competitors (Table 2.6).

Table 2.5: Labor Productivity for the Total Economy Indices, 2000 = 100

	Average 1993-99	2001	2002	2003	2004	2005	2006*
Czech Republic	90.8	102.0	103.3	108.5	112.9	119.0	125.0
Hungary	92.1	103.8	108.3	111.3	117.5	122.5	127.0
Korea	85.8	101.8	106.0	109.4	112.5	115.4	119.6
Mexico	93.0	99.7	98.1	98.3	98.6	102.2	104.8
Poland	81.8	103.4	108.1	113.6	118.1	119.5	122.1
Slovak Republic	89.6	102.6	107.4	109.9	116.3	121.6	128.7
Turkey	**91.1**	**92.7**	**100.9**	**107.8**	**114.0**	**121.0**	**128.0**
United Kingdom	92.3	101.5	102.8	104.5	106.9	107.9	109.7
United States	92.9	100.9	103.7	106.3	109.3	111.2	113.3
Euro area	95.5	100.3	100.5	100.9	101.7	102.2	103.4
Total OECD	93.3	100.6	102.4	104.1	106.3	107.9	109.9

* OECD forecast
Source: OECD Economic Outlook 80 database.

Table 2.6: Competitive Positions: Relative Unit Labor Costs Indices (ULC-based REERs), 2000 = 100

	Average 1993-99	2001	2002	2003	2004	2005	2006*
Czech Republic	89.3	103.9	118.3	116.1	117.2	124.1	129.8
Hungary	111.5	109.5	124.8	125.0	131.1	129.4	124.0
Korea	116.1	92.7	97.8	95.6	98.9	107.1	107.5
Mexico	99.8	106.5	109.9	99.1	98.0	103.5	103.8
Poland	96.9	104.3	93.8	76.7	69.6	78.3	78.0
Slovak Republic	89.2	97.4	98.0	104.7	113.6	118.4	123.3
Turkey	**76.0**	**73.4**	**72.2**	**71.3**	**79.3**	**87.8**	**83.6**
United Kingdom	78.0	96.9	100.9	96.6	101.1	101.4	103.0
United States	89.2	102.4	99.1	92.4	85.7	82.5	81.6
Euro area	116.8	100.7	105.9	120.7	125.4	122.9	121.5

Note: Competitiveness-weighted relative unit labor costs in the manufacturing sector in dollar terms. Competitiveness weights are taken the structure of competition in both export and import markets of the manufacturing sector of 42 countries into account. An increase in the index indicates a real effective appreciation and a corresponding deterioration of the competitive position.
* OECD forecast
Source: OECD Economic Outlook 80 database.

2.c.ii. Terms of Trade

Terms of trade (TOT) is a measure of relative price of exported goods to imported commodities. Improvement in a nation's terms of trade is preferable since it allows countries to give up fewer exported goods per unit of imported commodities. Our TOT measure indicates improvement in the competitiveness of Turkish exports for the 1991-2001 period relative to 1980s but deterioration in the 2000s (Table 2.7). During the same period not only Turkey, but also China, Brazil, Korea, Singapore and US also experienced deterioration in their TOT. On the contrary, TOT of Czech Republic, Poland, and Romania, in other words, TOT of the new members of the EU, together with Japan, Malaysia, Mexico, Russia and U.K, has improved in recent years.

Year to year changes in Turkish TOT, however, remained almost constant throughout the 2000-2006 period, though; the change in quantity ratio was much visible in the same period (Figure 2.4). As a result both ratios moved in downward direction implying strong deterioration of trade balance of Turkey in the last two years. Moreover, quantity of exports per imports decreased in the post-2001 while real domestic GDP grew faster than its historical period averages. Decrease in the ratio of export quantity index to import quantity index in the post-2001 period is noteworthy and may be a byproduct of increase in import dependence of exports. But, we will postpone the discussion of this issue to section 3.c.

We may also examine the relative contribution of quantity and price changes on steady increase in the value of exports and imports (Figure 2.5). Increase in quantity to price ratio indicates

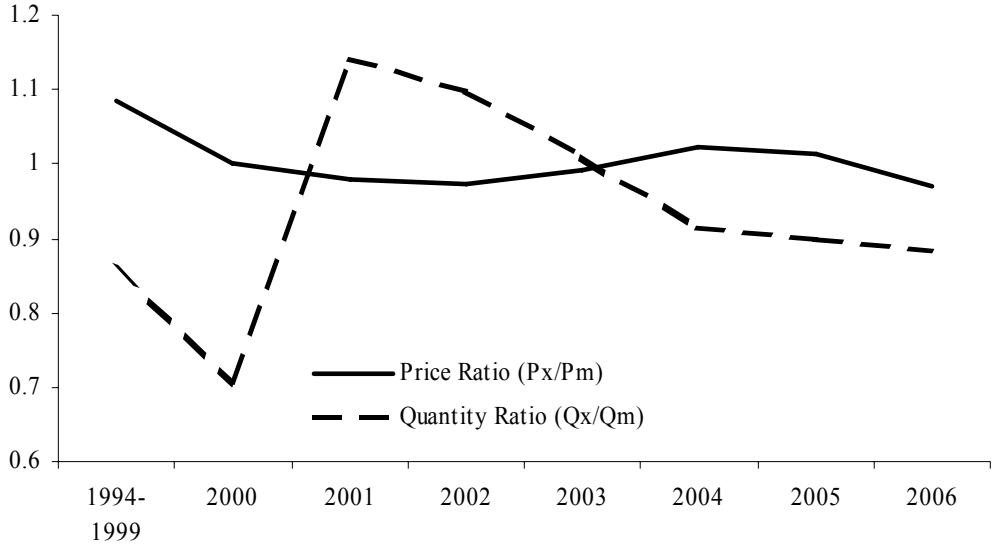
relatively greater contribution of quantity changes on the increase in the values. There is a secular long-run increase in quantity to price ratio for both exports and imports in the post-1994 period. This trend, however, stops after 2003 for both exports and imports signifying the importance of increase in the contribution of prices on the increase in the value of exports and imports. Throughout the 1994-2006 period there was a sharp fall in quantity to price ratio for imports during the financial crisis of 2001 implying a drastic decrease in the quantity of imports.

Table 2.7: Terms of Trade(1)

	1980-89	1990-2001	2002-2006(3)
Brazil	1.78	1.26	1.07
China(2)	0.82	1.01	0.96
Czech Rep.(1)	--	1.00	1.05
Germany	1.00	1.07	1.06
Japan	0.81	0.97	1.00
Korea	1.50	1.24	0.85
Malaysia (2)	0.98	0.90	0.99
Mexico	1.39	0.97	1.11
Poland	--	0.93	1.04
Romania (1)	--	1.00	1.07
Russia (2)	--	0.64	0.77
Singapore	1.14	1.07	0.89
Turkey	**1.04**	**1.09**	**1.00**
UK	1.02	1.02	1.04
US	1.00	1.03	1.00

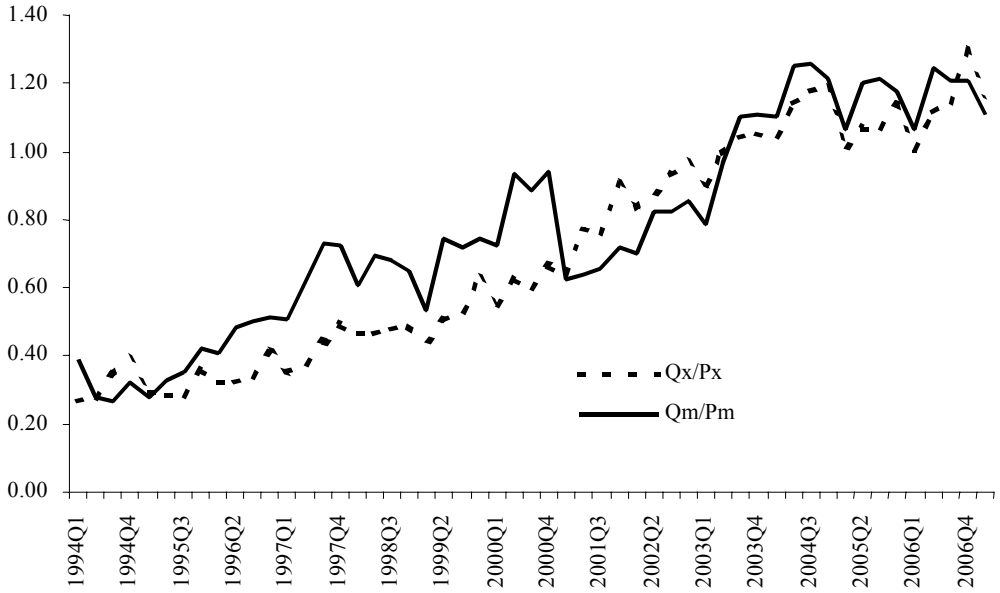
(1) Ratio of export unit value index to import unit value index
(2) Data from Eurostat (3) Data from WDI
(4) 2002-2005 period average for China, Germany, Malaysia, Romania, Russia and UK.

Figure 2.4: Price and Quantity Ratios



Note: Px: Export unit value index, Pm: import unit value index, Qx: Export quantity index, Qm: Import quantity index.
Source: TURKSTAT

Figure 2.5 Quantity and Price Ratios



Note: Px: Export unit value index, Pm: import unit value index, Qx: Export quantity index, Qm: Import quantity index.
Source: TURKSTAT

Table 2.8 presents the recent unit value and quantity developments in trade across the manufacturing sectors. The top panel of the table shows an improvement in the terms of trade for manufacturing industry after 2002, due to the rise in the relative export commodity prices of food and beverages, metal industry, machinery and equipment, electronics, motor vehicles and furniture sub-sectors. On the other hand, quantity index ratio across the manufacturing industries has been going down steadily since 2001. Fall in the quantity index ratio in textile and wearing apparels, electronics and furniture together with the poor real export performance of metal industry and machinery and equipments contributed to the fall in the overall manufacturing export to import quantity ratio.

3. Structural Change in Turkish Exports

After a brief overview of trade performance of the Turkish economy, this section analysis structural change in the Turkish trade with cross-country comparison in order to understand the direction and the sources of growth of Turkish exports in recent years. In this section, first commodity and country composition of Turkish exports are investigated from different perspectives. In this vein, the commodity concentration ratio, structure of intra-industry trade (IIT) and change in factor intensity of Turkish exports are examined. Then, import dependency of exports is analyzed and compared to that of the new EU members. Finally, position of Turkish exports in the world, as well as in the emerging markets is investigated by comparing and contrasting both relative export

performance and revealed comparative advantage (Balassa index) of Turkey at individual product level.

Table 2.8: Manufacturing Industries Price and Quantity Index Ratios

	1994-9	2000	2001	2002	2003	2004	2005	2006	2001-6 (avg)
					Price Ratio (Terms of Trade, Px/Pm)				
Manufacturing Industry	**1.09**	**0.99**	**0.98**	**0.97**	**1.00**	**1.02**	**1.04**	**1.03**	**1.01**
Food & Beverages	1.07	1.18	1.10	0.97	1.00	1.06	1.28	1.25	1.11
Textile & Wearing	1.02	0.93	1.01	1.06	1.01	1.05	1.06	1.05	1.04
Petroleum & Coal	0.76	0.70	1.24	1.36	1.01	0.94	0.86	0.88	1.05
Chemicals	0.94	1.06	1.00	0.96	1.00	0.99	1.00	1.04	1.00
Plastic & Rubber	1.26	1.09	1.06	1.00	1.00	1.04	1.03	1.05	1.03
Other Min.	0.90	0.83	0.85	0.91	1.01	0.83	0.92	0.93	0.91
Basic Metal	1.17	1.01	1.40	1.08	1.00	1.00	0.96	0.84	1.05
Metal Industry	1.34	1.05	0.88	0.81	1.01	1.27	1.32	1.37	1.11
Mach & Equip	1.01	1.64	0.93	0.96	1.00	1.34	1.40	1.44	1.18
Electronics	0.78	1.38	0.97	0.86	1.00	0.88	1.05	1.24	1.00
Motor Vehicles	1.33	1.08	1.37	1.15	1.00	1.09	1.12	1.11	1.14
Furniture	0.83	0.91	0.80	0.84	1.00	1.03	1.10	1.10	0.98
					Quantity Index Ratio (Qx/Qm)				
Manufacturing Industry	**0.85**	**0.70**	**1.15**	**1.12**	**1.01**	**0.89**	**0.86**	**0.85**	**0.98**
Food & Beverages	0.97	0.79	1.09	0.92	1.01	1.05	0.99	0.79	0.98
Textile & Wearing	1.03	1.13	1.36	1.06	1.01	0.89	0.86	0.75	0.99
Petroleum & Coal	0.69	0.22	0.38	0.51	1.05	0.79	1.06	0.93	0.79
Chemicals	1.14	0.86	1.16	1.03	1.00	1.01	0.97	1.00	1.03
Plastic & Rubber	0.90	0.73	1.17	1.14	1.01	1.02	1.18	1.14	1.11
Other Min.	0.60	0.74	0.96	1.09	1.02	0.98	0.73	0.52	0.88
Basic Metal	1.82	1.39	2.10	1.41	1.02	1.16	1.02	1.24	1.33
Metal Industry	0.42	0.57	0.51	0.68	1.00	1.00	0.95	0.85	0.83
Mach & Equip	0.39	0.58	0.81	0.95	1.01	0.84	0.84	0.83	0.88
Electronics	0.97	0.96	1.54	1.09	1.01	0.91	0.71	0.69	0.99
Motor Vehicles	0.49	0.42	1.50	1.65	1.11	0.89	0.98	1.10	1.20
Furniture	0.71	0.68	1.27	1.24	1.03	0.80	0.90	0.60	0.97

Source: CBRT and TURKSTAT

3.a. Commodity Composition of Exports

3.a.i. Recent Trends in Commodity Composition of Exports

The list of top 10 export items of Turkey is shown in Table 3.1. As can be seen in that table, vehicles other than railway or tramway rolling stock is placed as the first with 12 percent share in total exports for the 2001-2006 period. It is followed by articles of apparel and clothing accessories knitted (10.5 percent), electrical machinery and equipment (7.6 percent), articles of apparel and clothing accessories not knitted (7.5 percent), and iron and steel items (7.1 percent). These items are very heterogeneous in terms of their growth rate, their factor content, intra-industry trade (IIT) index, and net trade balance.

