INVESTIGATION ON THE DETERMINANTS OF TURKISH EXPORT-BOOM IN 2000s

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Abstract

This paper investigates the causes of Turkish export-boom after 2000 in the manufacturing sector. We mainly concentrate on cost and productivity aspects of the production in the manufacturing sector. Effects of productivity, wage and exchange rate are analyzed in the framework of the augmented unit labor cost model. Following the Edwards and Golub (2004) paper we use the dynamic panel data techniques for the analysis. In addition, the importance of the above mentioned factors is examined for the rising and declining sectors. We find that manufacturing export is negatively related to the unit labor cost (ULC). Decomposition of ULC into its two components also shows that an improvement in productivity increases export while an increase in nominal wages decreases it. We also find that nominal wage is an important factor in the declining sectors while productivity is the stimulus in rising sectors.

***JEL Classification*:** F14, F15, F16

***Keywords*:** Manufacturing export, unit labor cost, wage, productivity, real effective exchange rate

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1. Introduction

Turkey's export increased substantially in the years between 1996 and 2006. In 1996, total export was 23 billion dollars, whereas in 2006 it reached 85 billion dollars. Before concentrating on the export performance of Turkey in last 11 years it is necessary to figure out the process towards integration of Turkish economy to the world economy. Turkey's import substitution industrialization strategy in 1960s and 1970s shifted towards an export-oriented industrialization strategy in the 1980s. The main objectives of the new strategy were promotion of export, liberalization of foreign trade regime, and encouragement of the private sector activities. Since that date, the main stimulus behind all governments' economic policy has been the integration of Turkish economy to world markets and promotion of export. In this regard, the beginning of 1980s constituted a turning point in the economic history of Turkey.

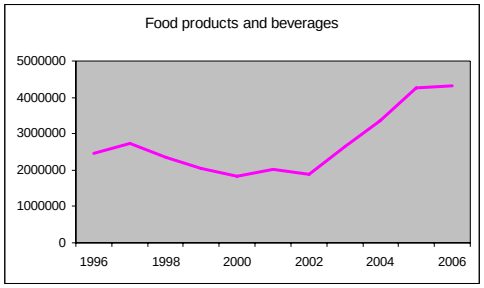
Reforms after trade liberalization in the early 1980s spurred private sector activity and improved the structural factors for international competitiveness which caused export high growth rates. The period between 1981-87 export revenues increased 15% on average. Following Turkey's application for EU membership in 1987, an incomplete Customs Union (CU) between Turkey and the EU was put into force on 1 January 1996. According to the CU, except iron and steel products, manufacturing goods and processed agricultural products could circulate freely between Turkey and the EU. The CU agreement with the EU was not encompassing agriculture or services sectors (Togan, 2005). In addition to eliminating the custom duties and charges and forbidding the quantitative restrictions, Turkey accepted the common tariff of the EU with respect to third countries. This resulted Turkey to face with the serious competitive pressure.

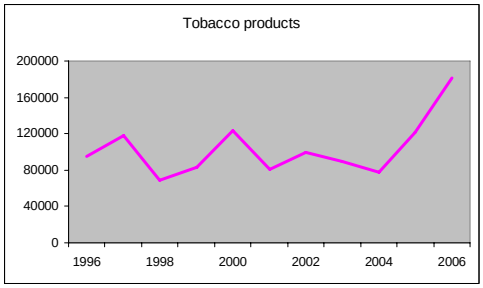
After 1996 there were certain global and domestic factors which affected the trade performance of Turkey. The crises in Asia and Russia in 1997 and 1998, the two severe earthquakes occurred in the Marmara region in 1999, and the crises in November 2000 and February 2001 in Turkey adversely affected the economic conditions. As a result of these developments, the country witnessed substantial declines in import demand during 1999 and 2001.

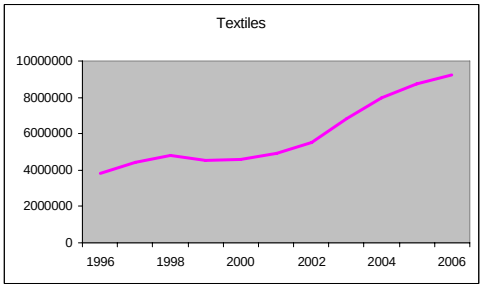
Establishment of CU between Turkey and the EU and the events both in the domestic and the global levels took place after 1996 have led to a transformation of Turkish economy especially in foreign trade. During the period 1996–2006, Turkey's total export grew at an annual rate of 13 per cent. Only one year in 1999 the increase in export halted and declined at a rate of 1.4 percent. In the remaining years between 1996 and 2006, Turkey's export increased substantially. Turkey's export in 2006 was 85 billion dollars whereas it was 23 billion in 1996. Figure 1 shows the time path of the main manufacturing sectors for the years 1996-2006.

