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STRUCTURAL CHANGES IN EXPORTS OF AN EMERGING ECONOMY: CASE OF TURKEY

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Structural Changes in Exports of an Emerging Economy: Case of Turkey[*]

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Abstract

This study examines structural changes in Turkish export supply and demand functions, which can be used as a good reference in understanding the determinants of trade performance of an emerging market economy. Results show that as the export shares of new non-traditional commodities that have not only higher import and income sensitivity, but also lower real exchange rate elasticity than the traditional commodities increases, coefficients of the total export functions changes accordingly. Process of transformation accelerates during the major reform periods and economic crisis.

Keywords: Turkish Exports, Structural Change, Kalman Filter, Commodity Based Exports, Panel Co-integration

JEL Classifications: F1, F4

[*] The opinions expressed in this study are those of the authors and should not necessarily reflect the views of the UNCTAD secretariat or the Central Bank of the Republic of Turkey.

1. Introduction

The concept of structural change in international trade pattern is not a new phenomenon in the international trade literature. Improvements in information and communication technologies, decreases in transportations costs, reductions in barriers to trade and advances in production technologies allow development of new global production networks, such that production can be divided into different stages and performed at different locations. Division of production process across countries, meanwhile, not only causes structural change but also increases the import dependence (Krugman, 1995; Feenstra, 1998; Hummels *et. al.*, 2001; Ando, 2006; Jones *et. al.*, 2005; Nordas, 2007). However, some development economists consider deverticalization of production structures in developing countries as rather undesirable by product of trade liberalization. Besides, market-oriented reforms reduce domestic content of production by forcing small to medium size domestic subcontractors of large exporting companies to exit the market (Cimoli and Katz, 2003). These policies may actually lead developing countries to specialize on commodities or production processes that they have static comparative advantages but require transferring R&D and engineering activities to headquarters of multinational companies in developed economies.

Transformation of trade pattern in developing countries is rather rapid compared to developed countries. Reallocation of multinationals' production processes towards emerging countries and development of global supply chains stimulate structural changes in emerging markets. Yet, developing countries are also trying to cope with difficulties of domestic and international turbulences while integrating their economy to the world markets via trade reforms. During the transformation process it is crucial to design prudential trade reforms as it determines long-term trade and growth performance of a country. Policy makers should have clear idea about growth potential of their sectors in order to guide domestic and foreign investments efficiently. Cimoli and Katz (2003) argues that Latin American (LA) experience is an evidence against the internationally integrated production system that pushes these countries into a low development

trap by integrating them to the world production process via allocating low domestic knowledge generation and value-added stages or production of traditional commodities to these economies. Balaguer and Cantavella-Jorda (2004) and Montobbio and Rampa (2005), meanwhile, suggest that countries investing in non-traditional manufactured and semi-manufactured commodities, which are considered as high technology intensive sectors, could boost their economic growth and exports. In this respect, analyzing the Turkish experiment, which depicts an increasing trend in exports in the same internationally integrated production system, will allow us to understand potential changes in a typical emerging market economy's export behavior.

There are numerous empirical studies in the literature documenting the changes in the nature and structure of world trade. A study by Stern *et. al.* (1979) reports evidence of structural change in US imports but not in US exports by using data for the 1956-1976 period. In a similar fashion Hall *et. al.* (1996) report shifts in UK export demand function by using sequential testing procedure. Ben-David and Papell (1997) show that export to GDP and import to GDP ratios increased substantially exhibiting a structural break during the postwar period in 48 countries. Balaguer and Cantavella-Jorda (2004) state that changes in the composition of exports in favor of non-traditional manufactured and semi-manufactured commodities explain the Spain's higher export growth after the implementation of outward-looking trade regime in 1959. Montobbio and Rampa (2005) also link the export performance of nine developing countries to their technological activities. They argue that a country, which expands its economic activity in high technology sectors with increasing technological opportunities and avoid expansion of medium technology sectors with low opportunity for technical change, can achieve higher average export growth.

Empirical studies on the structural changes in trade pattern of developing countries is rather limited and only few studies in the literature actually analyze the changes in the coefficients of trade functions and their implications for the policymakers. Yet, effectiveness of public policies to promote international competitiveness depends crucially on these trade

elasticities. In a highly integrated world economy, traditional export promoting strategies, such as high protective tariffs and exchange rate depreciations, may actually backfire if the process of export growth is not well understood. Acceleration of global competition and trade liberalization increased division of labor among nations resulting in import dependence of national production via vertical specialization of production processes. Deverticalization of production processes and increased import dependence may decrease exchange rate sensitivity of trade flows and weaken domestic competition policies based on exchange rate depreciation.

Main contributions of this study to the literature are twofold. First, it analyzes how sensitivities of exports to competitiveness indicators, income and imports change as the structure of trade alters over time. Majority of studies in the literature consider the structural change as one time jump in export or import functions due to external shocks. This study, estimate coefficients of export function as time varying parameters without imposing any predetermined breaking point in time by applying Kalman filter approach. Second, having shown that parameter values are instable over time the impact of the changes in composition of exports in favor of non-traditional commodities is examined as a potential source of structural change in total exports. A panel co-integration analysis is conducted across the group of non-traditional and traditional commodities to examine group-wise differences in export function parameters. Application of the panel co-integration techniques gives more reliable long-run coefficient estimates than the single equation methods, especially when time period is not long enough. Lastly, the study estimates export supply and demand functions separately that was also largely ignored in this literature.

The rest of the paper is organized as follows. Section two briefly discusses the recent trends in Turkish exports. Section three, after explaining the model and econometric methods used in the analysis presents empirical results while section four concludes.

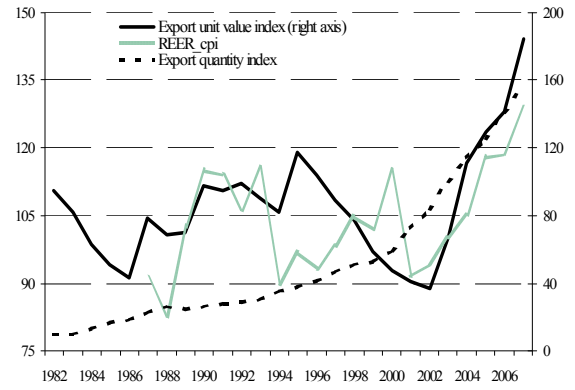
2. Trends and Structure of the Turkish Exports

Turkey changed its trade policy from import substitution to export-led growth in 1980s, and since then, the share of Turkish exports in the world trade had increased from 0.36 percent in 1980-1990 to 0.44 percent in 1991-2000 and then to 0.60 percent in 2001-2005 (Aydın, *et al*., 2007). Performance of the Turkish exports after 1980 can be classified in four sub-periods (Figure 1.a). In the first period, early 1980s, a rapid fall in prices and a gradual rise in real exports were observed due to the export promoting policies based on depreciation of Turkish lira (TL) and export subsidies. The second period covers 1987-1996 and represents the period of gradual capital account liberalization of Turkey, in which TL appreciated in real terms, as a result of an increase in capital inflows. Appreciation of TL, in turn, slowed down the growth rate of exports during this period. Very extensive and important Turkey-EU customs union (CU) in 1996, so called "era of crisis" (1994-2001) put pressure on and initiated the IMF sponsored reform programs in Turkey. Sharply falling export prices were affected mostly from the 1996 CU, 1997 Asian and 1998 Russian crises and resulted in disappearance of positive relationship between export prices and real effective exchange rates in the third period (1997-2001). As a response to the 2001 crisis, Turkish policymakers initiated another extensive reform program under the supervision of IMF aiming to reduce public deficit, reforming the banking sector, implementing floating exchange rate regime and decreasing inflation rate to single digits in the fourth period of post-2001. As the Turkish economy struggle to cope with the post-2001 crisis era, average yearly growth rate of Turkish exports reached to 20.9 percent, which is registered as the highest in the recent Turkish history. High export performance was mainly attributed to the success of domestic firms in adopting non-price competitive strategies. Effect of the CU on exports was evident with lags after the impact of Asian and Russian crises disappeared. Under these conditions, it would be rather unrealistic to expect stable export function coefficients. In fact, the swift changes in