Table 3.1: Top 10 Exporting Commodities (2001-2006 Average)

	Export Share	Avg. Export Growth	IIT	T. Balance/ T. Volume
Vehicles other than railway or tramway rolling stock	12.1	36.9	0.923	-0.02
Articles of apparel and clothing accessories knitted	10.4	10.8	0.062	0.93
Electrical Machinery and equipment	7.7	20.7	0.754	-0.25
Articles of apparel and clothing accessories not knitted	7.3	10.9	0.134	0.86
Iron and steel	7.1	21.6	0.787	-0.25
Nuclear Reactors, boilers, machinery and mech. appl.	7.0	28.7	0.461	-0.53
Articles of Iron and steel	3.6	28.8	0.701	0.33
Edible fruits and nuts	3.3	14.8	0.100	0.90
Other make up textile articles	3.0	10.8	0.052	0.95
Plastic and articles thereof	2.3	27.9	0.465	-0.54
Total Exports	**63.8**[(1)]	**17.3**	**0.627**[(2)]	**-0.21**

(1) Export share of top 10 commodities.
(2) Trade balance adjusted IIT index. This is usually greater than standard IIT index.
Source: TURKSTAT.

Fastest growing sectors are also highly heterogeneous (Table 3.2). Some of them are also among the largest exported items, such as vehicles other than railway or tramway rolling stock, or Nuclear Reactors, boilers, machinery and mechanical appliances, but some others have very small market share. Generally these commodities have around or above average IIT index. Interestingly, out of the top 10 fastest growing export items; Turkey has trade deficit in 7 of them. Whether this may indicate change in comparative advantage of Turkey in these commodity groups or not requires further study. In section 3.d.iii changes in revealed comparative advantage of Turkey will be discussed in detail.

Table 3.2: Top 10 Fastest Growing Export Commodities (2001-2006 Average)

	Avg. Export Growth	Exports Share	IIT	T. Balance/ T. Volume
Arms and ammunition	50.7	0.31	0.473	-0.29
Vehicles other than railway or tramway rolling stock	36.9	12.15	0.923	-0.02
Miscellaneous articles of base metal	29.3	0.36	0.810	-0.19
Wood and articles of wood	28.9	0.35	0.603	-0.44
Articles of Iron and steel	28.8	3.63	0.701	0.33
Nuclear Reactors, boilers, machinery and mech. appl.	28.7	7.02	0.461	-0.53
Furniture	28.5	1.27	0.699	0.30
Wadding, felt and nonwovens	28.1	0.22	0.776	-0.22
Plastic and articles thereof	27.9	2.30	0.465	-0.54
Stone, plasters, asbestos	27.5	0.94	0.510	0.50
Total Exports	**17.3**	**28.6**[(1)]	**0.627**[(2)]	**-0.21**

(1) Export share of top 10 fastest growing commodities.
(2) Trade balance adjusted IIT index. This is usually greater than standard IIT index.
Source: TURKSTAT.

Table 3.3: Top 10 Trade Surplus Generating Commodities (2001-2006 Average)

	T. Balance/ T.Volume	Avg. Export Growth	Exports Share	IIT
Meat and edible meat offal	0.98	9.8	0.04	0.017
Prep. of meat, of fish or of crustaceans, mulls or oth. aquatic invertebrates.	0.96	-12.3	0.05	0.041
Other make up textile articles	0.95	10.8	3.0	0.052
Prep. of vegetables, fruits, nuts and other parts of plants	0.94	14.0	1.56	0.056
Articles of apparel and clothing accessories knitted	0.93	10.8	10.4	0.062
Products of milling industry	0.90	13.8	0.38	0.129
Edible fruits and nuts	0.90	14.8	3.3	0.100
Articles of apparel and clothing accessories not knitted	0.86	10.9	7.3	0.134
Edible vegetables	0.79	16.5	0.88	0.218
Sugars and sugar confectionery	0.77	-3.4	0.40	0.242
Total Exports	**-0.21**	**17.3**	**27.3(1)**	**0.627(2)**

(1) Export share of top 10 trade surplus commodities.
(2) Trade balance adjusted IIT index. This is usually greater than standard IIT index.
Source: TURKSTAT.

There are several approaches to measure comparative advantage. The most direct way is to rank commodities according to their net exports. The top 10 items of Turkey that have net trade surplus for the 2001-2006 period is given in Table 3.3. As can be seen in the table, most of these items are traditional Turkish export commodities that are considered as agricultural and/or labor intensive instead of capital or technology intensive goods. Besides, these commodities not only have growth rate less than average total export growth but also very low IIT. These commodities are from the traditional sectors that may not have high potential to grow in the future indicating that even though there is a process of transformation in the Turkish exports after the crises period in the 1990s, Turkey is still short of building any comparative advantage in new commodities.

3.a.ii. Commodity Concentration Ratios

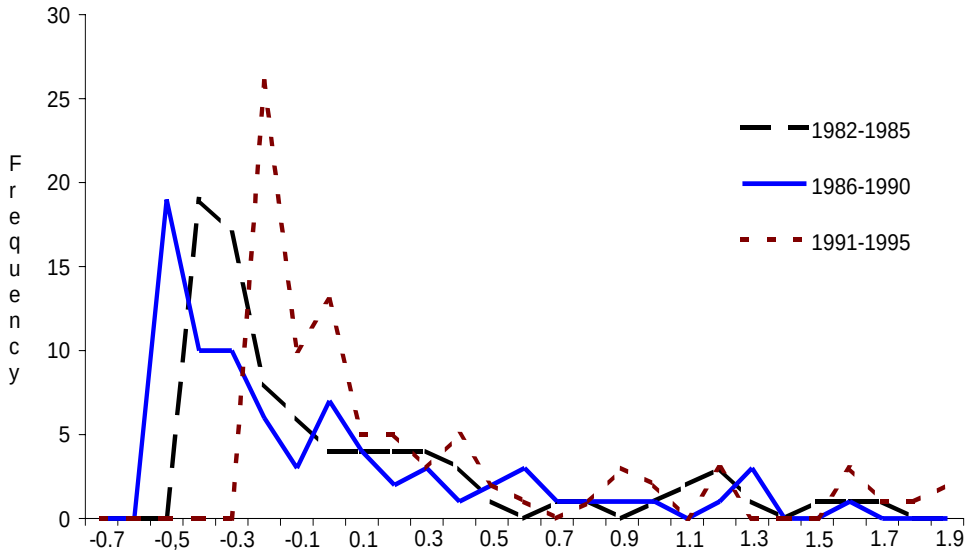
Concentration of exports on few commodities is usually considered as a potential problem for economies to sustain long run high export growth, since fluctuations in export commodity prices may also increase volatility in export receipts of a country. In this section, we will study different measures of commodity concentration of Turkish exports over time: namely, frequency distribution of Turkey's normalized exports by commodity groups, weighted spread of Turkish exports, and share of top 10 and 20 commodities in total exports.

Frequency distribution of Turkey's normalized exports by commodity groups is shown in Figure 3.1 and Figure 3.2.[3] These graphs show whether sectoral exports are distributed symmetrically around its mean. In general, Turkey's frequency distribution is skewed right due to large share of few sectors in the total exports. As the highest point of this distribution moves toward zero, one can

[3] Sectoral exports are normalized by mean and standard deviation as follows: $(x-\mu)/\sigma$. x, μ, and σ are sectoral exports, average exports, and standard deviation of exports, respectively.

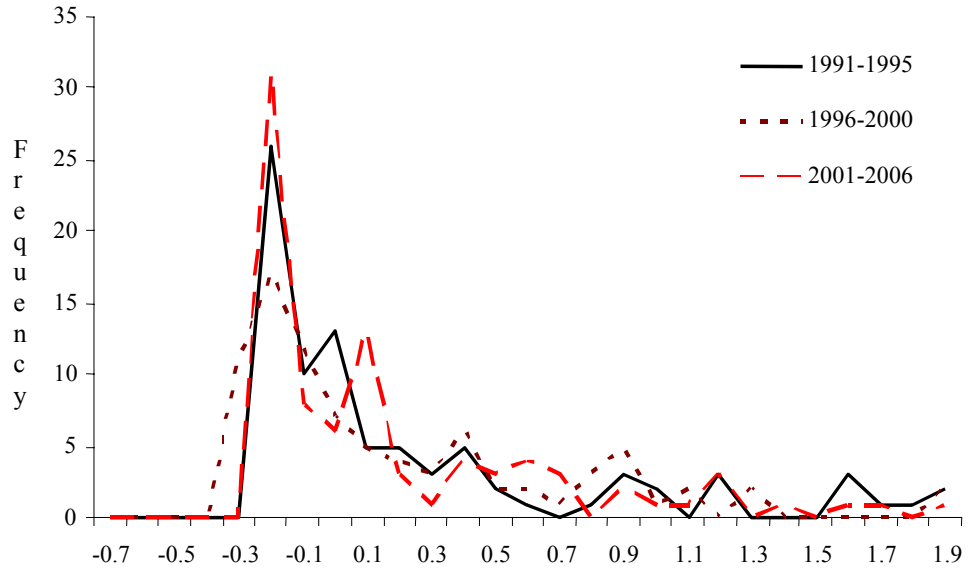
conclude that the frequency distribution becomes more even around its mean. Increase in skewness, however, increases the dispersion among the sectoral exports. From 1982-1985 to 1986-1990 frequency distribution moved away from zero to the left but in 1991-1995 it went closer to zero mean again, implying that distribution of exports improved from 1986-1990 to 1991-1995. On the other hand, distribution of exports across commodity groups slightly deteriorated during 1996-2000 period but it slightly improved during the 2001-2006 period.

Figure 3.1: Distribution of Normalized Exports by Commodity Groups (1982-1995)



Source: Our calculations from TURKSTAT data.

Figure 3.2: Distribution of Normalized Exports by Commodity Groups (1991-2006)



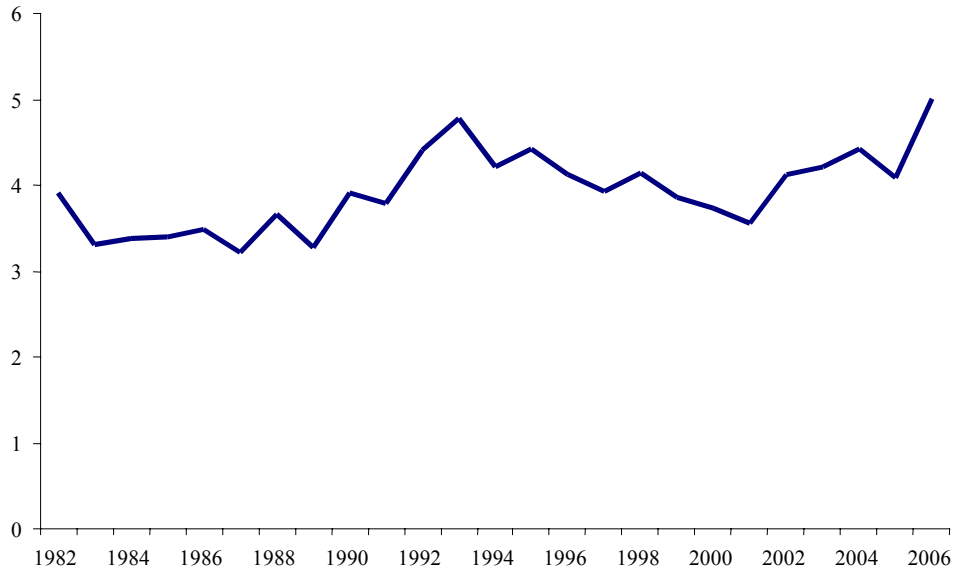
Source: Our calculations from TURKSTAT data.

Frequency distribution is a useful but an inadequate measure of dispersion of exports, since it relies on visual judgments instead of quantifiable criteria. Alternatively, spread of exports by commodity groups, which is measured as a ratio of standard deviation of commodity exports to its mean, can be used to examine commodity concentration of Turkish exports.[4] Increase in this ratio implies concentration of Turkish exports across different commodity groups. In Figure 3.3 three different episodes can be identified: 1983-1993, 1993-2001, and 2001-2006. In the first period spread of Turkish exports increased reflecting a decrease in diversification of commodities. It is followed by a decrease in concentration of trade in the second period. In the last period, after the financial and currency crisis in 2001, concentration of Turkish exports raised again. Close investigation of these graphs reveals very interesting dynamics. First of all, Turkish exports enjoyed stable positive growth during the post-1982 period until the 1994 crisis. In this period, Turkish economy increased its exports through success of few industries, which caused export concentration ratio to increase (increase in spread). However, during the turbulent period (1994-2001), Turkish economy struck by major economic crises almost every two years (1994, 1997, 1998, 1999, and 2001). In this period, some sectors were not able to adjust to new conditions, particularly volatile exchange rates and domestic output. Few old and new industries, however, survived the turbulence by finding new markets abroad and the last financial and currency crisis in 2001 followed by a sharp and immediate recovery in Turkish exports. Commodity concentration of exports increased in the same period, as well. Contrary to the case in previous crises, recovery in Turkish exports after 2001 was long lasting and it is realized through increase in share of new commodities in exports.