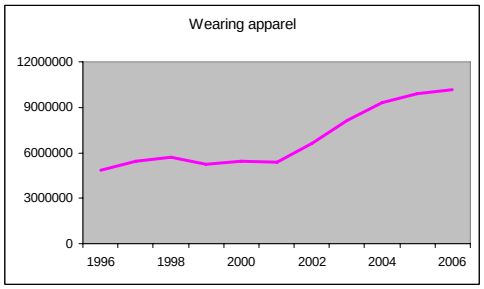
When we analyze detailed export data of Turkey it becomes apparent that main stimulus behind the export growth is manufacturing. Manufacturing export rose from 20 billion dollars in 1996 to 79 billion dollars in 2006. Between 1996 and 2006 Turkey's annual average growth rate for manufacturing export was 14%. As can be seen in Figure 1, not only the total export increased, but there has been a significant change in the composition of Turkish export over time.

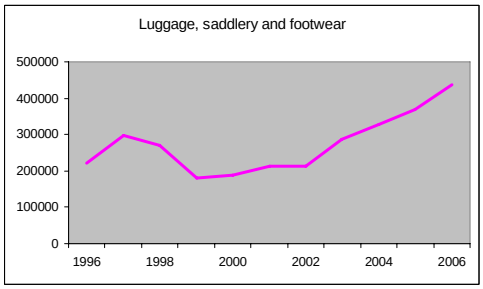
FIGURE 1
Sectoral Level Manufacturing Export (US$ million)