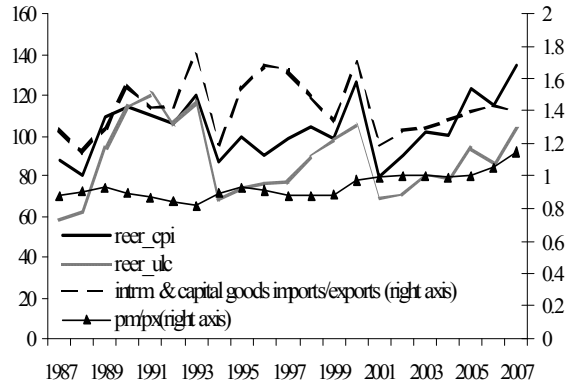
relative importance of determinants of exports are reported in various studies (Şahinbeyoğlu and Ulaşan, 1998; Saygılı *et. al*., 1998; Aydın *et. al.*, 2004; Sarıkaya, 2004).

Figure 1: Turkish Exports, Imports, Prices and REER (2003=100)

a



b



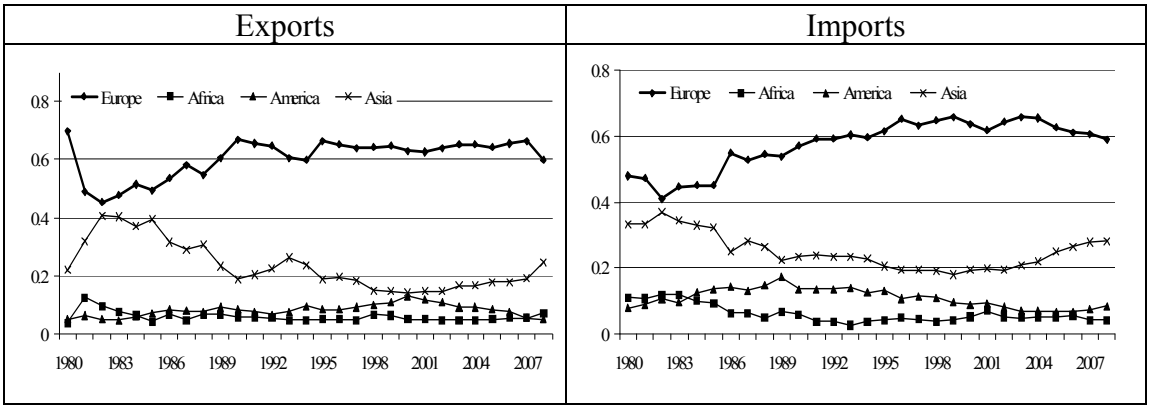
Source: TURKSTAT

As real exports increase, a parallel sharp rise has been observed in imports since 2001 as well. According to Aydın, *et al*. (2007) and Yükseler and Türkan (2006) Turkish exports performance becomes highly dependent on imports during this period, as it is also the case in the new EU members. Sönmez (2005) reaches to the same conclusion by examining the implementation of inward processing regime in Turkey. Figure 1.b shows that intermediate and capital goods imports per unit of exports had an increasing trend even before the 1996 CU. CU with EU in 1996 seems to decrease imports of intermediate and capital goods per unit of exports until the financial and currency crises in 2001, probably due to real appreciation of TL during the 1997-1999 crises period. With the reform and stabilization policies the ratio starts to gain an increasing trend again. This is the period analyzed by Aydın, *et al*. (2007), Yükseler and Türkan (2006) and Sönmez (2005). It is worthy noting that though imports to exports ratio is greater than the 1980s figure, it has not reached its pre crises level yet. During this period, even though there was a slight increase in ratio of import prices to export prices, the change was not that significant to affect imports of intermediate and capital goods per unit of exports. Albeit, it appears that there

is a positive relationship between REER and ratio of imports to exports.

Country composition of Turkish exports also showed interesting pattern. Europe has been the major trade partner of Turkey since 1960s. Turkey and EU (formerly known as European Community) signed a trade treaty in 1963 aiming to gradually integrate Turkish economy to the union. As part of the agreement, member states eliminated tariffs on imports from Turkey in 1973 on agreed group of commodities but a long transition period was granted to Turkey's complience to the agreement. In the early 1980s Turkey begun its trade liberalization era by eliminating restrictions on its foreign trade. There is a gradual increase in the share of European economies in the Turkey's trade volume during this period. When CU came into force in 1996, tariffs on bilateral trade was alrady low and thus CU seem to have no significant increasing effect on Turkey and EU trade volume(Figure 2). Another interesting trend is the increasing development in trade share of Asian economies after 2001 that was falling before that year. Detailed analysis shows that, while imports from EU27 and North America have been falling since the CU, the deficiency is replaced by imports from European emerging markets and Asia (other than Near and Middle East). On the other hand, growth rate of Turkish exports to Near and Middle East as well as European emerging markets accelerated apparently after 2001, while there was no significant change in exports to EU27.

Figure 2: Regional Export and Import Shares



Source: TURKSTAT

If export as well as import shares of Europe are not changing significantly, then it might be the composition of trade that is influenced from CU and the recent global developments. Table 1 reports the list of 10 commodities that have the highest share in Turkish exports from 1982 to 2006. The content of the list changes throughout this period. Mid 1990s marks a swift change. Among the commodity groups that constituted the list of 2006, only few were in the same list of 1980s and the first half of 1990s. Top-10 list for 1982, 1985, and 1990 included only 3, 4, and 5 commodities from the top-10 of 2006, respectively. However, 1995 and 2000 lists included 8 and 9 commodities from the 2006 top-10 list, respectively. Those commodities that were in the top of the list before the financial turmoil period (1994-2001) were mostly replaced by the new ones afterwards. Thus, it might be concluded that the crisis and structural adjustment period worked as a selection process among the export sectors of Turkey. There are only three commodity groups recorded in the top 10 list of all selected years: (08) Edible fruits and nuts, (61) Articles of apparel and clothing accessories knitted, (73) Articles of Iron and steel, of which are relatively labor intensive and Turkey traditionally has static comparative advantage. After the crises and structural adjustments process Turkey starts to export less of relatively labor intensive traditional export commodities such as (07) Edible vegetables, (24) Tobacco and manufactured tobacco, (25) Salt, sulphur, earths and stone plastering materials, (27) Mineral fuels and oils and production of their distillation. Instead, exports of relatively capital intensive commodities such as (63) Other make up textile articles, (84) Nuclear Reactors, boilers, machinery and mechanical textile articles, (87) Vehicles other than railway or tramway rolling stock are increasing in the same period. Also note that increasing trend in share of exports of (72) Iron and steel and (85) Electrical Machinery and equipment which are considered as capital intensive commodities started before the 1994crises.