The third measure of commodity concentration of exports uses the share of top 10 and 20 commodities in the total exports (Figure 3.4). One can identify two different episodes, pre-1997 and post-1997 in Figure 3.4. The share of top 10 commodities was roughly constant during the 1983-1996 period while the share of top 20 commodities was declining throughout the same period. However, shares of both commodity groups have been increasing since 1997, which is a clear indication of commodity concentration of exports. The trend in this measure of concentration ratio and the one in Figure 3.3 are broadly consistent particularly after 1993. Note that, the third measure takes only the top sectors into account but the previous one uses the full sample.

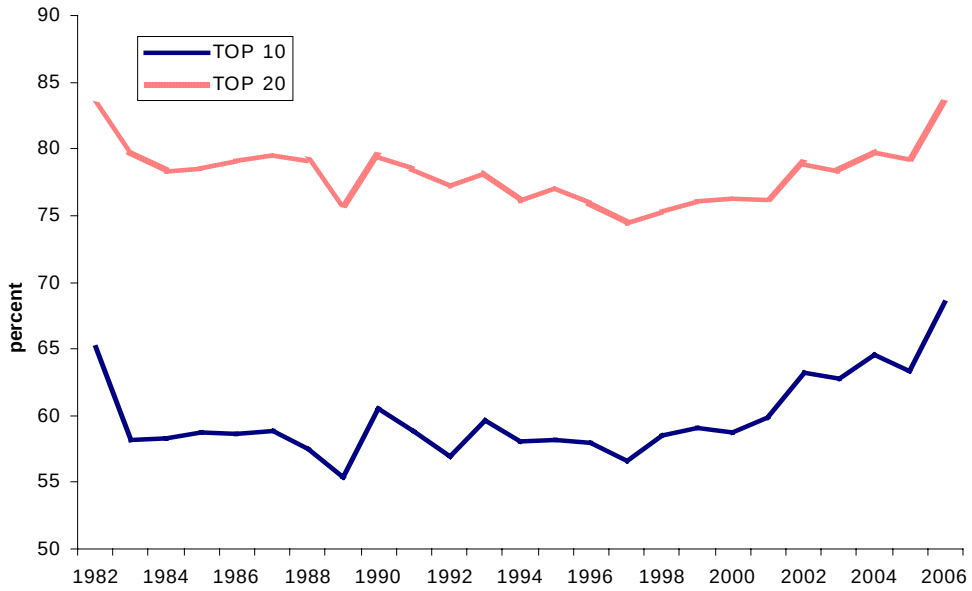
[4] Weighted spread at time *t* is calculated as: $\left[\sum_i \left((x_{it} - \mu_t)/\mu_t\right)^2\right] \Big/ N$, where x_{it}, μ_t, and N are export of commodity *i* at time *t*, average exports at time *t*, and total number of commodities, respectively.

Figure 3.3: Weighted Spread of Exports by Commodity Groups (1982-2006)



Source: Our calculations from TURKSTAT data.

Figure 3.4: Shares of Top 10 and 20 Sectors in Total Exports (1982-2006)



Source: Our own calculations from TURKSTAT data.

Throughout the 1982-2006 period, there were also changes in the commodity content of top 10 and top 20 groups. Especially mid 1990s marks a structural break in the content of top 10 export commodities. Among the commodities in the top 10 of 2006, only few were in top 10 of the 1980s and first half of 1990s (Table 3.4). Top 10 commodities in 1982, 1985, and 1990 includes only 3, 4, and 5 goods from the top 10 in 2006, respectively. On the other hand, 8 and 9 commodities in the top 10 in 2006 were also in the top 10 in 1995 and 2000, respectively. Commodities, which were at the top of the list before the financial turmoil period of 1990s, were mostly replaced by new ones

afterwards. Rising commodities were the ones, which were flexible enough to adapt to the new unstable economic environment. However, some others failed to cope with the difficulties. In other words, these new rising sectors were more resilient to financial and currency crises than others. Combining this with the previous discussion one may argue that change in the content of top exporting sectors is accompanied with the rise in the top 10 and 20 sectors in the total exports for the post 1997 period.

Table 3.4 Top 10 Export Items of Turkey (1982-2006)

	1982	1985	1990	1995	2000	2006
1	55	**73**	**61**	**61**	**61**	**87**
2	**08**	55	**72**	**62**	**62**	**61**
3	**73**	**08**	**62**	**72**	**85**	**84**
4	25	**61**	**08**	**08**	**72**	**85**
5	01	42	42	**85**	**87**	**72**
6	24	**84**	52	**84**	**84**	**62**
7	27	27	**85**	**87**	**08**	**73**
8	07	24	24	55	**63**	**39**
9	**61**	60	07	**63**	52	**08**
10	58	07	25	20	**73**	**63**

01: Live animals.
07: Edible vegetables.
08: Edible fruits and nuts.
20: Prep. of vegetables, fruits, nuts and other parts of plants.
24: Tobacco and manufactured tobacco substitutes.
25: Salt, sulphur, earths and stone plastering materials.
27: Mineral fuels, mineral oils and production of their distillation.
39: Plastic and articles thereof.
42: Articles of leather.
52: Cotton, cotton yarn and cotton fabrics.
55: Man-made staple fibers.
58: Special woven fabrics.
60: Knitted or crocheted fabrics.
61: Articles of apparel and clothing accessories knitted.
62: Articles of apparel and clothing accessories not knitted.
63: Other make up textile articles.
72: Iron and steel.
73: Articles of Iron and steel.
84: Nuclear Reactors, boilers, machinery and mechanical appliances.
85: Electrical Machinery and equipment.
87: Vehicles other than railway or tramway rolling stock.

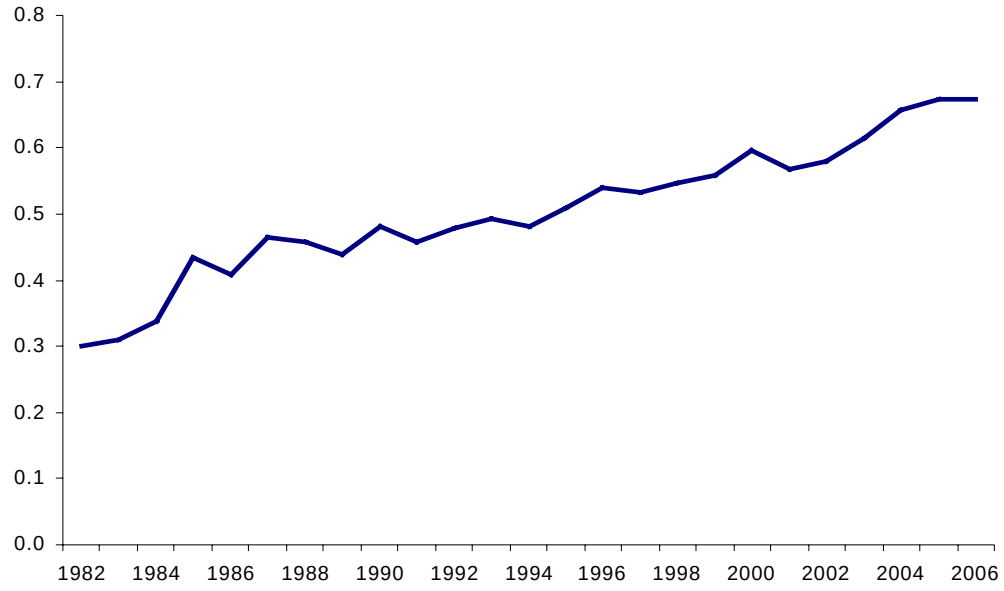
Items that were also in the top 10 of 2006 were written in bold.
Source: TURKSTAT

3.a.iii. Intra-industry Trade

Another measure of commodity composition of trade is IIT index. IIT arises when countries simultaneously export and import similar commodities. In a sense, this index measures similarity of export and import content of countries. While some economists argue that IIT is simply a matter of aggregation error of commodities of different features and factor intensities into broad categories, some others supports the existence of IIT on the basis of product differentiation and/or economies of scale. Oligopolistic competition may also cause two-way trade in identical or similar commodities since competing local monopolies may find it profitable to penetrate their international competitors' market. There is a huge literature on this topic and interested readers may find it useful to read Bhagwati and Davis (1994) and Helpman and Krugman (1985).

Our measure of IIT is standard Grubel-Lloyd IIT index adjusted for trade imbalances. According to this index, there is a secular long run increase in the IIT of Turkish exports (Figure 3.5). IIT may increase due to many reasons. Generally, trade in differentiated manufactured goods is considered as a source of IIT. Secular increase in this index may also indicate decrease in income differences between Turkey and its main trade partners (Linder hypothesis) and/or increase in the share of manufactured goods in total trade. A study by Gönel (2001) argued that IIT index of Turkey is still low and 1996 Turkey-EU customs union (CU) did not have any significant effect on Turkey's IIT. However, the data she used in her analysis covers the 1992-1997 period, which does not reflect the full impact of CU on the Turkish exports. Our study with longer time span, shows that there is a significant upward trend in IIT of Turkey. As it is discussed earlier, there is also a significant transformation within the Turkish export industries during the 1994-2001 crises episode. The rising industries of the post crises period can be considered as relatively more capital and high technology intensive commodities compared to the top 10 export commodities of the 1980s and early 1990s, which might increase the intra-industry content of the Turkish exports.

Figure 3.5: Adjusted Intra-Industry Index (1982-2006)



Source: Our calculations from TURKSTAT data.

3.a.iv. Transformation of the Factor Intensity of Exports

Among other factors affecting export performance, technological competitiveness is frequently mentioned in the literature. The classification of exports in terms of factor intensity[5] reveals that concentration occurs in the high technology products in the world

[5] The classification of exports in terms of factor intensity is based on the Standard International Trade Classification (SITC) 3-digit level. The SITC codes of these classifications can be found in Annex.

export market (Table 3.5). The same is also true for the emerging market economies (Table 3.6). In the case of Turkey, exports were dominantly relied on labor, agriculture and raw materials-intensive products during 1980s. However, the picture has dramatically changed in recent years. Regarding technological competitiveness, research and development (high and leading-edge technology) intensity in total manufacturing exports in Turkey tripled from 1980s to 2000s while the share of the raw materials and agriculture-intensive sectors is substantially fell (Table 3.7). Although the share of R&D-intensive product exports is well below that of the world average and 12 out of 20 emerging market economies in our sample, Turkey ranks the first in the growth rate of R&D products among emerging market economies over the period of 2001-2004 (Tables 3.8 and 3.9). Put differently, this rapid transformation in the factor intensity signals the "take-off" in the technological competitiveness of Turkey.

Table 3.5: The Classification of Exports According to Factor Intensity (World, % share in total exports)

	High tech-intensive	Raw material-intensive	Labor-intensive	Capital-intensive	Agriculture-intensive
1980-1989	29.7	19.9	8.4	8.7	9.1
1990-1996	36.9	12.8	9.3	8.1	7.4
1997-2000	41.8	11.4	8.7	7.6	6.1
2001-2003	42.8	12.8	8.2	7.3	5.7

Source: UNCTAD and our calculations

Table 3.6: The Classification of Exports According to Factor Intensity (Emerging Economies, % share in total exports)

	High tech-intensive	Raw material-intensive	Labor-intensive	Capital-intensive	Agriculture-intensive
1980-1989	16.4	24.8	15.9	6.4	13.2
1990-1996	26.9	15.0	17.6	6.4	7.9
1997-2000	35.7	11.9	14.9	6.2	5.9
2001-2004	38.8	12.6	13.3	6.3	4.8

Source: UNCTAD and our calculations

Table 3.7: The Classification of Exports According to Factor Intensity (Turkey, % share in total exports)

	High tech-intensive	Raw material-intensive	Labor-intensive	Capital-intensive	Agriculture-intensive
1980-1989	6.0	16.9	30.6	9.3	24.2
1990-1996	6.9	5.5	42.7	14.8	17.7
1997-2000	12.0	3.7	44.3	12.8	13.0
2001-2004	18.0	3.9	39.4	16.0	8.8

Source: UNCTAD and our calculations

Foreign direct investments (FDI) might have a significant role on the specialization of countries on high technology intensive products. Indeed, FDI is seen as an important channel of transferring technologies to emerging countries. South East Asian countries, which have the largest share of high technology intensive exports among other emerging markets, received substantial amounts of FDI. Ng (2006) found evidence that the level of FDI inflows causes technological upturn in selected Asian countries. The technology transfer by multinational firms may boost the technological capacity of local firms of host countries. As a result, we found positive correlation between FDI stock (inward) as a share of GDP and the export share of high technology intensive products for selected emerging countries (Table 3.10). Moreover, this finding can be generalized for the 20 emerging countries in our sample.[6]

Table 3.8: The Classification of Emerging Economies Exports According to Factor Intensity (2001-2004, percent share in total exports)

	High tech-intensive	Raw material-intensive	Labor-intensive	Capital-intensive	Agriculture-intensive
Philippines	73.5	2.4	9.0	3.4	4.1
Singapore	66.5	9.0	2.5	1.6	1.2
Malaysia	58.3	12.6	4.4	2.3	2.1
Korea	51.9	5.3	9.7	6.6	1.2
Mexico	51.8	10.4	8.6	10.0	4.0
Hungary	45.9	3.3	7.4	6.9	6.6
Hong Kong	44.8	1.3	21.4	1.2	0.9
Thailand	39.4	7.4	11.6	5.4	14.0
Czech Republic	39.2	5.6	10.8	14.4	2.6
China	37.4	3.9	23.3	3.8	4.1
Poland	22.1	7.6	10.7	12.5	7.4
Brazil	18.6	20.4	3.5	12.8	19.6
Turkey	**18.0**	**3.9**	**39.4**	**16.0**	**8.8**
Indonesia	15.8	31.8	14.1	3.9	6.1
India	13.5	9.7	29.3	5.8	11.0
Bulgaria	12.8	12.9	24.9	12.3	7.0
Argentina	10.2	25.8	1.8	7.7	32.1
Russia	6.5	57.5	1.0	10.4	1.5
Chile	3.0	27.9	1.1	29.7	22.1

Source: UNCTAD, IFS, own calculations.