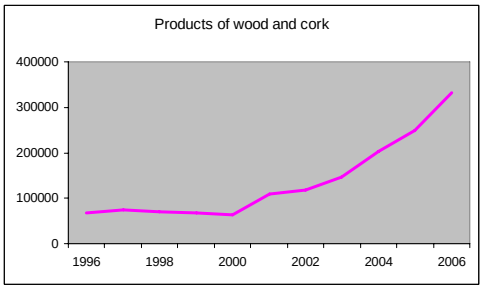


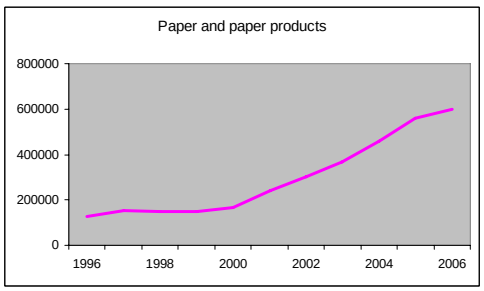


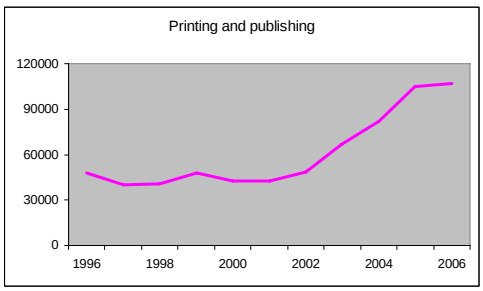


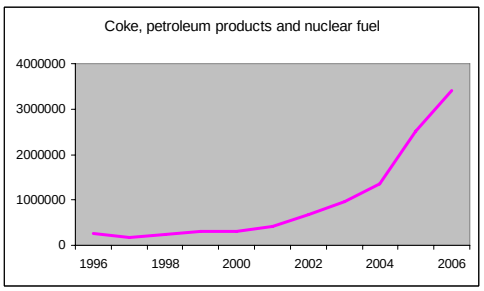


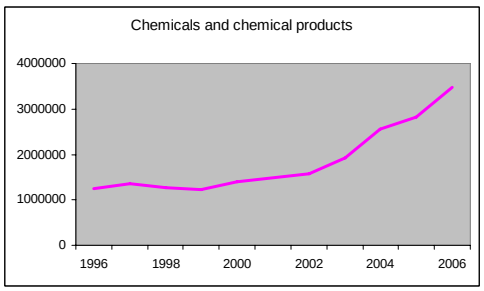


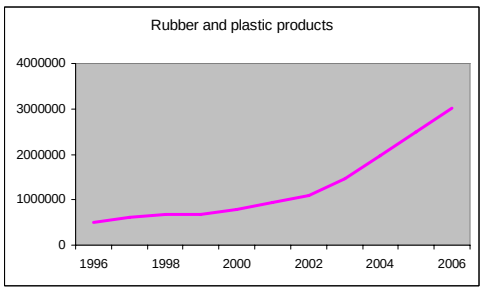


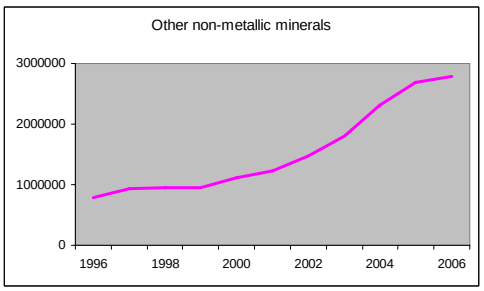


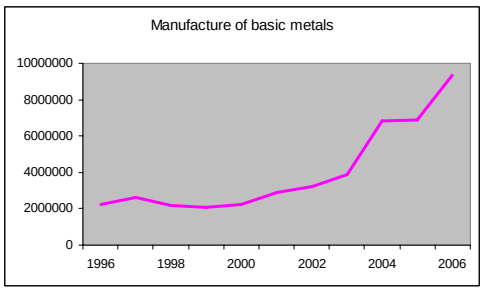


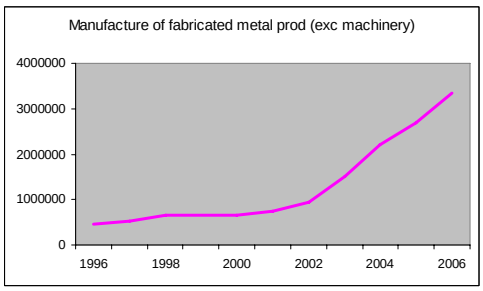












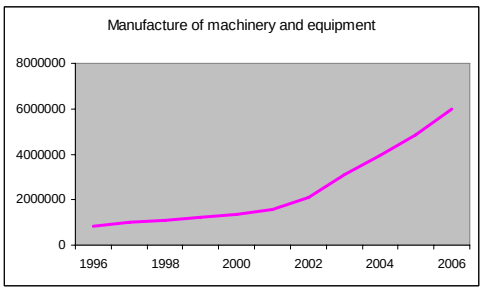
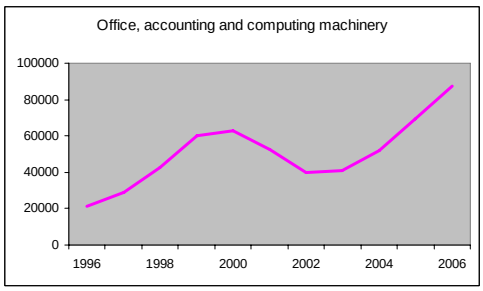
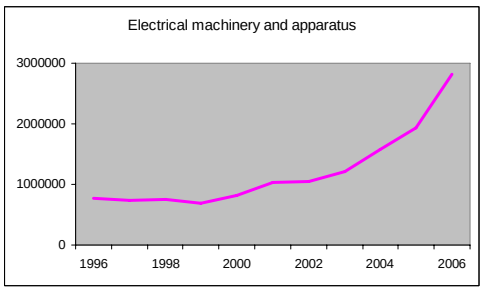
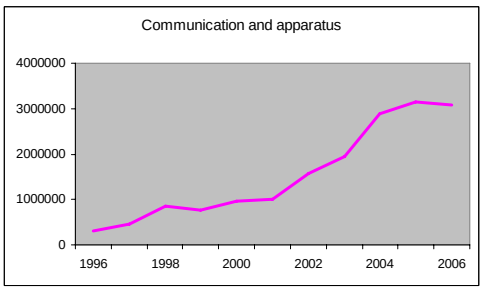
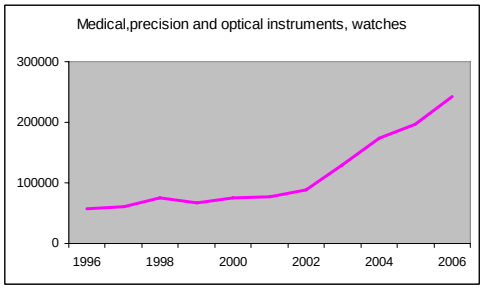