Table 1: Top 10 Export Items of Turkey (1982-2006)

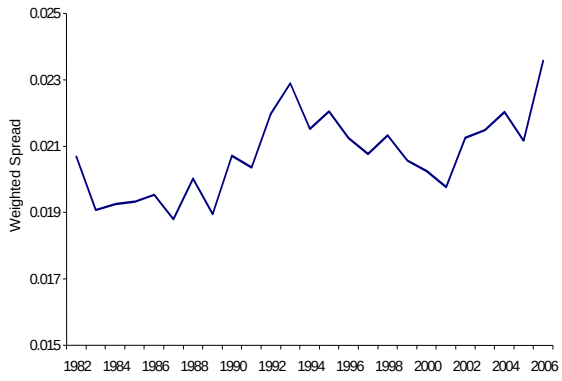
	1982	1985	1990	1995	2000	2006
1	55	**73**	**61**	**61**	**61**	**87**
2	**08**	55	**72**	**62**	**62**	**61**
3	**73**	**08**	**62**	**72**	**85**	**84**
4	25	**61**	**08**	**08**	**72**	**85**
5	01	42	42	**85**	**87**	**72**
6	24	**84**	52	**84**	**84**	**62**
7	27	27	**85**	**87**	**08**	**73**
8	07	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 and 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.

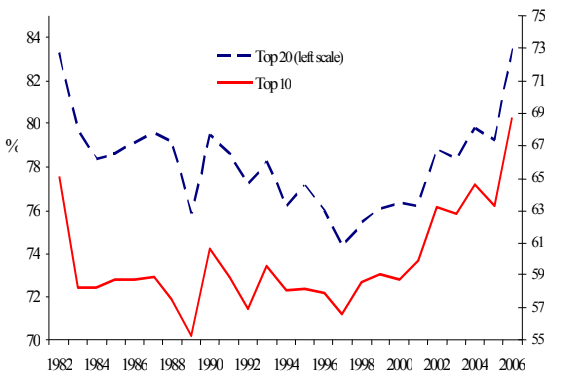
Note: Table is taken from Aydın, *et. al.* (2007). Items that were also in the top 10 of 2006 were written in bold.
Source: TURKSTAT

Figure 3: Concentration Measures (1982-2006)

Weighted Spread of Exports by Commodity Groups



Shares of Top 10 and 20 Sectors in Total Exports



Source: Aydın, *et. al.* (2007).

Analysis of concentration ratio, further, points out the self-selection process in favor of non-traditional sectors in Turkey. Figure 3 reports the evolution of two different export

concentration ratio indicators: Weighted spread[1] of exports and shares of top 10 and 20 commodities in total exports. Note that the first indicator gets values between zero and plus infinity and increase in its value indicates deterioration of distribution of exports among commodity groups. According to the first indicator, except for the 1993-2001 period, exports tended to concentrate on particular commodity groups. The pre-1994 phase can be explained by the influence of export led growth strategy implemented at the beginning of 1980s. Yet, concentration phase halted at the beginning of the economic and financial turmoil periods (1993-2001), and at the end of this turmoil period, it climbed up again, as the new commodities becoming the driving force of the export growth. Figure 3 also shows that the share of top 10 commodities, which remained mostly the same in 1980s and 1990s around 58 percent, begun to increase in 2001, and reached to 69 percent in 2006. The share of top 20 commodities in total exports, which fell during 1980s and most of 1990s, has shown an increasing trend since 1998.

Further evidence for the change in the composition of Turkish exports can be documented by analyzing the best end worst performing commodity exports. Following Pineres and Ferrantino (1997), commodity groups are separated into two different categories: traditional and non-traditional. Traditional commodity is the one in which its export experience is concentrated at the earlier years of the period. Yet, export experience function of the non-traditional commodity is concentrated at the later years of the period. In other words, traditional commodities experience faster but non-traditional commodities slower growth at the earlier stage of the period. After ranking total of 96 commodities according to their traditionality index, top 20 and low 20 goods were pooled into two groups.[2]

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[1] Weighted Spread of Exports is the sum of squared deviation from the overall mean of commodity-based exports across goods corrected for mean: $\frac{\sum_{i=1}^{N}\left(x_{ti}-\mu_t\right)^2/N-1}{\mu_t}$. x_{ti}, μ_t, and N are exports of goods *i* in time *t*, average commodity exports in time *t*, and total number of commodities, respectively.

[2]These commodities roughly cover the first and last 20% of the commodities of the total group. Though a 20% cut-off criterion for the groups is rather arbitrary, the data and econometric method impose limitations on the cut-off percentages. Simulation exercises on the panel cointegration method conclude that a minimum of 10 or more

Table 2 shows the share of each group of commodities in total exports, the list of the commodity groups can be found in appendix B. Majority of non-traditional commodities consist of capital and high tech intensive commodities such as vehicles other than railway or tramway rolling stocks, furniture, electrical machinery and equipment, ships, boats and floating structures etc. Share of non-traditional commodity exports increases from 14 percents at the end of 1980 to 41 percents in 2000s. Share of traditional commodity exports which mainly consist of agricultural and labor intensive commodities such as live animal, fertilizers, leather, tobacco, edible vegetables etc., decreases from 27 percents to 5 percents in the same period. In this respect, the Turkish experience is rather different from the LA case. As opposed to the LA example the share of traditional processing sectors lost their share after the trade liberalization of 1980s and 1990s. Yet, sectors such as transportation vehicles and consumer electronics thrived in both LA and Turkey. Though they are not considered as traditional sectors by general classification for both of them, these sectors increased the economies' import dependence of exported commodities.

Table 2: Share of Traditional and Non-traditional Commodity Exports

	Traditional	Non-traditional
1987-91	26.71	14.01
1992-96	14.38	18.20
1997-01	9.77	29.43
2002-07	5.05	40.60

Source: TURKSTAT and our calculations.

The preceding analysis demonstrates structural change in the Turkish exports in which shares of capital and high-tech intensive commodities in total exports increases. Aydın *et al*. (2007) state that European emerging markets are also in a similar transformation process. Yet, increase in the share of capital and high-tech industries does not necessarily mean that Turkey is

cross-sections in the panel improve the panel results considerably. On the other hand, too large cut-off shares may add additional noise to our estimates. Commodities which had less than 15 million USD export value in all of the 20 years of observations were excluded from the analysis. Moreover, the export growth rates of the commodities between the best and worst performing ones are very close to the overall average export growth. Thus, their inclusion in the analysis will blur our efforts to identify common properties of fast growing and slowly growing export commodities.

specializing on the high-tech process of the production. It may simply indicate increase in the dependence of domestic production on imports of high value added inputs. Across the manufacturing sectors, the rate is relatively higher in electrical machinery and apparatus followed by motor vehicles and textile and wearing apparels. The first two sectors are considered as non-traditional sectors that exhibited rapid growth path after the crises period (1994-2001). Thus, transformation mainly takes place in manufacturing industries that have import dependency rate higher than that of the overall economy (Aydın, *et al.* 2007).

What derives this sectoral selection and sorting process? Trade liberalization and market deregulations may initiate such a process. As it is noted in Cimoli and Katz (2003) firms and sectors differ not only because they produce different commodities but also because they respond differently to the changes in macro-micro settings and regulations. After the macro-economic stabilization and trade liberalization programs of LA economies during the 1970s and 1980s, local firms faced contraction of domestic markets on the one hand and immense arrival of imports on the other. At the end, some incumbent firms were able to adjust to the new environment by lowering production costs-expelling labor- but many firms -mainly small and medium sized enterprises- had to exit the market. Thus, ECLAC (2000 and 2002), and Cimoli and Katz (2003) conclude that export–oriented sectors and firms closer to the static comparative advantages of the country react swiftly and positively to the new micro-macro environment. These sectors include unskilled labor intensive and natural resource-processing industries in the case of LA economies. Contrary to the LA case, the share of highly unskilled labor intensive agricultural sectors decreased as a response to macro-micro regulations. Knowledge-intensive sectors producing for the domestic market under the protection of tariffs react negatively to the new economic environment. Among the sectors that forge ahead during the trade liberalization and deregulation era of the LA economies, non-tradable service sectors, 'in bond' assembly industries producing electronic equipment, televisions, etc and the vehicle industry, showed strong success in increasing its share in national income and exports. A similar pattern is also

observed in Turkey during the transformation process.