[6] Direction of the relationship deserves further study.

Table 3.9: The Classification of Emerging Economies Exports According to Factor Intensity (2001-2004, percent growth with respect to 1997-2000)

	High tech-intensive	Raw material-intensive	Labor-intensive	Capital-intensive	Agriculture-intensive
Turkey	**50.7**	**5.9**	**-11.0**	**25.2**	**-31.9**
Indonesia	43.1	4.4	-4.1	48.6	-11.4
China	41.1	-21.8	-18.3	-2.9	-25.5
Hong Kong	29.8	-37.5	-14.7	-24.6	-35.5
India	14.0	70.4	-11.2	24.9	-20.5
Czech Republic	13.8	-16.4	-16.7	2.7	-16.3
Hungary	13.4	-17.7	-20.5	8.3	-24.2
Korea	13.1	-1.6	-28.7	0.6	-30.6
Poland	7.4	-10.6	-27.1	5.7	-21.3
Thailand	3.5	17.8	-13.7	37.1	-15.0
Mexico	3.4	8.5	-11.6	6.8	-15.8
Philippines	3.0	-5.2	-10.1	33.0	-0.2
Bulgaria	0.5	-3.8	38.9	-5.4	-3.7
Brazil	0.1	26.5	-9.0	-15.2	-2.4
Russia	-0.5	14.4	-22.2	-17.7	50.6
Singapore	-1.6	1.5	-17.2	-6.0	-22.8
Malaysia	-5.1	15.4	-19.2	17.4	7.5
Venezuela	-15.1	3.5	-40.2	1.7	-50.0
Chile	-16.8	9.9	-29.3	-5.3	-1.9

Source: UNCTAD, IFS, own calculations.

Table 3.10: FDI Stock and the Share of High-technology Intensive Exports for Selected Emerging Economies (2005, %)

	FDI stock (inward, ratio to GDP)	Share of high-technology intensive exports	Coefficient of correlation (1990-2005)
Turkey	8.1	18.0	0.86
Czech Republic	43.6	39.2	0.93
Malaysia	58.4	58.3	0.90
Singapore	161.5	66.5	0.63

Source: UNCTAD, IFS, own calculations.

3.b. Country Composition of Trade

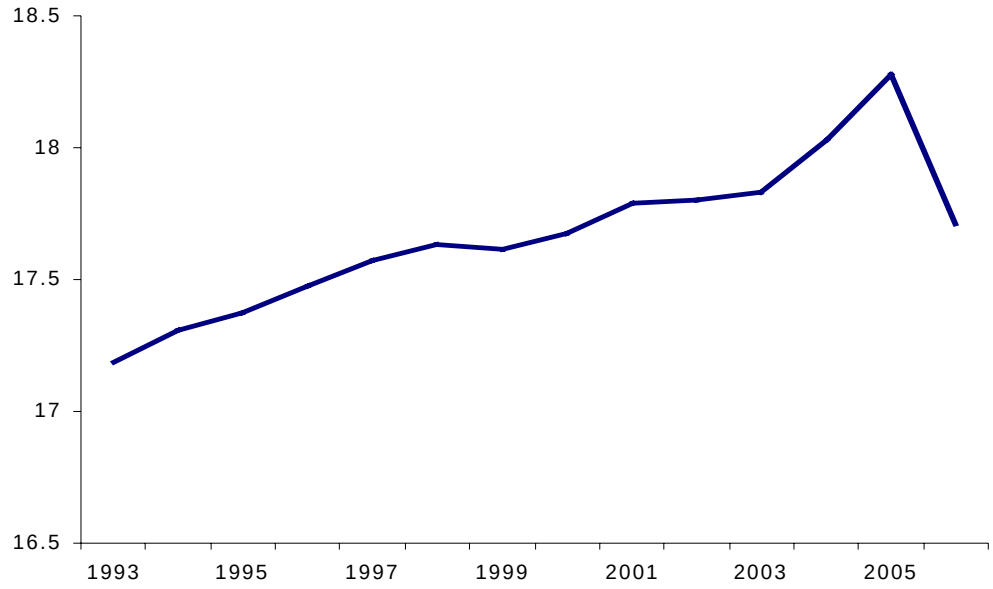
As it is discussed earlier, concentration of exports on few commodities and markets are usually considered as potential dangers for trading nations. Diversification in markets is especially important in minimizing the risks of business cycles. Economies with diversified markets would be able to adjust to changing macroeconomic conditions in a fast and flexible way thanks to the existence of variety of trade channels between economies.

In this section, two different concentration measures will be examined in detail. First of these measures is the spread of Turkish exports by countries. Due to emergence and dissolution of some countries in the former Soviet Union and Eastern Europe, post 1993 period is used in the analysis.

Throughout the period of 1993-2005 there was a continuous increase in country concentration ratio of Turkish exports even after the Turkey-EU Customs Union agreement in 1996 (Figure 3.6) signaling concentration of Turkish export markets. In 2006, however, this trend suddenly turned downward. Yet, it is too early to conclude whether this fall in concentration ratio is permanent or temporary.

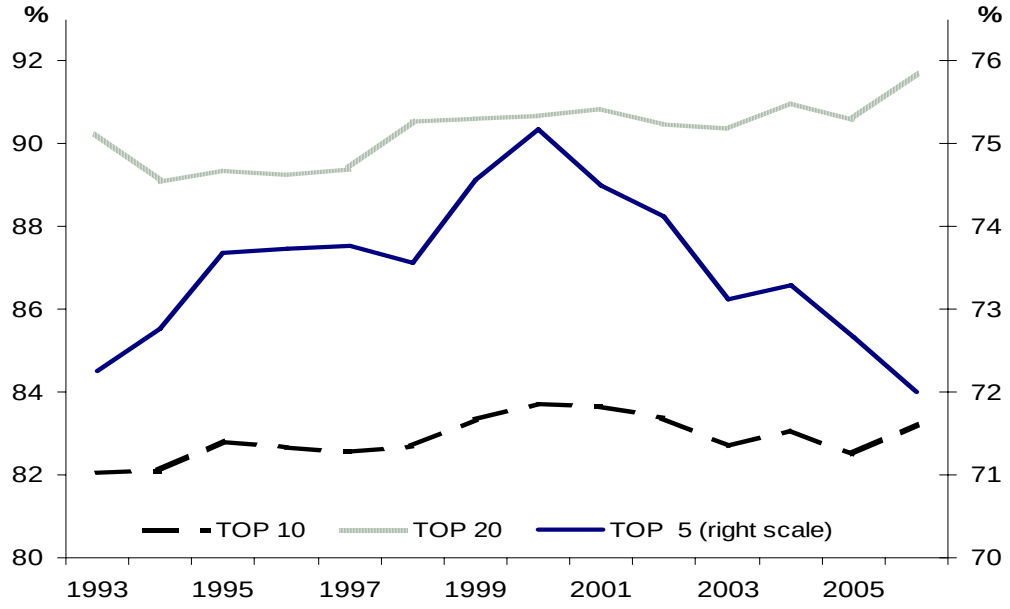
The second measure of country concentration of exports tells us a similar story. In Figure 3.7 the export share of top 5, 10 and 20 countries in the total is shown. It is evident that there is a secular increase in concentration of trade in 10 and 20 countries throughout our sample period. The share of top 20 countries in total increased from 89 percent in 1994 to almost 92 percent in 2006. On the contrary, the increasing trend in the share of top 5 countries reversed after it reached its peak in 2000. Previously we noted deterioration in Turkey's commodity concentration ratio especially for the post 2001 period. Yet, country concentration of Turkish exports has been deteriorating throughout the whole period, except 2006, with seemingly no relationship between crises period and these statistics. Secondly, there are relatively small changes in the members of the top 10 export destinations over our sample period (Table 3.11). Among the economies that penetrate into the top 10 of the list in 2006, 7, 8, and 8 of them were also in the top 10 in 1993, 1995, and 2000, respectively. Yet, among these 10 countries the number of EU members increased from 5 to 7 from 1993 to 2006.

Figure 3.6: Weighted Spread of Exports by Countries (1993-2006)



Source: Our calculations from TURKSTAT data.

Figure 3.7: Shares of Top 5, 10 and 20 Countries in the Total Turkish Exports (1993-2006)



Source: TURKSTAT

Table 3.11: Top 10 Export Destinations for Turkish Commodities (1993-2006)

	1993	1995	2000	2006
1	**Germany**	**Germany**	**Germany**	**Germany**
2	**US**	**US**	**US**	**UK**
3	**UK**	**Italy**	**UK**	**Italy**
4	**France**	**Russia**	**Italy**	**US**
5	**Italy**	**UK**	**France**	**France**
6	Saudi Arabia	**France**	**Netherlands**	**Spain**
7	**Netherlands**	**Netherlands**	**Spain**	**Russia**
8	China	Saudi Arabia	Israel	**Netherlands**
9	**Russia**	Belgium-Luxembourg	Belgium-Luxembourg	**Romania**
10	Taiwan	**Spain**	**Russia**	**U. Arab Emirates**

Note: Countries that were also in the top 10 of 2006 were written in bold.
Source: TURKSTAT

3.c. Import Dependence of Exports

The recent performance of imports is attributed to the rise in import dependency of exports. There are different approaches to analyze this question. In this section, we investigate the question by comparing the changes in the share of exports in total production with changes in the share of exports in total supply. The analysis is done for overall economy, manufacturing industry and sub-sectors of the manufacturing industry. A detailed analysis can be found in Yükseler and Türkan (2006). Here, we calculated respective ratios for Czech Republic, Hungary, Poland and Slovakia for comparison purpose.

3.c.i. Overall Economy

The ratio of exports to total production measures the share of exported goods and services in domestic production. Therefore, increase in the ratio indicates a rising tendency in production for exports. In order to calculate this indicator, total production from the 1998 input-output tables is updated by using growth rate of industrial production index for the years from 1999 to 2005. The same indicator is also calculated for Czech Republic, Hungary, Poland and Slovakia to compare and contrast the export tendency of production in these countries with Turkey. Input-output tables for these countries are available in Eurostat for few years. The same updating procedure is applied to proxy total production for the missing years for these countries as well.

Several points arise from the examination of Table 3.12. First of all, it is found that Turkey exported about 16 percent of its domestic production during the 1998-2001 period, but 15 percent if we exclude 2001. The ratio increased to 17 percent during the 2002-2005 period. Cross-country comparisons show similar increasing trend in exports share of production since 1998 in all of countries in our sample. The rise is slightly lower in Turkey than Eastern European countries, particularly after 2001, implying relatively higher domestic use of production in Turkey (Table 3.12). Note that, even if the ratio of exports to domestic production is almost the same for Turkey and Poland during the pre-2001 period, it increased much faster in Poland in the following years.

Ratio of exports to total supply is calculated to analyze the contribution of imports to exports. Total supply is calculated as sum of imports and domestic production. In order to obtain real import values, imports from 1998 input-output tables are updated by using growth rate of import quantity indices. Next, real imports are added to total production to find out total supply. The ratio of exports to total supply for the overall economy, which was 14 percent in 1998, increased to 16 percent in 2001 and then decreased back to 13 percent at the end of 2005 (Table 3.13). Meanwhile, the share of exports to total supply for the new EU member countries increased steadily throughout this period.

Comparison of the ratio of exports to total supply to the ratio of export to total production would show us how supply for exports changes with increase in imports. Sharp fall in the share of export in total supply compared to the share of exports in total production implies increasing demand for imported goods to produce exported goods**.** The difference between percentage point change in export to total production and export to total supply ratios relative to 1998 is presented in Table 3.14. Share of exports in production stayed roughly the same (16 percent) from 1998 to 2005. On the other hand, export share in total supply decreases from 14 percent in 1998 to 13 percent in 2005. As a result, export share in total supply decreased by 0.002 basis point more than the export share in

production from 1998 to 2005, implying an increasing tendency to use imported commodities for exported goods.