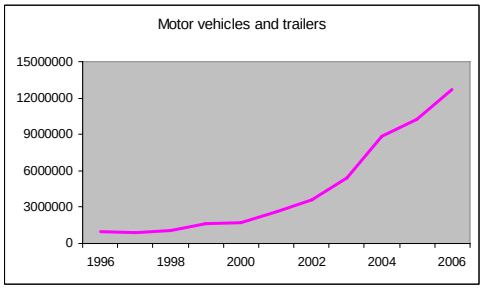
FIGURE 1 *Continued*

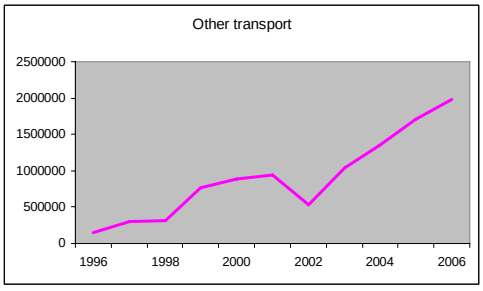


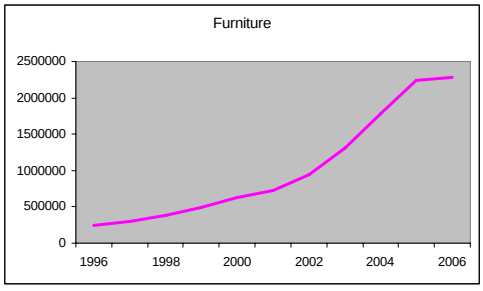








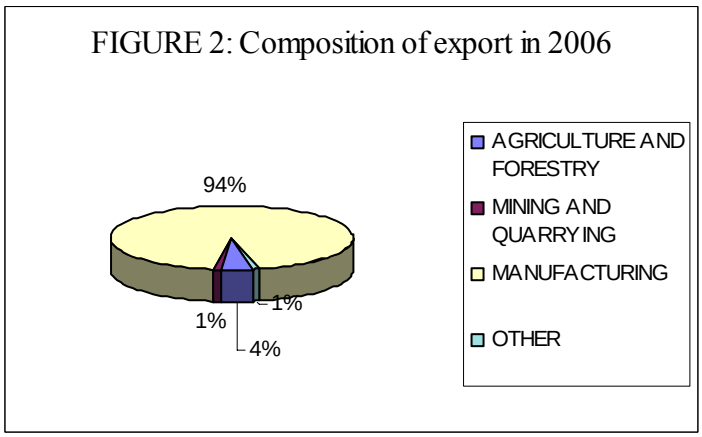


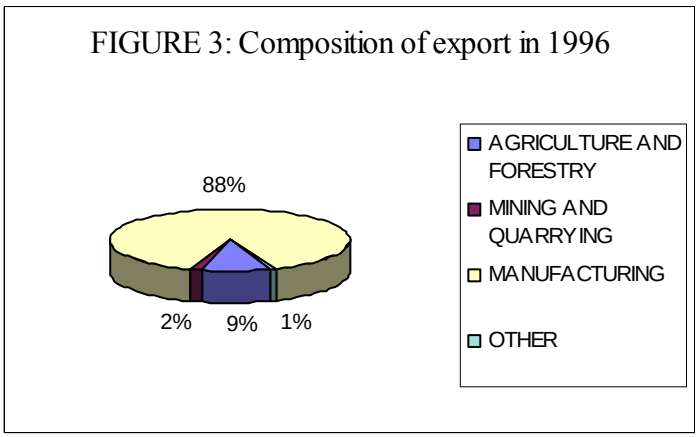


Source: TURKSTAT

Figure 2 and 3 reveals that the sectoral composition of export has changed substantially in favor of manufacturing goods, the share of manufacturing export raised from 88% in 1996 to 94% in 2006. In this period, share of mining and agriculture in total export stagnated which implies that a structural shift was also evident in the exported goods from the agriculture sector towards the manufactured goods. In addition, manufacturing export increase in Turkey is more than the world average (8.1 %[1]) in this period.

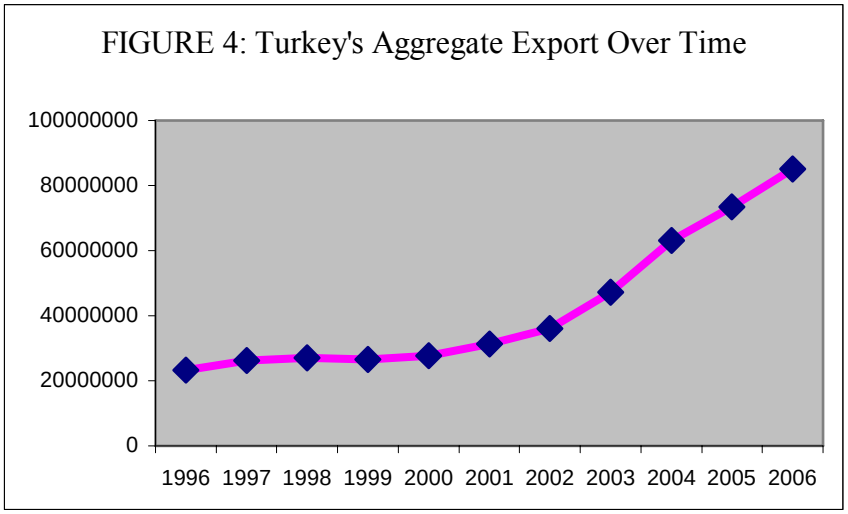
[1] See Edwards and Alves (2006) for detail.