According to Cimoli and Katz (2003) macro-economic stabilization and trade liberalization programs increased business concentration ratio as well. As the small and medium sized companies forced to exit the market, large firms that have accumulated technological capability and access to long-term financing and technology markets survived. Moreover, these large firms, in order to survive in the new environment, adapted a new production process. The new regime turned the local production into assembly activity that uses imported parts and components as well as foreign technology and engineering services. Thus, the industries and firms that have been successful in recent decades are the ones that deverticalize their production structure and specialize on particular stage of the production process.

3. The Model and Main Results

A standard export demand equation can be specified as a function of competitiveness indicators and foreign income. *Ala* Rao and Singh (2007) a typical export function of a county can be specified as follows:

$$\ln X = \alpha_0 - \alpha_1 \ln\left[\frac{P_d}{E \times P_f}\right] + \alpha_2 \ln Y_f \qquad (1)$$

where X, Y_f, P_d, P_f and E are exports, foreign income, domestic prices, foreign prices and exchange rate, respectively. The term $\frac{P_d}{E \times P_f}$ represents the competitiveness indicator, real exchange rate. When more than two country is competing in a single market the real exchange rate formulation above may not be sufficient to measure how competitive is the price of a single country. Then a trade weighted competitiveness indicator such as REER would be the better indictor to be used in estimating export demand function. CPI based REER assess price competitiveness of a country relative to its principal competitors in international markets.

Standard export supply equation, on the other hand, can be specified as a function of competitiveness indicators such as relative prices, unit labor costs, effective exchange rate and scale variables such as domestic output and output gap, as well as some form of import constraint variables such as total imports, imported raw materials and capital goods. Muscatelli *et. al.* (1995) defines export supply as a function of export prices, variable costs (includes imported raw material and wage costs) and stock of fixed capital. The prices and costs are in common currency terms so they also include changes in exchange rates. However there are two issues need to be solved related to the equation. Firstly, if firms are mark-up pricing then export prices and variable costs would be collinear and by including only the variable cost one may consistently estimate the export supply function. Besides, Muscatelli *et. al.* (1995) did not estimate export supply function directly but use the equation to estimate export supply prices in order to estimate integrated supply and demand equations. In our study, we used unit labor cost index (ULC) since it is the most reliable measure of costs in Turkey. Domestic currency dominated unit labor costs are converted into foreign currency terms by computing ULC based real effective exchange rate.[3] Secondly, Muscatelli *et. al.* (1995) include capital stock to estimate the effect of product quality on export supply. However, there is no official capital stock statistics in Turkey and its alternative measures are usually considered as rather problematic. Since the focus of our paper is not on the effect of product quality and there are significant data problems we did not include capital stock in our analysis. Yet, the export supply specified by Muscatelli *et. al.* (1995) excludes a very significant variable that we believe derives the recent trend in international trade. Increase in import dependence of production in developing countries necessitates the use of imported intermediate goods for exported commodities. Since the current deverticalized mode of production led developing countries to specialize on a particular process of production, they may have neither means nor technology to produce the other parts and components. Thus, imports of

[3] Our analysis suggests that among the price competitiveness indictors the use of REER_ulc in the export supply function reveals empirically better results.

parts and components impose constraints on domestic production and exports.

One may also include domestic production capacity as a variable determining export supply of a country. Though, the actual and potential outputs are alternative measures of physical productive capacity we found poor evidence for their inclusion in the long-run supply function. Also, we avoid using import and output variables in the same equation due to the endogeneity problem.

Following the literature, supply and demand functions for the overall exports in Turkey are analyzed for the period of 1987q1-2008q1. Exports and imports USD values and respective unit price values, unit labor costs and domestic output are taken from the Central Bank of the Republic of Turkey (CBRT) website while both unit labor costs based (REER_ulc) and consumer price index based real effective exchange rates (REER_cpi) are taken from Eurostat.[4] Lastly, foreign income in current prices and PPP for the OECD countries is taken from the OECD website.

Application of standard augmented Dickey-Fuller unit root tests suggests that all variables are integrated of order one, I(1). Table A in appendix reports the results for the variables chosen for the rest of the analysis. Then, following the literature, co-integration tests over the different vector of non-stationary variables are applied to find out well-defined long-run supply and demand equations. In addition, USD value of the sum of capital goods and raw material imports, which are used as a measure of import dependency of exports, are found to be significant factors in determining the long-run supply function.[5] For the export demand equation, the standard set up is preserved and in addition to REER_cpi, foreign income is included, specifically OECD income, as a demand factor in estimations.

[4] Currencies of 34 countries are used to calculate real effective exchange rate indexes, Belgium, Germany, Greece, Spain, France, Ireland, Italia, Luxembourg, Netherlands, Austria, Portugal, Finland, Denmark, Sweden, United Kingdom, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, Slovakia, Australia, Canada, United States, Japan, Norway, New Zealand, Mexico, Switzerland, and Turkey.

[5] Using total imports in the export supply function did not make any significant change in our results. The export supply function is estimated by using quantity indices, as well. The results were quite similar. However, since quantity indexes are not available at commodity level, which we need in the panel co-integration analysis in section 5, we use

Accordingly, the following model is specified to analyze export supply and demand functions, respectively for Turkey.

$$xs_t = \beta_0 + \beta_1 m_t + \beta_2 reer\_ulc_t + \beta_3 s_1 + \beta_4 s_2 + \beta_5 s_3 + u_{2t} \quad (2)$$

$$xd_t = \alpha_0 + \alpha_1 y_t^f + \alpha_2 reer\_cpi_t + \alpha_3 s_1 + \alpha_4 s_2 + \alpha_5 s_3 + u_{1t} \quad (3)$$

Here, xs_t and xd_t are the log of exports; y_t^f is the log of foreign income; m_t is the log of imports, $reer\_cpi_t$ and $reer\_ulc_t$ are the log of REER_cpi and REER_ulc, respectively, u_{kt} ~ *iidN (0,1)* k=1,2 and s_j (j=1,2,3) are the seasonal dummies. Since quarterly data is used in the analysis seasonal dummies are added exogenously to deal with seasonality.

3.1 Kalman Filter Approach and Results

Kalman filter approach or state space models, which are developed by Kalman (1960, 1963), have been used extensively in economics. The Kalman filter is a recursive algorithm for expressing dynamic systems that involve unobserved state variables z_t, conditional on observed vector y_t (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:

$$z_{t+1} = \Phi_t z_t + G_t w_t \quad (4)$$

$$y_t = H_t z_t + \zeta_t \quad (5)$$

Here, $z_t \in R^n$ is an $(n \times 1)$ 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 with time, w_k, and ζ_t are vectors of normally distributed *i.i.d* shocks. Equation (4) is called a transition equation that describes the dynamics of the state variables. Equation (5) is the measurement equation points out a relationship

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USD values in all analyses in order to have comparable coefficient estimates.