Table 3.12: Ratio of Exports to Total Production (in purchasing prices, 1998-2005)

	Czech Rep.	Hungary	Poland	Slovakia	Turkey
1998	0.23	0.26	0.14	0.25	0.16
1999	0.24	0.27	0.13	0.27	**0.13**
2000	0.26	0.33	0.14	0.30	**0.14**
2001	0.26	0.33	**0.14**	**0.31**	**0.19**
2002	0.25	0.31	**0.15**	0.30	**0.17**
2003	0.25	**0.30**	**0.18**	**0.32**	**0.16**
2004	0.28	**0.31**	**0.20**	**0.31**	**0.17**
2005	**0.28**	**0.32**	**0.20**	**0.32**	**0.16**

Note: Following procedure is used to calculate bold rates: 1.The output value in output-input tables is updated by using industrial production index. 2. Exports, which include both goods and services, are obtained from OECD statistics web site.

Cross country comparisons show that while the average exports to total supply ratio for the overall economy stayed the same in Turkey from 1998 to 2005 (except 2001 crisis period), it slightly increased in Hungary, Czech Republic, Poland and Slovakia, indicating an increase in share of exports in total supply for Eastern European new EU member countries. Table 3.14 suggests that import dependency of exports in Czech Republic, Hungary, Poland and Slovakia increased more than that of Turkey. It is also worth to note that even if the rate of import dependency is almost the same in Poland and Turkey; the rate had increased much faster in Poland during the 1998-2005 period.

Table 3.13: Ratio of Exports to Total Supply (in purchasing prices, 1998-2005)

	Czech Rep.	Hungary	Poland	Slovakia	Turkey
1998	0.18	0.20	0.12	0.20	0.14
1999	0.19	0.21	0.11	0.21	**0.12**
2000	0.20	0.25	0.12	0.23	**0.12**
2001	0.21	0.25	**0.12**	**0.23**	**0.16**
2002	0.20	0.23	**0.13**	0.22	**0.14**
2003	0.20	**0.23**	**0.15**	**0.24**	**0.13**
2004	0.22	**0.23**	**0.16**	**0.24**	**0.14**
2005	**0.22**	**0.24**	**0.16**	**0.24**	**0.13**

Note: Following procedure is used to calculate bold rates: 1. The last output value in output-input tables is updated by using industrial production index. 2. Exports, which include both goods and services, are obtained from OECD statistics web site.

3.c.ii. Manufacturing Industry

Sectoral export to production ratio is presented in Table 3.15. First of all, the ratio of exports to production for total manufacturing industry has been in an increasing trend in Turkey since 1998. Meanwhile, the manufacturing exports to production ratio has been increasing in Czech Republic, Hungary, Poland and Slovakia, as well. Indeed, among these economies exports to production ratio for the total manufacturing industry is the lowest in Turkey during the 1998-2005 period, implying

greater share of production for domestic consumption in Turkey. This is not a surprising outcome as Turkey is being the largest economy in our sample of countries.

Table 3.14: Difference Between the Change in Export to Total Production and Export to Total Supply with Respect to 1998

	Czech Rep.	Hungary	Poland	Slovakia	Turkey
1998	..	..	..	..	..
1999	0.003	0.003	-0.002	0.002	-0.005
2000	0.012	0.032	0.000	0.012	-0.002
2001	0.013	0.028	-0.001	0.021	0.006
2002	0.007	0.019	0.001	0.014	0.002
2003	0.008	0.016	0.007	0.020	0.000
2004	0.019	0.021	0.013	0.018	0.004
2005	0.018	0.025	0.011	0.024	0.002

Note: Calculated from Table 3.12 and 3.13.

Secondly, share of exports in total production tend to increase in all manufacturing sectors during the 1998-2005 period, in Turkey. Share of exports in production is the highest in textiles and wearing sectors followed by motor vehicles. More than a half of production is devoted to exports in these sectors. Meanwhile, in addition to textile and wearing apparels, some capital-intensive sectors such as coke, motor vehicles and semi-trailers, electrical machinery and apparatus, and machinery and equipments increased their production for exports rapidly after 2001. Comparing exports to production ratios, there is a shift in the exports performance across the sectors in favor of capital-intensive sectors. These findings are also consistent with Yükseler and Türkan (2006). Cross-country comparisons reveal that export share of capital-intensive sectors tends to increase in our sample of countries after 2001.

Furthermore, analysis of export to total supply across the manufacturing sectors in Table 3.16 shows that Turkey has the lowest exports to total supply ratio for the manufacturing industry compared to the other countries in our sample. While other countries use about 30-40 percent of their total manufacturing supply for exports, the rate fluctuates around 20 percent in Turkey. The ratio tends to increase in all countries and increase is the highest in Czech Republic and Poland. When we compare the change in export to total production to the change in export to total supply for manufacturing industries across these countries we observe that increase in import dependency of manufacturing exports is the highest in Slovakia in 2004 and Czech republic in 2005 (Table 3.17).

Investigating the sub-sectors of the manufacturing industry in terms of the import dependency rate, we found high difference between exports to total supply and exports to production ratios in electrical machinery, motor vehicles, textile and wearing apparels, and machinery and

equipment in Turkey, implying relatively high import dependency of exports in these sectors (Table 3.17). Cross country analysis shows that the difference between exports to total supply and exports to production ratio is higher mostly in textile, chemical and basic metal in most of the countries in our sample. Hungary, similar to Turkey, had an increase in the use of imported products in sectors of machinery and equipment, and electrical machinery and apparatus.

Table 3.15: Sectoral Exports to Production Ratio

	Manuf. Industry	Food prod., beverages & tobacco	Textiles, Wearing appeals & furs	Coke, refined petroleum prod. & nuclear fuels	Chem., chem.. prod. & man-made fibers	Basic metals	Fabricated metal prod. except mach. & equip.	Machinery & equipment	Electrical machinery & apparatus	Motor vehicles, trailers & semi-trailers
Turkey										
1998-2001	0.22	0.09	0.54	0.07	0.14	0.30	0.12	0.20	0.23	0.31
2002-2003	0.33	0.10	0.70	0.11	0.18	0.39	0.27	0.37	0.33	0.59
2004	0.37	0.11	0.72	0.15	0.20	0.41	0.37	0.33	0.49	0.53
2005	0.39	0.12	0.85	0.24	0.19	0.39	0.31	0.38	0.47	0.55
Czech Rep										
1998-2001	0.50	0.16	0.66	0.25	0.56	0.48	0.42	0.71	0.63	0.63
2002-2003	0.55	0.16	0.68	0.27	0.61	0.51	0.44	0.84	0.69	0.64
2004	0.61	0.19	0.78	0.21	0.68	0.57	0.48	0.95	0.76	0.68
2005	0.72	0.21	0.81	0.24	0.73	0.65	0.47	0.93	0.73	0.64
Hungary										
1998-2001	0.60	0.25	0.72	0.25	0.57	0.55	0.40	0.63	0.84	0.88
2002-2003	0.66	0.22	0.83	0.32	0.62	0.59	0.40	0.82	1.16	0.88
2004	0.73	0.26	0.85	0.41	0.76	0.65	0.42	0.98	1.27	0.90
Poland										
1998-2001	0.33	0.11	0.73	0.18	0.28	0.42	0.27	0.34	0.50	0.44
2002-2003	0.46	0.12	0.79	0.17	0.29	0.50	0.30	0.46	0.63	0.55
2004	0.56	0.16	0.84	0.32	0.36	0.72	0.32	0.56	0.64	0.56
Slovakia										
1998-2001	0.68	0.18	1.16	0.47	0.84	0.71	0.50	0.77	0.90	0.94
2002-2003	0.75	0.25	0.88	0.64	0.79	0.68	0.61	0.84	0.88	1.05
2004	0.85	0.30	0.96	0.81	0.92	0.91	0.59	0.87	0.93	1.13

Note: Following procedure is used to calculate bold rates: 1. The last output values from the input- output tables are updated by using sectoral industrial production index. 2.Sectoral exports are obtained from OECD statistics web site.

Table 3.16: Sectoral Exports to Total Supply Ratio

	Manuf. Industry	Food prod., beverages & tobacco	Textiles, Wearing appeals & furs	Coke, refined petroleum prod. & nuclear fuels	Chem., chem.. prod. & man-made fibers	Basic metals	Fabricated metal prod. except mach. & equip.	Machinery & equipment	Electrical machinery & apparatus	Motor vehicles, trailers & semi-trailers
Turkey										
1998-2001	0.16	0.08	0.46	0.06	0.07	0.17	0.10	0.09	0.14	0.17
2002-2003	0.22	0.09	0.54	0.09	0.08	0.17	0.22	0.17	0.17	0.32
2004	0.22	0.10	0.54	0.13	0.08	0.17	0.29	0.15	0.18	0.26
2005	0.23	0.11	0.60	0.19	0.08	0.16	0.25	0.16	0.15	0.27
Czech Rep										
1998-2001	0.33	0.14	0.40	0.16	0.28	0.30	0.33	0.39	0.40	0.44
2002-2003	0.35	0.13	0.39	0.17	0.27	0.31	0.33	0.45	0.44	0.44
2004	0.39	0.15	0.42	0.14	0.30	0.34	0.36	0.51	0.47	0.46
2005	0.43	0.17	0.42	0.16	0.32	0.36	0.36	0.54	0.46	0.46
Hungary										
1998-2001	0.37	0.22	0.43	0.20	0.28	0.30	0.25	0.27	0.49	0.54
2002-2003	0.39	0.20	0.45	0.23	0.31	0.32	0.25	0.38	0.61	0.52
2004	0.42	0.22	0.45	0.27	0.37	0.31	0.25	0.45	0.59	0.51
Poland										
1998-2001	0.24	0.10	0.49	0.15	0.14	0.30	0.21	0.17	0.32	0.27
2002-2003	0.31	0.11	0.47	0.14	0.14	0.31	0.23	0.22	0.40	0.33
2004	0.54	0.16	0.79	0.31	0.33	0.68	0.31	0.52	0.61	0.54
Slovakia										
1998-2001	0.41	0.14	0.55	0.41	0.41	0.52	0.33	0.34	0.45	0.52
2002-2003	0.41	0.20	0.49	0.53	0.38	0.48	0.34	0.38	0.46	0.53
2004	0.48	0.23	0.49	0.62	0.38	0.61	0.34	0.43	0.50	0.60

Note: Following procedure is used to calculate bold rates: 1. The last output values from the input- output tables are updated by using sectoral industrial production index.
2. Sectoral exports are obtained from OECD statistics web site.

Table 3.17: Difference Between the Change in Sectoral Export to Total Production and Export to Total Supply with Respect to 1998-2000

	Manuf. Industry	Food prod., beverages & tobacco	Textiles, Wearing appeals & furs	Coke, refined petroleum prod. & nuclear fuels	Chem., chem.. prod. & man-made fibers	Basic metals	Fabricated metal prod. except mach. & equip.	Machinery & equipment	Electrical machinery & apparatus	Motor vehicles, trailers & semi-trailers
Turkey										
2002-2003	0.044	0.002	0.075	0.005	0.027	0.090	0.034	0.101	0.075	0.134
2004	0.081	0.004	0.105	0.018	0.043	0.109	0.061	0.078	0.218	0.135
2005	0.095	0.006	0.169	0.038	0.042	0.108	0.041	0.126	0.221	0.141
Czech Rep										
2002-2003	0.022	0.000	0.023	0.002	0.060	0.025	0.010	0.073	0.017	0.012
2004	0.057	0.010	0.097	-0.020	0.102	0.060	0.026	0.130	0.057	0.032
2005	0.119	0.016	0.123	-0.010	0.128	0.122	0.017	0.075	0.038	-0.003
Hungary										
2002-2003	0.038	-0.001	0.090	0.043	0.025	0.026	0.012	0.083	0.190	0.010
2004	0.080	0.014	0.114	0.090	0.109	0.088	0.018	0.171	0.332	0.039
Poland										
2002-2003	0.051	0.001	0.079	0.003	0.006	0.073	0.006	0.072	0.048	0.054
2004	-0.076	-0.007	-0.194	-0.02	-0.11	-0.081	-0.055	-0.124	-0.154	-0.147
Slovak										
2002-2003	0.062	0.008	-0.226	0.047	-0.024	0.013	0.099	0.031	-0.036	0.098
2004	0.098	0.028	-0.143	0.134	0.103	0.118	0.082	0.01	-0.027	0.096

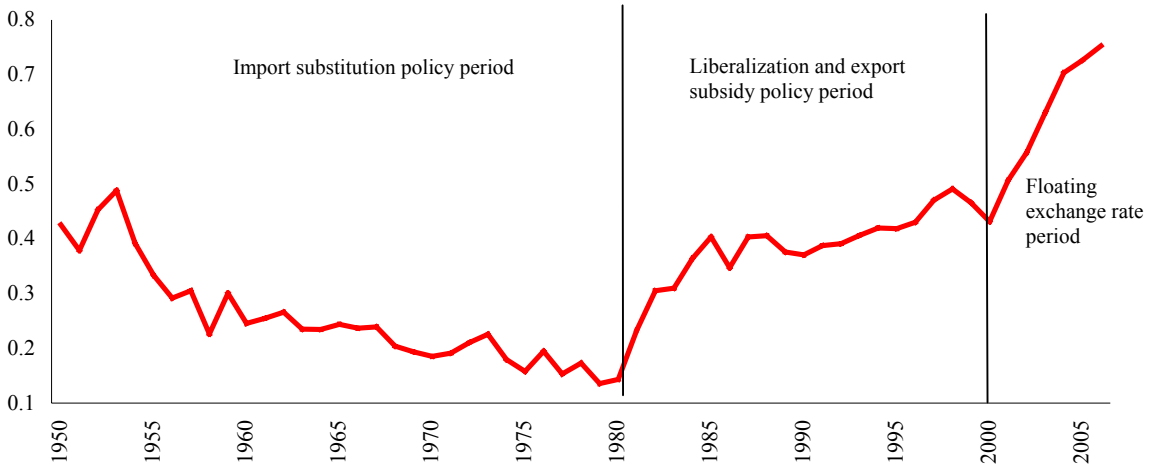
Note: Calculated from Tables 3.15 and 3.16.