Source: TURKSTAT

Figure 4 shows the time path of the export over the 1996-2006 period. The figure depicts two episodes of export developments: 96-00 and 01-06. After the crisis in 2001, domestic demand shrank and the government decided to abandon the crawling peg regime and floated the currency which caused the Turkish currency to devaluate. This situation has provided acceleration in export.



Source: TURKSTAT

The driving factors behind the Turkish export phenomenon have constituted a matter of debate. At the background of successful export growth performance of Turkey, overall

competitiveness of Turkish economy emerges to be the key factor. In spite of the awareness that the stimulating export growth is central for long term prospect of Turkey, there is no consensus on what led the Turkey's export to increase substantially. Some have pointed out the repression of wages after 2001 crisis. Others have focused on the productivity changes. In this study, we empirically analyze the determinants of export in Turkey in order to shed some light on this ongoing debate. In addition, since each sector would be affected differently from the economic events, an aggregated trade analysis conceals the dynamics at the sectoral level. Hence, an analysis of export performance on sectoral basis is necessary to investigate the dynamics of this export growth. There is a wide range of possible sectoral determinants that could affect the export. In our estimations, we account for as many sectoral variables as possible for which we have data so as to have more disaggregated estimates for the recent export performance of Turkey.

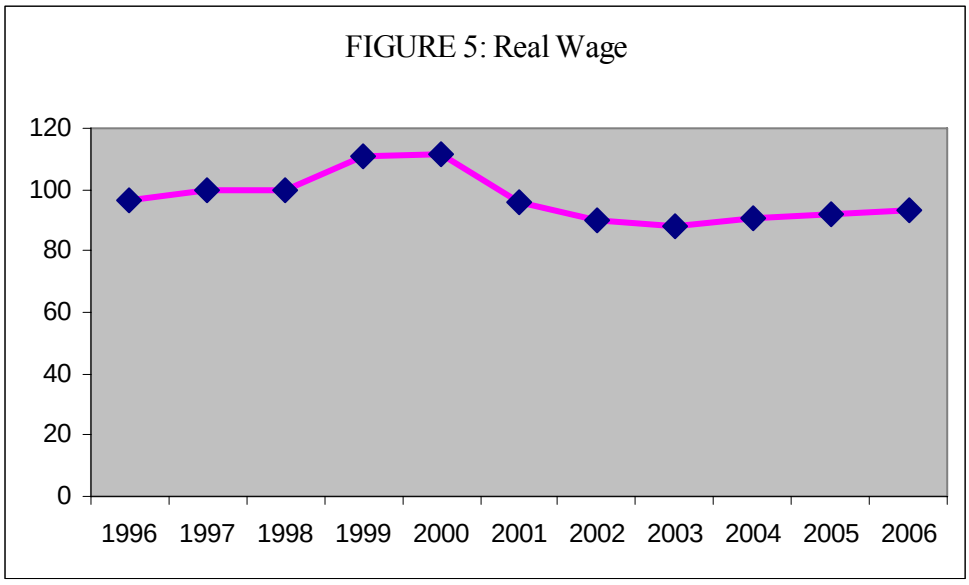
The main objective of this study is then to analyze the cost and productivity dimension of the production in the manufacturing sector. We analyze Turkish manufacturing export econometrically by using a panel data of 2-digit Standard Industry Classification (ISIC) industries for the 1996-2006 period. In this context, effects of productivity, wage and exchange rate are discussed in the framework of the augmented unit labor cost model. Following the Edwards and Golub (2004) paper we use the dynamic panel data technique for the analysis. In addition, the importance of the above mentioned factors is examined for the rising and declining sectors.

The remainder of this paper is organized as follows. The current debate on export is given in Section 2. In section 3, some recent studies regarding the Turkish export are reviewed. The data sources, models for manufacturing export and estimation results are discussed in Section 4. Finally, Section 5 concludes.

2. Wage, Productivity, Exchange Rate, and Current Debate on Export

Figure 5 shows the index of real wages per production hour worked (1997 = 100) in total manufacturing sector. As it could be observed in the figure, before 2000 there is an increase in real wages. Real wage level in manufacturing declined between 2000-2003 in Turkey due to severe and frequent crises in 2000 and 2001. Until 2003, wages in manufacturing were repressed. Since 2003, with the help of the appreciation of domestic currency, wages in manufacturing have been significantly increasing. In addition, there is a permanent increase in nominal wages for the whole period. Hence it is self-evident that in international markets, Turkey has shown a tendency of increasing wage level in manufacturing considering appreciating domestic currency in recent years.