between observed variables and unobserved state variables. The model satisfies the following assumptions:

$$E\left[\zeta_t\right]=0 \quad , \quad E\left[w_t\right]=0 \tag{6}$$

$$E\left[\zeta_t\zeta_j'\right]=R_t\lambda_{tj} \quad , \quad E\left[w_t w_j'\right]=Q_t\lambda_{tj} \tag{7}$$

$$E\left[\zeta_t w_j'\right]=0 \quad , \quad E\left[z_0\right]=\overline{z}_0 \tag{8}$$

$$E\left[(z_0-\overline{z}_0)(z_0-\overline{z}_0)'\right]=P_0 \tag{9}$$

$$E\left[z_0 w_t'\right]=0 \quad , \quad E\left[z_0\zeta_t'\right]=0 \tag{10}$$

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

$$\hat{z}_t=\hat{z}_{t|t-1}+K_t\left(y_t-H_t\hat{z}_{t|t-1}\right) \tag{11}$$

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

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

$$K_t=P_{t|t-1}H_t'\left(H_tP_{t|t-1}H_t'+R_t\right)^{-1} \tag{12}$$

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

$$P_{t|t-1}=\Phi_{t-1}P_{t-1}\Phi_{t-1}'+G_{t-1}Q_{t-1}G_{t-1}' \tag{13}$$

$$P_t=\left(I-K_tH_t\right)P_{t|t-1} \tag{14}$$

$$\hat{z}_{t|t-1}=\Phi_{t-1}\hat{z}_{t-1} \tag{15}$$

As it is clear from equation (14) the success of the estimation depends on the representation of the

dynamics of the system. If the best Kalman gain is used then

$$g_t = y_t - H_t \hat{z}_{t|t-1} \tag{16}$$

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

$$C_{0,t} = E\left[g_t g_t'\right] = H_t P_{t|t-1} H_t' + R_t \tag{17}$$

Kalman filter approach explained above can be modified to our export demand and supply models. Since this paper is interested in analyzing how model parameters change over time, it is assumed that all parameters of the equation 2 and 3 follow a random walk process. Then the transition equations for the supply and demand functions are:

$$\beta_{it+1} = \beta_{it} + \varepsilon_{2t} \quad , i=0,1...5 \tag{18}$$

$$\alpha_{it+1} = \alpha_{it} + \varepsilon_{1t} \quad , i=0,1\ldots5 \tag{19}$$

where ε_t is normal white noise processes. Then, the measurement equation can be written as

$$xs_t = F_t * B_t' + u_{1t}, \tag{20}$$

$$xd_t = H_t * A_t' + u_{2t}, \tag{21}$$

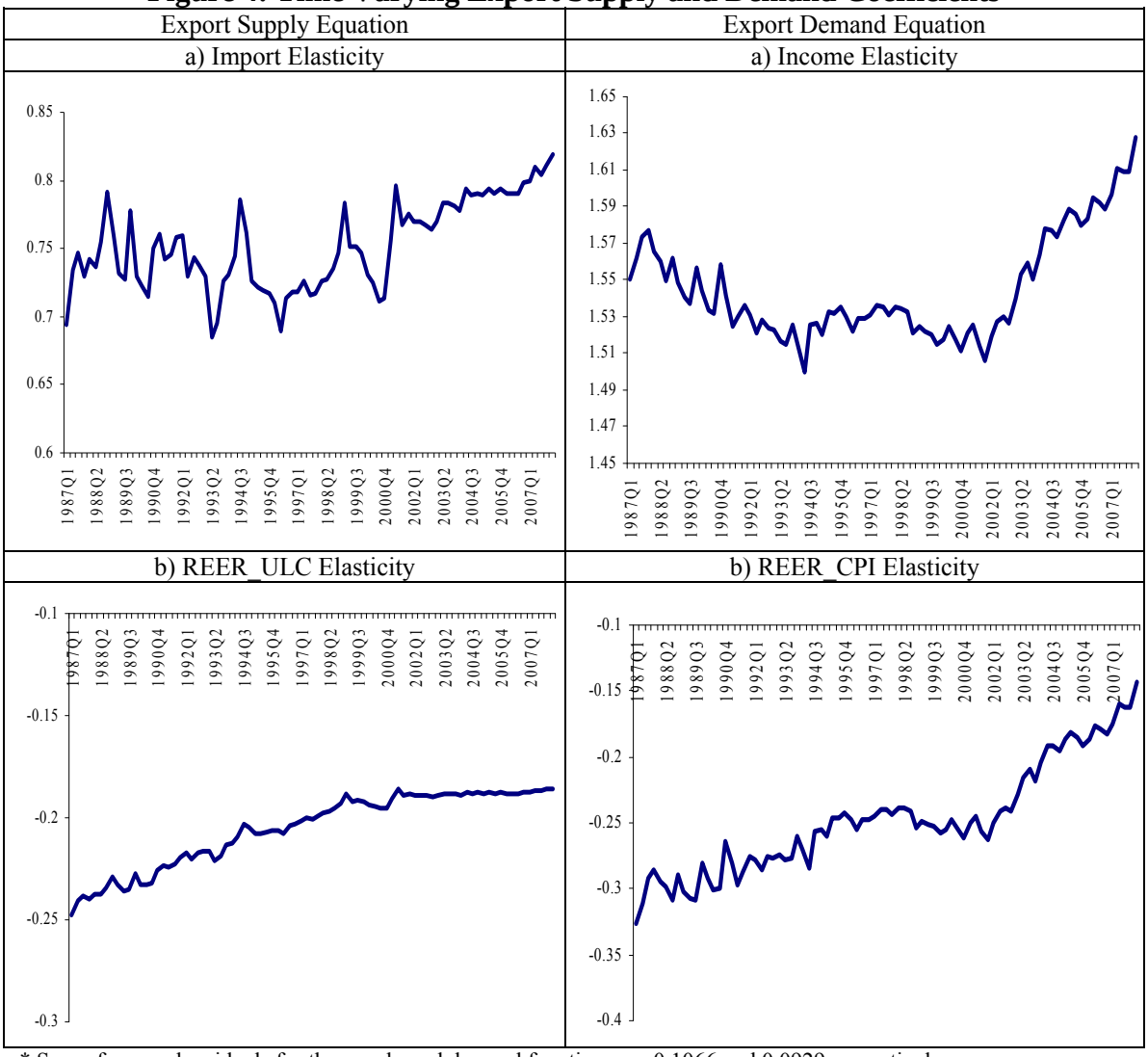
where, $F_t = \begin{bmatrix} 1 & m_t & reer\_ulc_t & s_{1t} & s_{2t} & s_{3t} \end{bmatrix}$, $H_t = \begin{bmatrix} 1 & y_t^f & reer\_cpi_t & s_{1t} & s_{2t} & s_{3t} \end{bmatrix}$,

$B_t = \begin{bmatrix} \beta_{0t} & \beta_{1t} & \beta_{2t} & \beta_{3t} & \beta_{4t} & \beta_{5t} \end{bmatrix}$, $A_t = \begin{bmatrix} \alpha_{0t} & \alpha_{1t} & \alpha_{2t} & \alpha_{3t} & \alpha_{4t} & \alpha_{5t} \end{bmatrix}$, $u_{1t} \sim iidN(0,1)$ and $u_{2t} \sim iidN(0,1)$. Kalman Filter approach is a recursive process that updates estimated coefficients over time as new information arrives. In estimations 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 $T > t$ is applied. The idea is that as new data are made available, we can improve our estimation results from the Kalman filter by taking into account the additional information.

Estimated coefficients for the export function are presented in Figure 4. 1994, 1997-1998, and 2001 crises and 1996 CU are marked on these graphs as shaded areas. Smoothed Kalman filter estimates show that import elasticity of export supply fluctuates around 0.74 during the 1987-1996 period. It rises steadily after 1996. The trend is disrupted three times in 1994, 1999 and towards the end of 2000. However, these shocks are not sufficient to change the path of the import elasticity. It seems that the CU agreement in 1996 and economic reforms of post-2001 have significant positive impact on Turkish exports, such that the elasticity gains an increasing trend. Indeed, import elasticity, which is about 0.73 at the beginning of the period, reaches 0.81 at the end of the period, showing about 11 percent increase. Meanwhile, the responsiveness of the export supply to the changes in REER_ulc steadily decreases from about -0.24 in 1987 to around -0.18 in 2007. That counts roughly 22.8 percent decrease in elasticity. As in the case of import elasticity, domestic economy originated shocks in these years do not have long lasting effects on the falling REER_ulc elasticity of exports.