3.d. Competitiveness Indicators and Integration of Turkey to the World Markets

3.d.i. Export Market Shares of Turkey and Emerging Economies

Historically, there are two milestones in the export market share of Turkey in the world: the early 1980s and 2001-2006 period (Table 3.18 and Figure 3.8). After the failure of the import substitution policy in boosting exports during 1970s, the export market share increased rapidly as a result of the liberalization process and export subsidy policy in the 1980s. In value terms, Turkey accounted for 0.36 percent of world exports of goods during the 1980-1990 period doubling the 1970s figures. While the export market share of Turkey remained relatively stable, displaying only a small increase over the 1991-2000 period, it experienced decent performance over the 2001-2006 period. However, the structures of these two successful periods are quite different. The success in the 1980s was mainly due to macroeconomic policies that not only intentionally led the Turkish lira to depreciate but also allowed certain privileges, such as enormous amount of subsidies to export-oriented firms. Therefore, we may say that the success in export performance during 1980s was basically policy-driven. In other words, the export-oriented firms had gained artificial price competitiveness through the application of these policies. On the other hand, the success in export performance during the 2001-2006 period was not policy-driven. Policymakers had no intention to boost the exports by depreciating the Turkish Lira. In this period, the export-oriented firms suffered from loss of price competitiveness. However, firm-driven factors (technological progress, integration to the world export market, attaching importance to quality…etc) compensated the detrimental effect of real currency appreciation.

Figure 3.8: The Share of Turkish Exports in the World Total



Source: WTO, TURKSTAT

Table 3.18: The Share of Turkish Exports in the World Market

	World Export (billion US dollar)	Turkish Export (billion US dollar)	Share (%)
1990	3,493.6	13.0	0.37
1991	3,506.2	13.6	0.39
1992	3,760.3	14.7	0.39
1993	3,774.7	15.3	0.41
1994	4,313.3	18.1	0.42
1995	5,168.9	21.6	0.42
1996	5,397.5	23.2	0.43
1997	5,577.5	26.3	0.47
1998	5,493.8	27.0	0.49
1999	5,705.9	26.6	0.47
2000	6,435.7	27.8	0.43
2001	6,177.4	31.3	0.51
2002	6,465.2	36.1	0.56
2003	7,490.3	47.3	0.63
2004	8,975.6	63.2	0.70
2005	10,120.0	73.5	0.73
2006*	11,334.4	85.5	0.75
1951-1960	100	0.3	0.33
1961-1970	206	0.5	0.22
1971-1980	1,027	1.7	0.17
1981-1990	2,380	8.5	0.36
1991-2000	4,913	21.4	0.44
2001-2006	7,378	44.4	0.60

* Estimate
Source: WTO, TURKSTAT

When compared with the emerging economies, although there were significant increases in the emerging market countries' exports over the 2001-2004 period, Turkey had experienced a significant rise in its market share in the emerging markets over the whole period (Table 3.19).

Table 3.19: The Share of Turkish Exports in the Emerging Markets

	Emerging Market Export (billion USD)	Turkish Export (billion USD)	Share (%)
1993	645.1	15.3	2.38
1994	769.0	18.1	2.35
1995	936.6	21.6	2.31
1996	987.8	23.2	2.35
1997	1050.3	26.3	2.50
1998	994.3	27.0	2.71
1999	1,027.3	26.6	2.59
2000	1,249.1	27.8	2.22
2001	1,209.1	31.3	2.59
2002	1,314.4	36.1	2.74
2003	1,609.2	47.3	2.94
2004	2,073.6	63.2	3.05
1993-1996	834.6	19.6	2.35
1997-2000	1,080.3	26.9	2.49
2001-2004	1,551.6	44.5	2.87

Source: UNCTAD, TURKSTAT

3.d.ii Relative Export Performance of Individual Products: Turkey and Other Emerging Economies

This section aims to find out the recent relative export performance and competitiveness of emerging economies (including Turkey) in individual products. A country's export performance in individual products relative to world exports is considered as a good indicator of its competitiveness in those products.

Disaggregated 3-digit Standard International Trade Classification (SITC) data is used to compute export performance statistics for Turkey and emerging economies. The UNCTAD database (2006) provides the three-digit SITC product code of annual exports comprising 239 types of products. The basic analysis is conducted according to the growth rate of each product in 20 emerging economies. In this framework, if the growth rate of the export value of the product *i* in country *j* is higher than the growth rate of the world export value of that commodity, then country *j* is considered as highly competitive in that commodity. Reverse is also true:

$$\frac{X_{ij(2001-04)} - X_{ij(1990-2000)}}{X_{ij(1990-2000)}} > \frac{\sum_{j=1}^{n} X_{ij(2001-2004)} - \sum_{j=1}^{n} X_{ij(1990-2000)}}{\sum_{j=1}^{n} X_{ij(1990-2000)}} \Rightarrow \text{Highly competitive}$$

$$\frac{X_{ij(2001-04)} - X_{ij(1990-2000)}}{X_{ij(1990-2000)}} < \frac{\sum_{j=1}^{n} X_{ij(2001-2004)} - \sum_{j=1}^{n} X_{ij(1990-2000)}}{\sum_{j=1}^{n} X_{ij(1990-2000)}} \Rightarrow \text{Less competitive}$$

where subscript *i* denotes products and subscript *j* denotes countries. Left hand side of these inequalities refers to growth rate of product *i* in country *j* and the right hand side refers to growth rate of product *i* in the total world market. The products with export value less than 1 million USD are omitted from this analysis.

Analyzing Table 3.20, the emerging economies as a whole showed successful performance in the 2001-2004 period. The share of highly competitive products in total exports is greater than fifty percent in all 20 emerging economies, which implies sound performance of emerging economies relative to world export market. Turkey is one of the best among the emerging economies in terms of both the number of highly competitive products and the share of these products in total exports. Turkey has 164 of 239 products with the growth rate higher than world export and they account 88.1 percent of total export.

Table 3.20: Competitiveness of Emerging Economies in the World Market (2001-2004)

Rank	Countries	Number of Prod. with High Level of Competitiveness	Share	Number of Prod. with Low Level of Competitiveness	Share
1	China	199	98.0	30	2.0
2	Czech Republic	152	91.5	64	8.5
3	Chile	110	91.4	64	8.6
4	Poland	174	90.6	46	9.4
5	**Turkey**	**164**	**88.1**	**42**	**10.9**
6	Hungary	135	88.0	66	11.0
7	Venezuela	67	86.8	83	13.1
8	India	182	85.0	35	15.0
9	Philippines	99	83.7	73	16.3
10	Mexico	138	82.6	74	17.4
11	Argentina	108	79.7	97	20.3
12	Brazil	137	78.2	81	21.8
13	Russia	119	77.8	97	22.2
14	Bulgaria	131	77.4	52	22.6
15	Korea	130	76.3	75	23.7
16	Malaysia	141	73.9	72	26.1
17	Thailand	150	68.1	63	31.9
18	Indonesia	156	61.1	58	38.9
19	Hong Kong	74	57.9	141	42.1
20	Singapore	72	53.5	138	46.4

Source: UNCTAD and our calculations

Table 3.21: Competitiveness of Emerging Economies in the Total Emerging Market (2001-2004)

Rank	Countries	Number of Prod. with High Level of Competitiveness	Share	Number of Prod. with Low Level of Competitiveness	Share
1	China	196	97.1	33	2.9
2	Poland	160	86.3	61	13.7
3	Venezuela	50	84.9	101	15.1
4	**Turkey**	**151**	**84.7**	**55**	**14.3**
5	Chile	79	82.2	96	17.3
6	India	168	81.6	50	18.4
7	Hungary	105	80.6	98	19.3
8	Philippines	82	80.0	92	20.0
9	Czech Republic	113	75.4	104	24.5
10	Bulgaria	118	73.2	65	26.5
11	Russia	87	71.5	130	28.5
12	Brazil	100	63.6	119	36.4
13	Korea	100	61.3	106	38.7
14	Argentina	69	57.3	136	42.7
15	Indonesia	137	54.7	78	45.3
16	Mexico	110	49.9	104	50.1
17	Singapore	50	42.8	160	57.2
18	Thailand	111	41.3	103	58.8
19	Malaysia	107	38.5	106	61.5
20	Hong Kong	37	37.1	178	62.9

Source: UNCTAD and our calculations

Table 3.21 limits the analysis to total emerging export markets rather than world economy in order to assess the relative competitive position of Turkey more accurately. Turkey is again among the best performing emerging economies in terms of the number of highly competitive products and

the share of these products in total exports. Turkey has 151 of 239 products with the growth rate higher than the total emerging export and they accounted for 84,7 percent of total exports. These results together with the jump in high–technology-intensive product exports signal fast integration of the Turkish economy to the world export markets.

In order to sustain integration to the world markets, countries need to introduce new products into the world market's "rising-star" product spectrum. Table 3.22 shows the number of emerging economies' competitive products that penetrates into top 10 and 25 export product which performs the highest increase in the world market. In this context, among Turkey's major competitors Turkey ranks the second, just behind China, in the number of the competitive products in the top 25 list. Moreover, between 2000 and 2004 Turkey introduced 8 "rising-star" products from the top 10 list to the world markets.

Table 3.22: Competitiveness of Emerging Economies (2001-2004)

Rank	Countries	Number of Competitive Prod. in Top 10	Number of Competitive Prod. in Top 25
1	China	7	21
2	**Turkey**	**8**	**17**
3	Czech Republic	7	17
4	Poland	5	17
5	Malaysia	7	15
6	Indonesia	7	15
7	Mexico	9	15
8	India	6	14
9	Hungary	6	13
10	Brazil	4	12
11	Singapore	5	12
12	Thailand	6	12
13	Argentina	3	11
14	Russia	3	11
15	Hong Kong	5	11
16	Chile	5	10
17	Korea	4	10
18	Bulgaria	3	9
19	Venezuela	4	8
20	Philippines	3	8

Source: UNCTAD and our calculations.

3.d.ii. The Revealed Comparative Advantage (RCA) Analysis of Turkey with Respect to Factor Intensity

The purpose of this section is to identify the Turkish industries that have revealed comparative advantages in exports. Export specialization index of Turkey has been calculated in terms of factor intensity measured by the revealed comparative advantage (Balassa) index over the 1994–2004 period. Balassa's RCA index (Balassa 1977), which compares the export share of a given sector in a country with the export share of that sector in the world and emerging market, is used for analyzing the degree of specialization (comparative advantage) quantitatively.

$$RCA_{ij} = \frac{X_{ij} \Big/ \sum_{i=1} X_{ij}}{\sum_{j=1} X_{ij} \Big/ \sum_{i=1} \sum_{j=1} X_{ij}}$$

The numerator represents the share of a given sector in national exports, where X_{ij} is the exports of sector *i* from country *j*; $\sum_{i=1} X_{ij}$ is the total exports of country j. The denominator represents the share of a given sector in the world/emerging market exports, where $\sum_{j=1} X_{ij}$ is the world/emerging market exports of sector *i*, and $\sum_{i=1} \sum_{j=1} X_{ij}$ are the world/emerging market exports. Thus, when RCA is above 1 then the country is said to have a relative comparative advantage, in that sector, put differently, country is specialized in that sector. When RCA is below 1 then (ranging from 0 to 1) the country is said to have a relative disadvantage in that sector.

Table 3.23. Revealed Comparative Advantage Index and Percentage Change Between 1994–2000 and 2001–2004 (World)

Type of Exports	RCA index 1994-2000 average	RCA index 2001-2004 average	Index change (%)
High-technology (R&D) intensive Exp.	0.25	0.40	59.1
Resource-intensive Exp.	0.32	0.29	-11.3
Labor-intensive Exp.	4.97	4.99	0.4
Capital-intensive Exp.	1.78	2.08	17.0
Agriculture-intensive Exp.	2.20	1.60	-27.1

Source: Own compilations and calculations on the basis of UNCTAD data.

Tables 3.23 and 3.24 contain the RCA indices for Turkey in the 1994–2000 and 2001-2004 periods, as well as percentage changes in those indices over those sub-periods. They also indicate Turkey's relative competitive position in the world and the emerging markets, respectively. For the 2001-2004 period, the RCA indices for labor, capital and agriculture intensive exports were greater than 1. In other words Turkey had strong revealed comparative advantage with respect to these sectors both in world and emerging markets.

On the other hand, structural shift in the specialization of product groups in terms of factor intensity of Turkey was observed for the 2001-2004 period compared to the 1994-2000 period. Even though the RCA index for high-technology intensive exports is less than unity, there has been a remarkable upward trend towards specialization in those commodities. The average RCA index of Turkey high-technology intensive exports was 0.4 for the 2001-2004 period in the world market, which implies 59.1 percent increase from its 1994-2000 period value. In the same vein, the RCA index for agriculture-intensive exports decreased by 27.1 percent in the said period. In other words, Turkey succeeded to decrease its competitive disadvantages in high-technology-intensive products after 2001, while lost its comparative advantage in the agriculture-intensive products. Concerning the capital-intensive products, Turkey raised its competitiveness significantly. We reached to similar results when we compute RCA index for emerging markets too.