FIGURE 5: Real Wage



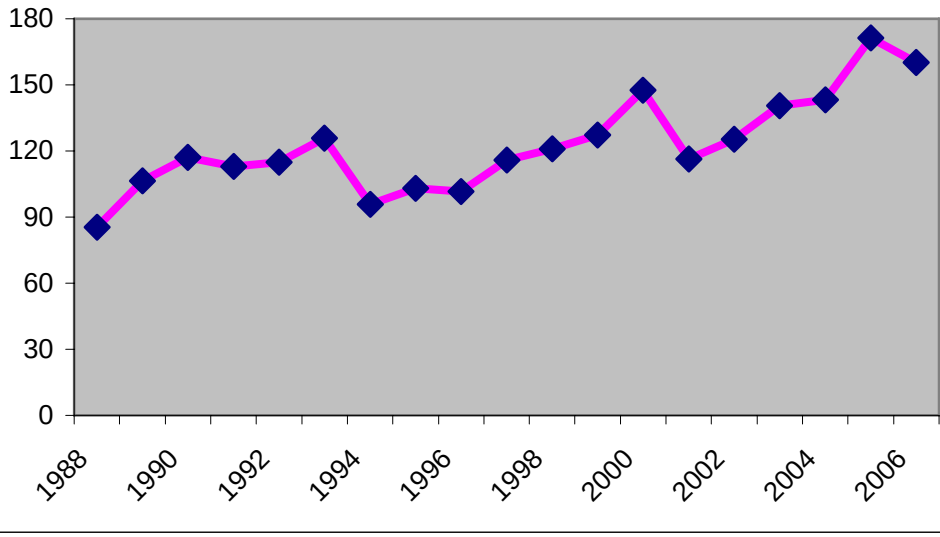
Source: TURKSTAT

The Figure 6 reveals five episodes of REER developments relying on the consumer price index (CPI) based reel effective exchange rate (REER)[2] data from the Central Bank of

[2] CPI based real effective exchange rate index is calculated using the IMF weights for 19 countries (1995 = 100). An increase in the index implies an appreciation.

the Republic of Turkey. After the 1994 crisis the REER depreciated sharply but then it started to appreciate again. The appreciation of the REER continued until 2000, when the economy faced with another crisis. After the sharp depreciation of the REER from 2000 to 2001, it began to appreciate again (Togan, 2005). Today, most people believe that appreciation of Turkish currency is negatively affecting the export performance in manufacturing sector. However, in recent years, Turkey has had record high levels of export performance despite the overvalued currency. This shows that current debate on the adverse effects of the acclaimed appreciation of Turkish currency on export is overly naïve considering the other more complex determinants of export.

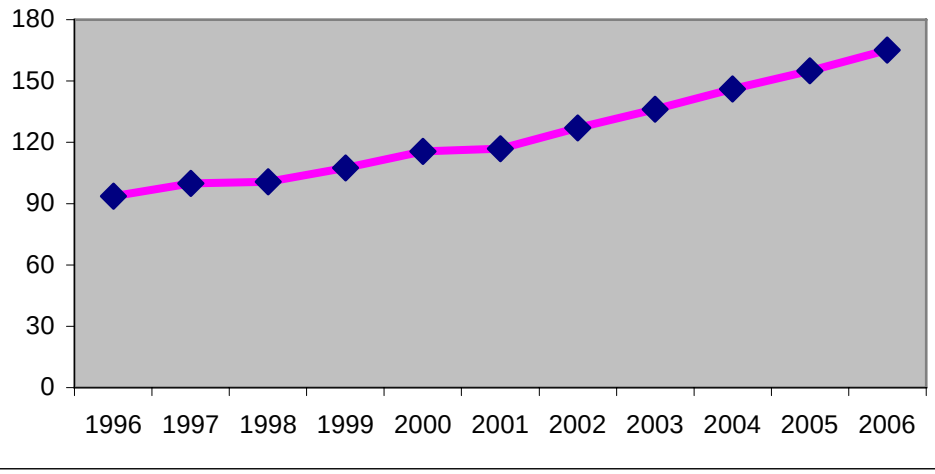
FIGURE 6: Real Effective Exchange Rate



Source: Central Bank of the Republic of Turkey (CBRT)

Another, maybe the most important, factor is the changes in labor productivity in the manufacturing sector for the 1996-2006 period. Index of partial productivity per production hour worked (1997=100) in total manufacturing sector can be seen in Figure 7. There is a continuous rise in labor productivity for 1996-2006 period.