Increase in import and decrease in ULC based exchange rate elasticity of exports can be due to increased import dependence of Turkish exports. As industries use greater share of imported inputs in production, their imported inputs possess greater influence on export performance. Moreover, profits, and so export supply of firms would be less sensitive to exchange rate movements since not only revenues but greater share of total costs will be in the form of foreign currencies. Thus, when import dependence increase, fluctuations in exchange rates have less effect on profits and so export supply decisions of exporting firms. Increase in import dependence may emerge as a result of economy wide increase in use of imported inputs or increase in the share of highly imported dependent industries in the total exports or a combination of both. We will address this issue in the next section.

Figure 4: Time Varying Export Supply and Demand Coefficients



* Sum of squared residuals for the supply and demand functions are 0.1066 and 0.0929 respectively.

The column on the right side of Figure 4 reports estimated parameters of the export demand equation. Income elasticity of exports, which was decreasing during the 1987-1994 period and roughly constant during the 1994-2000 period, gains an increasing trend after the financial crises in 2001. It appears that 2001 financial crises have a path breaking impact on the income elasticity of export demand. Thereby, towards the end of the period, the income elasticity shows almost 2.8 percent increase and goes up from about 1.56 in 1987 to 1.61 in 2006.REER_cpi elasticity demonstrates a decreasing path during the 1987-2008q1 period, too. It appears that the sensitivity of export demand to REER_cpi decreases from about –0.30 in 1987 to

around –0.16 at the end of the period, demonstrating about 47 percent fall. The speed of decrease increases after the 2001 crises.

The coefficient changes in the export demand function can be due to various factors. Increase in income elasticity of exports may indicate change in the composition of Turkish exports towards commodities with high-income sensitivity. Decrease in export demand exchange rate elasticity, on the other hand, may indicate decrease in substitution between average consumer good in Turkey's main export destinations (mostly developed countries) and Turkish commodities. Turkish producers may failed to lead their production towards commodities that compete with domestic producers of the developed economies. Instead, they are mainly competing with exports of other developing countries in the world markets. This is known as "fallacy of composition". Similarly Razmi and Blecker (2008) by using time series and panel data for 21 developing countries argued that low-technology intensive products exporting developing countries, including Turkey, compete with other developing countries rather than industrialized countries.

The analysis in the following section performs commodity based export supply and demand analysis to examine how changes in commodity composition of exports may affect model parameters

3.2 Commodity Based Panel Co-integration Analysis

The behavior of the best-performed commodity groups and low-performed commodity groups are mentioned above in section 2. Commodities were grouped following Pineres and Ferrantino (1997), in traditional and non-traditional categories. Traditional commodity is the one in which its export experience is concentrated at the earlier years of the period. Yet, export experience function of the non-traditional commodity is concentrated at the later years of the period. Here in this section a panel cointegration technique is applied separately over these two

groups of commodities to analyze first if long-run demand and supply functions differs across these groups and second how the aggregate demand and supply functions changed with respect to the changes in the composition of exports in favor of non-traditional commodity groups.

Multivariate panel co-integration technique developed by Pedroni (1999) and Pedroni (2001) is employed to test long run properties of the commodity based export demand and supply functions. Panel co-integration technique is a powerful method to investigate existence of co-integration, since it combines both time series and cross sectional information. Pedroni uses the following standard panel regression to develop test statistics for panel cointegration:

$$y_{it} = \alpha_i + \delta_i t + \beta_i x_{it} + u_{it} \qquad i=1,...,N;\ t=1,...,T. \qquad (22)$$

where y_{it} and x_{it} are panels of observations over the members of the panel and assumed to be integrated of order one (I(1)) for each panel member *i*. Under the null of no cointegration, residual u_{it} is assumed to be I(1). Parameters α_i and δ_i capture any fixed effects and deterministic trends that are specific to each member of the panel, respectively and β_i is a vector of parameters that are allowed to vary across members of the panel.

Pedroni (2000) and Pedroni (2001) propose use of FMOLS methods for estimating and testing hypothesis for cointegrating vectors in dynamic time series panels. The method modifies least squares to account for serial correlation and the endogeneity in the regressors that results from the existence of a cointegrating relationship. Based on equation (22), Pedroni suggests two sets of statistics that uses fully modified OLS (FMOLS) for testing the null hypothesis H0: "All of the individuals of the panel are not cointegrated, $u_{it} \sim$ I(1)" against the alternative H1: "A significant portion of the individuals are cointegrated, $u_{it} \sim$ I(0)". Thus, under the alternative hypothesis Pedroni permits individual members of the panel to differ whether they are cointegrated or not. Use of FMOLS principles not only accommodates considerable heterogeneity across individual members of the panel, but also produces asymptotically unbiased estimators.

Kao and Chiang (2000) suggest the use of panel within-dimension DOLS estimator based on including leads and lags of the first differences of the regressors in the estimated equations. Pedroni (2001) demonstrates that FMOLS and OLS estimators have minor size distortions. Between-dimension FMOLS estimator has advantage over the within-dimension DOLS estimator by setting the null hypothesis in a way to allow parameters to vary across the

panel members. In other words, between-dimension estimators allow to test H0: $\beta_i = \beta_0$ versus H1: $\beta_i \neq \beta_0$ for all *i*. In addition, when the true co-integrating vectors are heterogeneous, between-dimension estimator provides mean value of the co-integrating vectors that may reveal some information on the behavior of sample group. Due to these advantages, and also to the space limitation, only between-dimension estimators are used in this paper.

Pedroni suggests two sets of statistics for the panel co-integration tests. The first set consists of three panel statistics; 'panel variance ratio statistics', 'panel rho statistics' and 'panel t-statistics' that are based on pooling the residual of the regression along the within dimension of the panel. The second set of statistics consists of two statistics; 'group rho statistics' and 'group t-statistics', which are based on pooling the data along with between dimensions of the panel. As noted in Pedroni (2004), the first set of statistics is constructed by summing the numerator and denominator terms separately for the analogous time series statistics. The second set of statistics, as opposed to the first set, is constructed by first calculating the ratio corresponding to the time series statistics and then computing the standardized sum of the ratio over the cross section of the panel. In fact, the second set of statistics is the group mean of the respective individual time series statistics. Given the general form of the equation 1 and 2 and the assumptions on the parameters, the null hypothesis is set as 'all of the individuals of the panel are not co-integrated' and the alternative hypothesis is set as 'significant portion of the individuals of the panel are co-integrated'.

Panel cointegration analysis may suffer from cross-sectional dependency that must be treated cautiously. Demeaning the series by adding a time dummy helps to control the common aggregate shocks that are likely to generate cross sectional dependency. However, here in our analysis REER as well as OECD income are the same for each individual commodity, implying that common time effect and both REER and OECD income have only t dimension, which makes them perfectly collinear. Thus, it is redundant to include both common time effect and REER as well as OECD income.

Before proceeding to panel co-integration analysis panel unit root tests of the Im *et. al.* (2003), which is based on the Dickey-Fuller t-statistics and Maddala and Wu (1997)'s Fisher-test, which is based on p-values of individual unit root test are conducted. Results suggest that all of the panel variables are I(1). Next, as a standard procedure, a multivariate panel co-integration analysis is conducted to examine existence of a co-integrating vector for supply and demand equation of each group. Results are presented with and without heterogeneous trends, in Table 3. The first four columns of the table report the panel statistics and the next three columns display the group statistics. The parametric ADF version of these statistics is added next to the each set of statistics for comparison purpose. All these test statistics unanimously reject the null hypothesis of no co-integration and suggest that significant portion of the individuals of the panel are co-integrated.