Table 3.24. Revealed Comparative Advantage Index and Percentage Change Between 1994–2000 and 2001–2004 (Emerging Markets)

Type of Exports	RCA index 1994-2000 average	RCA index 2001-2004 average	Index change (%)
High-technology (R&D) intensive Exp.	0.30	0.46	56.4
Resource-intensive Exp.	0.30	0.30	0.2
Labor-intensive Exp.	2.87	2.97	3.5
Capital-intensive Exp.	2.19	2.52	15.2
Agriculture-intensive Exp.	2.29	1.85	-19.2

Source: Own compilations and calculations on the basis of UNCTAD data.

Table 3.25. Revealed Comparative Advantage Index for Selected Emerging Economies (2001-2004, average)

	High-technology (R&D) intensive Exp.	Resource-intensive Exp.	Labor-intensive Exp.	Capital-intensive Exp.	Agriculture-intensive Exp.
Turkey	**0.40**	**0.29**	**4.99**	**2.08**	**1.60**
Czech Rep.	0.91	0.45	1.37	1.93	0.46
Bulgaria	0.30	0.99	3.09	1.57	1.24
Romania	0.34	1.01	3.48	1.27	0.44
Malaysia	1.41	0.93	0.57	0.28	0.36
Argentina	0.25	2.04	0.23	1.05	5.60
Chile	0.07	2.07	0.14	3.90	4.12
Brazil	0.45	1.59	0.43	1.70	3.44

Source: Own compilations and calculations on the basis of UNCTAD data.

Table 3.25 displays RCA index calculations for major emerging market trading partners in terms of factor intensity. As far as the high-technology products concerned, Turkey has a noticeable comparative advantage over new EU member countries such as Bulgaria and Romania and Latin American countries such as Chile and Argentina. As it is expected, Turkey has comparative disadvantage in high technology products compared to East Asian emerging economies.

4. Empirical Analysis: Time Varying Parameter Estimates for Export Supply and Demand Functions

This chapter conducts an empirical analysis to estimate export demand and supply functions for Turkey. The primary purpose of the analysis is to investigate if the coefficients of the export functions exhibited a noticeable fluctuation over time that can be interpreted as structural changes in export elasticities. Our focus will be on long run export demand and supply functions of Turkey. These functions will be estimated separately in order to examine sources of potential structural changes. In the case of parameter instability Kalman Filter approach is better approach than classical regression methods since it allows one to estimate time varying coefficients. However, before proceeding with Kalman filter analysis standard long-run procedures must be performed to ensure whether there is a well-defined relationship among the specified variables in the supply and demand equations or not.

In the literature a standard export supply equation is defined as a function of competitiveness indicators such as relative prices, unit labor cost, effective exchange rate and scale variables such as domestic output and output gap, as well as some form of import constraint variable such as imported raw materials. On the other hand, a standard export demand equation is specified as a function of competitiveness indicators and foreign income.[7] After examining the stationarity properties of each variable, we proceed with co-integration tests over different vector of variables to find out a well-defined long-run export supply and demand equations for Turkey, for the 1987q1-2006q4 period. In both supply and demand equations, we used export quantity index, which is taken from the Central Bank of the Republic of Turkey (CBRT) website, as a dependent variable. Unit labor cost based real effective exchange rate (REER_ulc) is included as a measure of competitiveness in the supply function due to the fact that it reflects the cost of production better than the consumer price index based real effective exchange rate (REER_cpi). Indeed, our analysis suggests that among the price competitiveness indictors while REER_ulc produced theoretically and statistically better results in the export supply function, REER_cpi worked better in the export demand function. Both of these indicators, which include currencies of the 34 countries, are taken from Eurostat. In addition, we include import quantity index, which is taken from CBRT website, in the long run supply equation as a measure of import dependency of exports and found that it is a significant variable in determining the long-run supply function. However, even if the actual and potential outputs are alternative

[7] Interested readers may refer to Nowak-Lehman (2004) and Muscatelli et al (1995) for alternative export function specifications.

measures of physical productive capacity we found poor evidence for their inclusion in the long-run supply function. We also avoid using import and output variables in the same equation due to endogeneity problem. For the export demand equation, we preserve the standard set up and in addition to REER_cpi, we include foreign income in current prices and current PPP for the OECD countries, which is taken from OECD website.

4.a. The Model

As a result, the following equations were estimated to analyze export demand and supply functions respectively for Turkey.

$$xs_t = \beta_{0t} + \beta_{1t} m_t + \beta_{2t} reer\_ulc_t + \beta_{3t} s_1 + \beta_{4t} s_2 + \beta_{5t} s_3 + u_{1t} \quad (4.1)$$

$$xd_t = \alpha_{0t} + \alpha_{1t} y_t^f + \alpha_{2t} reer\_cpi_t + a_{3t} s_1 + a_{4t} s_2 + a_{5t} s_3 + u_{2t} \quad (4.2)$$

Here, xs_t and xd_t are the log of export quantity index; y_t^f is the log of foreign income; m_t is the log of import quantity index, $reer\_cpi_t$ and $reer\_ulc_t$ are the log of REER_cpi and REER_ulc respectively, s_j (j=1,2,3) are seasonal dummies, α_i's and β_i's, where i= 0, 1…5, are the coefficients of the explanatory variables. Equation (4.1) represents an export supply function that is determined by imports quantity index and real effective exchange rate. Equation (4.2) is a typical export demand function that relates exports to foreign income and real effective exchange rate. Since quarterly data is used in the analysis seasonal dummies are added to deal with seasonality.

4.b. The Method: Kalman Filter Approach

Kalman filter approach or state space models developed by Kalman (1960, 1963), has been used extensively in economics. The Kalman filter is a recursive algorithm for expressing dynamic systems that involve unobserved state variables, conditional on observed vector (Kim and Nelson, 2000). A detailed discussion of Kalman Filter approach is presented in the appendix. Theoretical explanation of the model can be found in the appendix. Application of a state space model on our question is explained in this section. The model consists of two equations. The first equation is called transition equation that describes the dynamics of the state variables. The second equation is the measurement equation which points out a relationship between observed variables and unobserved state variables. Since this paper is interested in analyzing how model parameters change over time, we assumed that all parameters of the equation (4.1) and (4.2) follow a random walk process. Then the transition equations for the demand and supply functions are:

$$\beta_{it+1} = \beta_{it} + \varepsilon_{2t} \qquad i=0,1\ldots5, \tag{4.3}$$

$$\alpha_{it+1} = \alpha_{it} + \varepsilon_{1t} \qquad i=0,1...5, \tag{4.4}$$

here ε_t is normal white noise processes. Then, the measurement equations can be written as

$$xs_t = F_t * B_t' + u_{1t}, \tag{4.5}$$

$$xd_t = H_t * A_t' + u_{2t}, \tag{4.6}$$

where, $F_t = \begin{bmatrix} 1 & m_t & reer\_ulc_t & s_1 & s_2 & s_3 \end{bmatrix}$, $H_t = \begin{bmatrix} 1 & y_t^f & reer\_cpi_t & s_1 & s_2 & s_3 \end{bmatrix}$,

$B_t = \begin{bmatrix} \beta_{0t} & \beta_{1t} & \beta_{2t} & \beta_{3t} & \beta_{4t} & \beta_{5t} \end{bmatrix}$, $A_t = \begin{bmatrix} \alpha_{0t} & \alpha_{1t} & \alpha_{2t} & \alpha_{3t} & \alpha_{4t} & \alpha_{5t} \end{bmatrix}$, $u_{1t} \sim iidN(0,1)$ and $u_{2t} \sim iidN(0,1)$. We also include seasonal dummies (s_j) in both equations. Kalman Filter approach is a recursive process that updates the estimated coefficients over time as new information arrives. However, this may reduce reliability of estimated coefficients especially at the beginning of the period. Instead, we may apply a fixed-point Kalman smoother, which gives the estimated value of the state variable at time *t* based on all available information up to time *T*, where $T > t$. The idea is that as new data become available, we can improve our estimation result from the Kalman filter by taking into account the additional information.

4.c Results

As a first step, unit root properties of the each variable are analyzed and found that all are I(1).[8] Then, co-integration analysis is conducted and found that there is a well-defined long-run relationship among the vector of variables that are defined in each equation. Smoothed Kalman filter estimation results based on the long-run relationship are presented in Figure 4.1.

Estimated coefficients for the export supply function are presented in the first column of Figure 4.1. 1994, 1997-8, and 2001 crises and 1996 customs union are marked on these graphs as shaded areas. Smoothed Kalman filter estimates show that intercept term can be considered as constant through out the period in both supply and demand equations. On the other hand, other parameter values vary over time. Both import and income elasticity, as well as the real effective exchange rates have an upward trend. The rate of increase in the parameters accelerated right after the CU in 1996. The trend in import elasticity of export supply was disrupted temporarily three times in 1994, 1998 and towards the end of 2000. While the crises in 1994 and 2000-2001 had an upward

[8] Unit root tests were not presented in the paper in order to keep the paper as short as possible. However, these test results could be provided to an interested reader.

jump affect, 1998 had a downward effect. However, neither of these shocks had path-breaking impact, albeit, the shock in 2000 had a level shifting impact on import elasticity of export supply. As a result, it is estimated that the import elasticity of exports increased about 50 percent from 1987 to 2006.

Meanwhile, the responsiveness of the export supply to the changes in REER_ulc steadily decreased during the 1987-2006 period, indicating smaller sensitivity of export supply to the shocks in REER_ulc. The decrease in REER_ulc elasticity is estimated to be more than 50 percent. Similarly, we may clearly identify three different jumps in this trend in 1994, 1997 and 2001. The shock in 1994 changes the direction in REER_ulc elasticity between 1994 and 1997, such that export supply becomes more elastic. However, after the CU the elasticity starts to decrease again. As in the case of import elasticity, these shocks, which are originated from the domestic economy, had temporary impacts, thus the REER_ulc elasticity of exports continues to fall during the 1987-2006 period.

On the right hand side column, parameter estimates for the export demand equation are presented. As in the case of export supply function, elasticity parameters of the demand equation are time variant. Income elasticity of exports, which was roughly constant during the 1987-1997 period, gained an increasing trend a year after the CU, notwithstanding to the 1998, 1999 and 2000-2001 crises. Thereby, by the end of the period, the income elasticity increased by more than 50 percent compared to its initial value. Beside, oscillations of import elasticity of supply are deeper than supply function; therefore we may say that supply is affected more from external shocks than the demand function during the 1987-2006 period.

REER_cpi elasticity, which showed a slight decrease during the 1987- 1997 period, followed the path of income elasticity closely, afterwards. The decrease in REER_cpi elasticity of export demand is 70 percent throughout the sample period. As a result, even though REER_ulc elasticity of export supply depicted a more volatile path than the same coefficients of the export demand function, the decrease in sensitivity of export demand to the changes in REER_cpi was much higher than export supply function. Residuals of the estimated equation is presented in panel d) and they dont show any systematic error. However, all crises periods jumped the residual upward indirectly showing their effect on the estimated coefficients. It also worth to note that residual volatility of export demand and supply functions get smaller after 2001, which may indicate decrease in uncertainty in economic environment due to prudent fiscal and monetary policies.

5. Conclusion

This study investigates the structural change in the Turkish exports. The analysis consists of three broad sections. In the second section, performance of the Turkish economy is examined in various perspectives, such as export and import performance, and developments in competitive indicators compared to some of Turkeys' trade partners. The focus of the third section is on both changes in commodity and country composition of Turkish exports. Import dependency and competitiveness of Turkish exports are also examined and compared to some of those emerging markets. The final section conducts an empirical analysis and applies smoothed Kalman filter approach to estimate demand and supply functions with time varying parameters to examine how parameter values change during the 1987-2006 period. The outcomes of each section can be summarized as follows:

Second Section:

1. With the liberalization of the Turkish economy at the beginning of 1980s, trade openness rate had shown an increasing trend. Meanwhile, a similar trend is observed for other countries, as well. Cross country comparison revealed that small economies tend to increase their openness rate at relatively higher pace than large economies, and Turkey, in this sense, is not an exception.
2. Increase in openness rate was followed by fast economic growth. However, the fast growth raised the problem of trade and current account deficits. Cross-country comparison showed that countries in the EU accession process also had and still have large trade deficits. Indeed, for those countries, trade deficit in recent years is smaller than their earlier years of their EU candidacy, implying that any potential negative effect of EU accession process was temporary for few of those new members.
3. The average growth rate of GDP was about 4.2 percent between 1980 and 2006 in Turkey. Financial and currency crises created instability in 1990s but growth rate got back to its increasing trend afterwards.
4. Regarding competitiveness indicators, Turkish Lira appreciated in real terms during the 2002-2006 period, however, the same trend was also the case in most of the other countries. The decline in the real wages in Turkey was much more evident compared with the other trade partners. The positive effect of the decline in real wages compensated the negative effect of real appreciation of Turkish Lira on competitiveness on Turkish exports. As a result, external competitiveness indicators provided evidence in favor of gaining competitiveness power of Turkish exports in the world export market.

5. Overall contribution of the rise of quantity of exports and imports to the value of exports and imports increased during the 1994-2006 period, though after 2003 this trend slowed down. Investigation of price and quantity indexes across the manufacturing sectors shows that terms of trade improved after 2003 (particularly for food and beverages, metal industry, machinery and equipment, electronics, motor vehicles together with furniture), while real increase in exports was less than imports (except for chemicals, plastic and rubber, basic metals and motor vehicles).