FIGURE 7: Productivity of Total Manufacturing



Source: TURKSTAT

Unit labor cost (ULC) which is equal to the ratio of wages to labor productivity covers all of the factors that have been explained above. ULC measure takes into account both the wage and productivity changes simultaneously. We have calculated the ULC in terms of domestic currency in order to take into account the effect of appreciation of Turkish currency in terms of other weighted basket of currencies by including the REER variable into our model.

3. Explanations on Turkish Export Performance

In this section some recent studies regarding the Turkey's export performance are reviewed. Most of the studies considered focus on the relationship between growth of export and economic growth. Three examples of these studies are Bahmani-Oskooee and Domac (1995), Özmen and Furtun (1998), and Yiğidim and Köse (1997). The first paper confirms the validity of the export-led growth hypothesis for Turkey while the others reject this hypothesis.

Bahmani-Oskoode and Ltaifa (1992) analyze the effects of exchange rate on export, and shows that exchange rate adversely affect the export. On the other hand, Sivri and Usta (2001) concludes that the real exchange rate does not considerably account for the changes in export. Özatay (2000) estimates total export as a function of foreign income, and real exchange rate. According to his model while real exchange rate is statistically significant foreign income is not.

Arslan and Wijnberger (1993) examines the existence and driving forces behind the Turkish export miracle for 1980-87 period. They show that there was indeed a Turkish export miracle at this period and the export boom emanated from the macroeconomic policies and trade reform that allowed a steady real depreciation of Turkish currency.

Nowak-Lehmann *et al.* (2005) uses the extended version of the gravity model for Turkey covering the period 1988-2002 in order to investigate the trade effects of Turkey's trade integration into the EU. For this purpose, they examine sectoral trade flows to the EU based on panel data from the period 1988 to 2002 mainly concentrating on Turkey's sixteen most important export sectors. Their main emphasis is placed on the role of price competition, EU protection, and transport costs in the export trade between Turkey and the EU. According to the augmented gravity model, their findings indicate that transport costs and the real effective exchange rate are statistically significant indicating that a rise in transport costs decreases Turkish export while a depreciation of the real effective exchange rate increases Turkish export.

Lall (2000) considers the position and prospects of Turkish manufacturing export by analyzing its technological structure. He concludes that the structure of export is dominated by the low technology products and there is little evidence of an ability to shift to more dynamic products. In addition, much of the low technology export has spurred by privileged access to the European market rather than due to global competitiveness. He emphasizes not

having a strong advantage in low wages in low technology industry; Turkey is unlikely to sustain rapid growth once trade is fully liberalized by the year 2005. He thus claims: "As a high wage economy, Turkey has to compete with low-wage countries in simple, low technology products. As a technologically lagging economy, it has to compete against high technology European firms. Both are difficult, as there remain important structural deficiencies in Turkish competitiveness."

Özçelik and Taymaz (2002) estimated export intensity equations using TURKSTAT's firm-level Innovation Survey data for 4000 firms which covers the 1995-97 period to find out the determinants of export performance. They conclude that the innovations and R&D activities are crucial for the international competitiveness of Turkish manufacturing firms. On the other hand, technology transfers through license or know-how agreements and being a member of a business group are not significant determinants of export performance suggesting that a rational technology policy needs to be given a priority in promoting in-house innovations. Technology transfers and own innovation activities may be seen as "complementary" processes through their effects on enhancing innovation possibilities.

Findings of Özçelik and Taymaz (2002) also indicate that implementation of devaluation with a desire to enhance Turkey's competitiveness in international market via real cost reductions is an indispensable part of Turkey's international trade strategy. Nevertheless, Turkey must abstain from the illusion of temporary export booms achieved by devaluations and export subsidies. In contrast, Turkey needs to discern the importance of quality competition based on a comprehensive technological development policy that will generate permanent increases in productivity and competitiveness.

Özler, Taymaz, and Yılmaz (2007) empirically analyzes factors that influence the export participation decision using plant level data from Turkish manufacturing industry covering the period 1990-96. Their main result supports the presence of sunk costs of entry to

export markets and the full history of a plant's export experience matters for the current export decision. Aside from the past exporter status, several plant characteristics such as the plant size, the shares of female and administrative employees in total employment, and technology which is measured by capital-labor ratio and the imported share of machinery and equipment stock affect the export decision.