Table 3: Panel Co-integration Test

	Panel				Group			# of Rej.
	Var.ratio-stat	Rho-stat.	T-stat	ADF-stat	Rho-stat	T-stat	ADF-stat	%5
Non -traditional								
Supply Function								
with trend	4.977	-6.406	-10.798	-8.698	-7.029	-13.693	-10.283	7
without trend	4.201	-7.178	-14.988	-8.862	-8.362	-17.95	-8.445	7
Demand Function								
with trend	0.929	-7.613	-12.121	-4.977	-7.66	-14.29	-4.926	6
without trend	-1.379	-9.129	-16.606	-6.745	-8.343	-17.221	-5.604	6
Traditional								
Supply Function								
with trend	2.325	-14.288	-13.244	-10.085	-13.576	-14.197	-9.168	7
without trend	-1.009	-11.82	-14.264	-9.367	-10.301	-13.841	-8.337	6
Demand Function								
with trend	0.907	-14.091	-13.548	-9.808	-12.26	-13.607	-8.505	6
without trend	-1.845	-13.721	-15.362	-11.439	-10.626	-13.748	-9.354	6

Note: Under the alternative hypothesis the variance ratio statistics converges to $+\infty$ while the other statistics converges to $-\infty$. Therefore, the right tail of the normal distribution is used to reject the null hypothesis for the variance ratio test; where as the left tail of the normal distribution is used for the other statistics. Lags are selected by using Schwarz Information Criteria.

After determining co-integration properties of each panel, individual and panel group FMOLS results are reported in Table 4 and 5 below. Estimated coefficients of the group rather than the coefficients of individual commodities are relevant for the purpose of the study. The panel group FMOLS results are presented at the lower panel of each table. First of all, all

parameters are statistically significant for both commodity groups. Secondly, the average import elasticity is higher for the group of non-traditional commodities (1.57) compared to that of the group of traditional commodities (0.08). Besides, the group of non-traditional commodities has average REER_ulc elasticity of -0.05, which is lower than that of the group of traditional commodities (-1.12) in absolute terms. These are clear indications of high use of imported inputs and low REER sensitivity of the non-traditional commodity exports. In turn, this may also explain how producers of this commodity group might survive the turbulences and currency crises of the 1994-2001 period. Thirdly, for the group of non-traditional commodities, the average export income elasticity (4.09) is higher and average REER elasticity (-0.18) is lower than the respective elasticities (0.52 and –1.78) for the group of traditional commodities. [6]

Table 4: Individual and Panel Group FMOLS Results for Non-Traditional Commodities

	Import Elasticity		REER_ulc		Income elasticity		REER_cpi	
Panel	Coeff.	*t-stat*	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
1	1.06	*(34.04)*	0.02	*(0.14)*	2.34	*(16.65)*	0.76	*(2.42)*
2	1.23	*(13.82)*	-1.18	*(-4.37)*	2.95	*(11.52)*	-0.3	*(-0.52)*
3	0.88	*(9.01)*	0.08	*(0.24)*	2.12	*(7.39)*	0.34	*(0.59)*
4	1.41	*(11.34)*	1.17	*(2.64)*	3.26	*(12.16)*	0.82	*(1.38)*
5	1.7	*(7.18)*	2.87	*(3.40)*	3.81	*(6.45)*	2.08	*(1.58)*
6	1.43	*(22.87)*	-0.19	*(-0.85)*	3.44	*(32.40)*	-0.03	*(-0.13)*
7	1.7	*(6.76)*	2.28	*(2.63)*	4.28	*(7.32)*	0.97	*(0.73)*
8	0.52	*(0.95)*	3.85	*(1.66)*	6.09	*(4.02)*	-2.72	*(-1.77)*
9	1.23	*(19.6)*	-1.2	*(-5.39)*	3.14	*(14.99)*	-0.99	*(-2.12)*
10	1.8	*(12.26)*	-0.32	*(-0.62)*	4.4	*(14.06)*	-1.28	*(-1.83)*
11	1.8	*(22.61)*	0.01	*(0.03)*	4.34	*(34.14)*	0.33	*(1.18)*
12	2.3	*(21.46)*	-0.96	*(-2.51)*	5.81	*(28.66)*	-0.81	*(-1.79)*
13	1.61	*(20.45)*	-1.4	*(-4.99)*	4.04	*(15.17)*	-0.85	*(-1.43)*
14	1.44	*(16.32)*	-0.37	*(-1.18)*	3.38	*(14.88)*	0.06	*(0.12)*
15	2	*(7.12)*	1.65	*(1.60)*	5.02	*(7.43)*	1.88	*(1.34)*
16	1.22	*(20.53)*	-0.87	*(-4.10)*	2.95	*(12.97)*	-0.03	*(-0.06)*
17	1.83	*(12.71)*	-2.46	*(-4.80)*	4.71	*(9.23)*	-1.59	*(-1.39)*
18	3.01	*(14.22)*	-0.49	*(-0.66)*	7.64	*(29.96)*	-1.6	*(-2.81)*
19	1.61	*(27.73)*	-0.29	*(-1.40)*	3.89	*(32.79)*	0.23	*(0.85)*
20	1.63	*(20.58)*	-1.16	*(-4.12)*	4.1	*(17.69)*	-0.82	*(-1.58)*
Panel Group FMOLS Results								
	1.57	*(71.91)*	-0.05	*(-5.06)*	4.09	*(73.77)*	-0.18	*(-1.17)*

Note: t-stats for H_0: $\Theta_{ij} = 0$ are in parenthesis. The list of commodities in the non-traditional is in Appendix B. Lags are selected by using Schwarz Information Criteria.

[6] Similarly, Gönenç and Yılmaz (2007) classify Turkish manufacturing industries based on their competitiveness as highly competitive, intermediary and declining sectors. The more profitable industries produce, export and create employment more than the others.

Table 5: Individual and Panel Group FMOLS Results for Traditional Commodities

	Import Elasticity		REER_ulc		Income elasticity		REER_cpi	
Panel	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
1	-0.13	*(-2.13)*	-0.24	*(-1.12)*	-0.21	*(-1.40)*	-0.79	*(-2.37)*
2	-2.66	*(-9.65)*	-0.39	*(-0.47)*	-5.49	*(-9.83)*	-2.69	*(-2.11)*
3	1.11	*(2.09)*	-1.77	*(-0.96)*	3.59	*(2.78)*	-5.6	*(-2.13)*
4	-0.25	*(-4.66)*	0.27	*(1.38)*	-0.81	*(-7.47)*	0.89	*(3.69)*
5	1.26	*(4.18)*	-5.58	*(-5.21)*	4.19	*(4.28)*	-4.95	*(-2.26)*
6	0.06	*(0.55)*	-1.45	*(-3.76)*	0.3	*(0.98)*	-1.82	*(-2.65)*
7	0.00	*(-0.01)*	-1.03	*(-2.77)*	-0.39	*(-1.24)*	-0.49	*(-0.67)*
8	0.17	*(0.82)*	-2.38	*(-2.73)*	1.84	*(2.82)*	-3.43	*(-5.15)*
9	-1.26	*(-5.54)*	-1.71	*(-2.12)*	-2.54	*(-4.23)*	-2.78	*(-2.07)*
10	0.26	*(2.91)*	0.30	*(0.92)*	0.43	*(1.77)*	0.45	*(0.82)*
11	-1.31	*(-3.78)*	0.81	*(0.66)*	-2.52	*(-2.63)*	-3.6	*(-1.68)*
12	0.31	*(5.76)*	-0.41	*(-2.12)*	0.91	*(6.93)*	-0.71	*(-2.42)*
13	0.15	*(2.34)*	0.25	*(1.14)*	0.23	*(1.41)*	0.41	*(1.14)*
14	0.11	*(1.20)*	-0.63	*(-2.00)*	0.54	*(2.28)*	-0.85	*(-1.61)*
15	1.03	*(7.54)*	-1.78	*(-3.55)*	2.53	*(5.41)*	-2.16	*(-2.22)*
16	0.24	*(1.67)*	0.43	*(0.85)*	0.71	*(1.94)*	-0.25	*(-0.30)*
17	0.24	*(2.12)*	-0.01	*(-0.03)*	0.67	*(2.37)*	-0.69	*(-1.09)*
18	1.30	*(6.23)*	-4.35	*(-5.87)*	3.68	*(5.08)*	-4.16	*(-2.58)*
19	0.68	*(7.40)*	-2.56	*(-7.77)*	2.16	*(6.41)*	-3.03	*(-4.03)*
20	0.31	*(5.16)*	-0.10	*(-0.45)*	0.54	*(3.08)*	0.55	*(1.41)*
Panel Group FMOLS Results								
	0.08	*(5.41)*	-1.12	*(-8.04)*	0.52	*(4.64)*	-1.78	*(6.33)*