Third Section:

6. Post 2001 period witnessed a change in export commodity composition in favor of more capital and technology intensive commodities. In general fast growing sectors are relatively new commodities that are not considered as the traditional Turkish export commodities. However, it is shown that even though there is a process of transformation in the Turkish exports after the crises period, Turkey is still short of building any comparative advantage in these new commodities.
7. Three measures of commodity concentration ratios, distribution of normalized exports by commodity groups, weighted spread of exports by commodity groups and share of top 10 and 20 commodities in total exports, showed that commodity concentration of exports increased after 2001, thanks to the expansion of exports of new non-traditional commodities.
8. The rising industries of the post crises period are considered as relatively more capital and high technology intensive commodities compared to the popular industries of 1980s and 1990s. These new industries also have high intra-industry trade.
9. The classification of exports in terms of factor intensity reveals that concentration occurs in the high technology products in the world. Although the share of R&D-intensive product exports was below the world and emerging market averages, Turkey ranked the first in the growth of R&D product exports among the emerging market economies in the 2001-2004 period.
10. Both measures of the country concentration ratios; weighted spread of Turkish exports by countries and share of top 10 and 20 countries in total exports, indicate an increasing trend in country concentration of Turkish exports. On the other hand, the share of Turkish exports in the world market has been increasing since 1980s. Indeed, compared to the emerging markets, performance of the Turkish export is striking.
11. Analysis of exports shows that the high import dependence of overall Turkish exports is not exceptional. Indeed, import dependency of exports is higher in new EU members as well. It is found that the rate of dependency which was almost the same in Turkey and Poland during the 1998-2001 period, increased much faster in Poland in recent years.

Sectoral analysis shows that import dependency rate increased much faster in the Turkish manufacturing sectors, particularly in motor vehicles as well as electrical machinery and apparatus sectors. Examination of the indicators across the manufacturing sectors for the new EU member countries shows that the rate of increase is relatively high in Turkey and Slovakia. Considering the cross sectoral development we observe relatively high import dependency rate in motor vehicles and electrical machinery and apparatus sectors .

12. Investigating the export performance and competitiveness of Turkey relative to the world and emerging economies during the 2001-2004 period we find that Turkey is one of the best performing countries in terms of both the number of competitive products and the share of these products in total exports. The improvement of Turkey's position in both world and emerging markets together with the increase in Turkey's exports of high-technology intensive products signal steady integration to the world export market. With regard to the continuity of the integration of Turkey to the world economy it is important to introduce new products into the world markets` rising-star product spectrum. In this sense, Turkey ranked the second in the number of competitive products introduced to the world markets.
13. Finally export specialization index is calculated for Turkey to identify the Turkish industries that have comparative advantages in world exports. The analysis suggests that there is a remarkable upward trend towards the specialization in high-tech sectors.

Fourth Section:

14. Kalman filter approach is applied to examine how the value of each parameter values of the export demand and supply function varies over time, without predetermining a breaking point in time. The results suggest that none of the elasticity parameters in respective equations are stable. There is a continuous increase in imports as well as income elasticity as opposed to the persistent decrease in the real effective exchange rate elasticity.
15. None of shocks in 1994, 1998 and 2001 had path-breaking impact, except; the shock in 2001 had a level shifting impact on import elasticity of export supply. As a result, it is estimated that the import elasticity of export increased about 50 percent from 1987 to 2006.
16. We interpreted these findings in the following way: Some sectors were successful in integrating to the world markets especially after the Turkey-EU CU and this helped them to expand their export market share by producing for the external market during the turbulent periods. High import dependence and low real effective exchange rate elasticity shield them from the detrimental effects of real appreciation of Turkish lira. We believe

that there are two-way self-fulfilling dynamics between exchange rate sensitivity and import dependence. One possible explanation is that, due to real appreciation of Turkish lira, firms in these sectors were able to purchase inputs at lower price abroad.

17. Increase in the share of non-traditional commodities in total exports raised not only the overall income elasticity of total Turkish exports but also its import elasticity, which explains the recent surge in the import dependence of overall exports (Saygılı and Saygılı, 2007). It is evident that exchange rate elasticity of non-traditional commodities is smaller than that of the traditional goods, which also pulls down the overall exchange rate elasticity of exports over time especially after 1996. The change in the composition of Turkish exports in favor of low exchange rate elastic non-traditional commodities may explain the seemingly puzzling coincidence of high growth of total exports and real appreciation of the Turkish lira.

References

Aydın, F., Çıplak, U. and Yücel, E., (2004), "Export Supply and Import Demand Models for the Turkish Economy", Working Paper No. 04/09, The Central Bank of Turkey.

Balassa, B., (1977), "'Revealed' Comparative Advantage Revisited: An Analysis of Relative Export Shares of the Industrial Countries, 1953-71," Manchester School of Economic and Social Studies 45:327-344.

Bhagwati, Jagdish and Donald R. Davis (1994) "Intra-industry trade issues and theory", Harvard Institute of Economic Research, Cambridge.

Gönel, Feride Doğaner (2001) "How important is intra-industry trade between Turkey and her trading partners?" Russian and East European Finance and Trade, 4, pp:61-76.

Grupp, H. (1995), "Science, High Technology and the Competitiveness of EU Countries", Cambridge Journal of Economics, 19:1 p.209.

Helpman, Ethan and Paul Krugman (1985), **Market Structure and Foreign Trade**, Cambridge, MIT Press.

Kalman, R.E. (1960) "A New Approach to Linear Filtering and Prediction Problems. Transactions of the ASMA." *Journal of Basic Engineering 82D*, 35-45.

Kalman, R.E. (1963) "New Methods in Weiner Filtering Theory Problems." In: Bogdanoff, J.L., Kozin, F. (Eds), Proceedings of the First Symposium of Engineering Applications of Random Function Theory and Probability, New York, 270-388.

Kim, Chang-Jin and Nelson, C. R (2000), **State Space Models with Regime Switching: Classical and Gibbs Sampling Approaches with Applications**. Cambridge, MA: MIT Press.

Muscatelli, V.A., Stevenson, A.A., and Montagna, C. (1995), "Modeling Aggregate Manufactured Exports for some Asian Newly Industrialized Economies," The Review of Economics and Statistics, PP: 147-155.

Ng, Thiam Hee (2006). "Foreign direct investment and productivity: evidence from the East Asian economies" UNIDO, Staff working paper No: 03/2006

Nowak-Lehmann, F.D. (2004), "Different Approached of Modeling Reaction Lags: How do Chilean Manufacturing Exports React to the Movement of Real Exchange Rate," Applied Economics, 36, pp: 1547-1560.

Sarıkaya, Ç. (2004), "Export Dynamics in Turkey", Central Bank Review, No:2 p.41-64.

Saygılı, M. and Saygılı, H. (2007) "Investigating Structural Change in Turkish Exports: The role of Turkey-EU Custom Union and Economic Crises," unpublished manuscript.

Saygılı, M., Şahinbeyoğlu, G.; and Özbay, P.(1998), "Competitiveness Indicators and the Equilibrium Real Exchange Rates Dynamics in Turkey," **Macroeconomic Analysis of Turkey: Essays on Current Issues**, ed. E.M. Üçer, CBRT.

Sönmez, Mustafa (2005), "Türkiye İhrcatının İthalata Bağımlılığı: 2000-2004", unpublished manuscript.

Şahinbeyoğlu, G. and Ulaşan, B. (1999), " An Empirical Examination of the Structural Stability of Export Function," CBRT Discussion Paper No: 9907.

Thornhill, D. (1988), "The Revealed Comparative Advantage of Irish Exports of Manufactures", Journal of Statistical and Social Inquiry Socaaty of Ireland, Vol XXV, part V.

WTO (2006) International Trade Statistics, http://www.wto.org/english/res_e/statis_e/its2006_e/its06_toc_e.htm.

Yükseler, Z. and Türkan, E. (2006) "Türkiye'nin Üretim ve Dış Ticaret Yapısında Yapısal Dönüşüm: Küresel Yönelimler ve Yansımalar," Ekonomik Araştırmalar Formu Çalışma Raporları Serisi, TÜSİAD-Koç Üniversitesi.

Appendix

A. SITC 3 Classification of High-technology Intensive Sectors in Terms of Factor Intensity

	Product Group		**Product Group**
266	Synthetic fibers	745	Other non-electrical machinery
277	Advanced industrial abrasives	749	Non-electrical machinery parts, accessories
515	Heterocyclic chemistry	751	Office machines
516	Advanced organic chemicals	752	Automatic data processing machines
522	Rare organic chemicals	759	Advance parts for computers
524	Other precious chemicals	761	Television equipment
531	Synthetic matter	762	Radio-broadcast receivers
533	Pigments, paints, varnishes	763	Sound recorders, phonographs
541	Pharmaceutical products	764	Telecommunication equipment
551	Essentials oils, perfume, flavor	772	Traditional electronics
591	Agricultural chemicals	773	Optical fibred and cables
598	Advanced chemical products	774	Medical electronics
663	Mineral manufacturers, fine ceramics	776	Semi conductor devices
689	Precious non-ferrous base metals	778	Advanced electrical machinery
714	Turbines and reaction engines	781	Motor vehicles for persons
718	Nuclear, water, wind power generators	782	Motor vehicles for goods transport
724	Textile and leather machinery	791	Railway vehicles
725	Paper and pulp machinery	792	Aircraft and spacecraft
726	Printing machinery	871	Advanced optical instruments
727	Industrial food-processing machines	872	Medical instruments
728	Advanced machines tools	873	Measuring equipment
736	Metal working machinery tools	874	Advanced measuring equipment
737	Other metal working machinery	881	Photogram apparatus, and equipment
741	Industrial heating, cooling equipment	882	Photographic and cinematographic supplies
744	Mechanical handling equipment	884	Optical fibres and contact lenses

Note: The classification of high technology sectors is based on Grupp (1995).

B. Kalman Filter

Kalman filter approach or state space model is developed by Kalman (1960, 1963). The Kalman filter is a recursive algorithm for expressing dynamic systems that involve unobserved state variables, conditional on observed vector (Kim and Nelson, 2000). A state space model consists of two equations of which a general form of a linear state space system representation is written down bellow:

$$z_{t+1}=\Phi_t z_t + G_t w_t \qquad \text{(B.1)}$$

$$y_t=H_t z_t + \zeta_t \qquad \text{(B.2)}$$

Here, $z_t \in R^n$ is a $(n\times 1)$ state vector, $y_t \in R^m$ is the vector of observation Φ_t, H_t, G_t are known matrices that are also allowed to vary over time, w_k, and ζ_t are vectors of normally distributed *i.i.d* shocks. The first equation is called a transition equation that describes the dynamics of the state

variables. The second equation is the measurement equation points out a relationship between observed variables and unobserved state variables. The model satisfies the following assumptions:

$$E\left[\zeta_t\right]=0\ ,\qquad E\left[w_t\right]=0 \tag{B.3}$$

$$E\left[\zeta_t\zeta_j'\right]=R_t\lambda_{tj}\ ,\qquad E\left[w_tw_j'\right]=Q_t\lambda_{tj} \tag{B.4}$$

$$E\left[\zeta_t w_j'\right]=0\ ,\ \ E\left[z_0\right]=\overline{z}_0 \tag{B.5}$$

$$E\left[(z_0-\overline{z}_0)(z_0-\overline{z}_0)'\right]=P_0 \tag{B.6}$$

$$E\left[z_0w_t'\right]=0\ ,\quad E\left[z_0\zeta_t'\right]=0 \tag{B.7}$$

Under these assumptions, $\hat{z}_t$ can be determined by the Kalman filter:

$$\hat{z}_t=\hat{z}_{t|t-1}+K_t\left(y_t-H_t\hat{z}_{t|t-1}\right) \tag{B.8}$$

$$\hat{z}(0)=z_0$$

Here, K_t is the Kalman gain, which determines the weight assigned to new information about and calculated by

$$K_t=P_{t|t-1}H_t'\left(H_tP_{t|t-1}H_t'+R_t\right)^{-1} \tag{B.9}$$

where P_t is the $(n\times n)$ covariance matrix of conditional on information up to $(t-1)$ and calculated as follows

$$P_{t|t-1}=\Phi_{t-1}P_{t-1}\Phi_{t-1}'+G_{t-1}Q_{t-1}G_{t-1}' \tag{B.10}$$

$$P_t=\left(I-K_tH_t\right)P_{t|t-1} \tag{B.11}$$

$$\hat{z}_{t|t-1}=\Phi_{t-1}\hat{z}_{t-1} \tag{B.12}$$

As it is clear from equation (B.12) the success of the estimation depends on the representation of the dynamics of the system. If the best Kalman gain is used then,

$$g_t=y_t-H_t\hat{z}_{t|t-1} \tag{B.13}$$

The residual vector satisfies all white noise properties and its covariance matrix can be calculated as

$$C_{0,t}=E\left[g_tg_t'\right]=H_tP_{t|t-1}H_t'+R_t\,. \tag{B.14}$$

Kalman Filter approach is a recursive process that updates estimated coefficients over time as new information arrives. However, this may reduce reliability of estimated coefficients especially at the beginning of the period. Instead, we may apply a fixed-point Kalman smoother, which gives the

estimated value of the state variable at time *t* based on all the available information up to time *T*, where $T > t$. The idea is that as new data are made available, we can improve our estimation result from the Kalman filter by taking into account the additional information. Then Kalman smoothing gives

$$P_{t+1/t} = \left(I - K_t H_t\right) P_{t|t} \tag{B.15}$$

$$\hat{z}_{t+1|t} = \Phi_t \hat{z}_t \tag{B.16}$$