Note: t-stats for H_0: $\Theta_{ij} = 0$ are in parenthesis. The list of commodities in the traditional is in Appendix B. Lags are selected by using Schwarz Information Criteria.

4. Conclusion

This study examines the time and the sources of the structural changes in the Turkish exports. Results suggest a continuous increase in imports as well as income elasticities, but persistent decrease in the real effective exchange rate elasticity supporting the increased import dependency argument. Structural change in the composition of exports seems to determine the recent changes in export function in Turkey. Those sectors that have high income and import, but low exchange rate elasticities of exports tend to increase their shares in total Turkish exports. It is noted that composition thereby exports coefficients of Turkey changes rather rapidly during the major reform periods (customs union with EU in 1996) and economic crisis (2001 financial crisis) that usually takes long periods for a matured economy. This interesting finding is also documented in De Pineres and Ferrantino (1998), who argued that export diversification and

structural change accelerated in six LA economies during the debt crisis of early 1980s and policy reform periods. Their previous study on Chile also reached to similar conclusions (De Pineres and Ferrantino, 1997).

Important implications can be driven from these finding, not only for the sources of the structural change in total exports but also for the policy issues. Increase in the share of non-traditional commodities in total exports raises 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. 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. While required intermediate and capital goods for production of non-traditional goods are imported from abroad, sale of these commodities abroad by using the same currency makes non-traditional commodity exports and imports less responsive to the exchange rate fluctuations. 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 TL.

Global trends towards the vertical specialization of production may also contribute to the recent structural changes in the Turkish exports. Nordas (2007) states that in some industries such as automotive and electronics, technological advances allowed countries to specialize in particular stage of a production process of a good. In this respect, economic reforms and financial crises may actually speed up the process of integration to the world economy via vertical specialization since only those sectors which are fit and quick enough to cope with the global trend in international production sharing were able to survive the turbulence period. In a similar vein, Cimoli and Katz (2003) argued that trade liberalization and market deregulations may initiate the process. Export–oriented sectors and firms closer to the static comparative advantages of a country may react swiftly and positively to the new micro-macro environment while other

local firms face difficulties due to contraction of domestic market and massive arrival of imports. As large firms in some sectors survive in the new regime mostly small and medium sized firms forced to exit. Large firms, in order to survive in the new environment, adapt a new production process which turn local production into assembly activity that uses imported parts and components as well as foreign technology and engineering services. This new global production sharing activities may possess some dangers for the long-term growth prospects of a developing country as well. If the new production process based on deverticalization of production induces substitution of domestically produced capital goods by imports, then the process may lower utilization of highly skilled labor and contraction of R&D activities. This, in turn, may increase structural unemployment of skilled labor and decrease domestic technological capability of a country.

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6. Appendix

A:

Table A: Unit Root Test Results[(1)]

	Level		First Difference	
	ADF	PP	ADF	PP
Exports	2.79 (1.00)	0.81 (0.99)	-3.50 (0.00)	-13.87 (0.00)
Imports	0.73 (0.99)	0.20 (0.97)	-5.20 (0.00)	-13.32 (0.00)
OECD Income	-1.21 (0.66)	-1.71 (0.42)	-4.94 (0.00)	-4.84 (0.00)
REER_CPI[(2)]	-2.68 (0.08)	-2.69 (0.08)	-8.20 (0.00)	-8.88 (0.00)
REER_ULC	-2.36 (0.15)	-2.36 (0.15)	-7.39 (0.00)	-7.30 (0.00)

(1) ADF is for the Augmented Dickey-Fuller Unit Root Test and PP is for the Phillips-Perron Unit Root Tests. Test equations include intercepts. Values in parentheses are the probabilities. Schwarz Information Criteria and Newey-West using Bartlett kernel are used to calculate lag length for ADF and bandwidth for PP tests respectively.

(2) Though standard tests reject unit root in CPI based real effective exchange rate in level form, when we allow for deterministic trend both ADF and PP tests do not reject unit root at 5 percent level. ADF and PP test statistics in this case are –2.99 and –3.03 respectively.

B:

Table B: List of commodities made up non-traditional and traditional commodity groups

#	Non-traditional (Non-Traditional Goods)	Index	#	Traditional (Traditional Goods)	Index
12	Vehicles other than railway or tramway rolling stock	0.175	2	Live animals	0.740
18	Natural or cultured pearls	0.184	9	Fertilizers	0.724
17	Arms and ammunition	0.204	4	Articles of leather	0.574
11	Furniture	0.219	7	Meat and edible meat offal	0.574
19	Stone, plaster, asbestos	0.231	11	Cereals	0.560
20	Essential oils and resinoids, perfumery, cosmetics	0.241	8	Residues and waste from the food industries	0.542
13	Nuclear reactors, boilers, machinery and mechanical appliances	0.243	6	Prep. of meat, of fish or of crustaceans, mulls of other aquatic invertebrates.	0.519
7	Ships, boats and floating structures	0.249	5	Other vegetable textile fibres, paper yarn and woven fab	0.514
2	Albuminoidal substances	0.257	1	Products of animal origin; not elsewhere specified	0.509
6	Electrical machinery and equipment	0.267	17	Tobacco and manufactured tobacco substitutes	0.491
8	Aircraft, spacecraft and parts thereof	0.271	18	Wadding, felt and nonwovens	0.490
10	Cocoa and cocoa preparations	0.274	13	Coffee, tea, mate and spices	0.487
3	Aluminium and articles thereof	0.277	15	Knitted or crocheted fabrics	0.477
14	Optical instruments and apparatus	0.280	14	Organic chemicals	0.476
1	Miscellaneous articles of base metal	0.281	20	Edible vegetables	0.475
15	Toys, games and sports	0.283	3	Railway and tramway locomotives, rolling stocks and parts thereof	0.458
16	Plastics and articles thereof	0.285	16	Vegetable plaiting materials	0.456
9	Paper and paperboard	0.294	10	Animal or vegetable fats and oils	0.456
5	Other made up textile articles	0.296	19	Wool, fine or coarse animal hair	0.437
4	Miscellaneous manufactured articles	0.298	12	Inorganic chemicals	0.432

Note: Rankings are according to their order in the panel co-integration estimates.
Source: TURKSTAT.