There are also some reports which analyze the Turkey's trade performance for the recent years. Yükseler and Türkan (2006) investigates the Turkish manufacturing industry over 1996-05. In this study, the transformation of Turkish manufacturing industry is characterized by *importization*, *internationalization*, and *Asialization* for the last ten years. The simultaneous changes in domestic and global perspective in 2001 are the main causes of this transformation. These trends have caused a huge increase in export volume; but this high export volume has not contributed to the value added and employment creation significantly. Real appreciation of domestic currency has brought about a decline in Turkey's competitiveness in international market. According to authors, to compensate the negative effect of real appreciation of domestic currency firms have limited the real wage increase and stimulated the productivity.

The report by Albaladejo (2006) assesses Turkey's manufacturing performance by comparing its performance to that of the EU-15, the new EU members and other newly industrialized countries. The paper does not analyze the structural factors behind Turkey's performance. Nevertheless, the paper concludes that while manufacturing export have boomed, manufacturing value added per capita has stagnated. Turkey's trade performance may be a result of the country's accession to the EU market rather than the result of the domestic technological capabilities of Turkish firms. The paper also denotes that although the share of medium- and high-technology sectors has declined, Turkish industry is still highly dependent on technologically simple products. Finally, the paper conjectures that it is difficult

to think of a more competitive Turkey unless structural factors such as technological development, specialized human capital, modern infrastructure and the whole institutional set up for innovation and learning are stimulated.

Filiztekin (2005), Erlat and Erlat, Yılmaz (2003), and Kaya (2006) analyze the competitiveness of Turkey with respect to other countries. All of these papers employ Revealed Comparative Advantage (RCA) index developed by Balassa (1965). Yılmaz (2003) uses Comparative Export Performance (CEP), Trade Overlap (TO), and Export Similarity (ES) approaches in addition to RCA index. However, it is important to note two of the most important deficiencies of the RCA index. First, it does not take into account the dynamic comparative advantage suggesting that a competitive industry at a point in time does not always remain competitive. Second, RCA index cannot measure the underlying factors behind the competitiveness.

Keyder, Sağlam and Öztürk (2004) uses a different index, unit labor cost (ULC) based competitiveness index, for the whole manufacturing sector so as to compare Turkey with its 15 major trading partners over the 1994-2003 period. Since the unit labor cost index estimated for Turkey remained far below those of its trading partners, the unit labor cost based competitiveness index implies a considerable cost based advantage for Turkey, especially after the February 2001 crisis. Relatively higher productivity and relatively lower dollar based wages as compared to its trading partners lead to lower unit labor costs in Turkey and provide a competitive advantage to country. For the 1994-2003 period, the reduction in unit labor costs compensated the overvaluation of the Turkish currency. In addition to this main result, despite the relatively higher growth rates of output; employment was not affected because of the rise in productivity. This paper, however, does not rely on any econometric model for the analysis. Instead, their findings are based on the simple percentage change in the wage, productivity and ULC for Turkey and its trading partners. Secondly, the bulk of the work has

treated manufacturing as an aggregated sector. This tends to hide much of the variation at the sectoral level. However, since each sector would be affected differently from the economic events and an aggregated trade analysis conceals the dynamics at the sectoral level, an analysis of export performance on sectoral basis is necessary to investigate the structure of the export. In order to solve these two problems we use an econometric model with a sub-sectoral manufacturing data.

Yaşar and Nelson (2004) examines the relationship between export and productivity in the Turkish apparel and motor vehicle and motor parts industries with an Error- Correction specification for plant-level panel data covering a wide time span from 1990 to 1996. Their findings bring up a bidirectional relationship between export and productivity both in the short- and long-run. However, the effect of productivity on exporting is much stronger than the effect of exporting on productivity which implies that more productive firms enter into the export market.

Another paper by Yaşar and Rejesus (2005) uses unbalanced plant-level panel-data on manufacturing plants for the Turkish apparel, textile, and motor vehicles and motor parts industries over 1990–1996 in order to determine whether self-selection or learning-by-exporting is the more plausible explanation for the link between exporting status and plant performance in Turkish manufacturing plants. By using propensity score matching (PSM) techniques and difference-in-difference (DID) estimators their results suggest that learning by exporting may be the reason for the positive correlation between exporting status and firm performance in Turkey.

This paper assesses determinants of export in Turkey's manufacturing sector, particularly with regard to labor costs, and examines the quantitative relationships between Turkey's cost competitiveness and export of manufacturing goods at an industry level. This approach is especially worthwhile in the Turkish case where labor costs are still essential for

competitiveness. In addition, all studies discussed earlier use a static framework. However, we analyze the Turkish manufacturing export with a dynamic model. To the best of our knowledge, this is the first study investigating the Turkish manufacturing export with a dynamic panel data model.

4. Empirical Model

In order to investigate the determinants of export performance of Turkish manufacturing sectors, this section estimates export supply function using a panel of manufacturing industry data covering the period 1996-2006. Export performance characterized by ability of domestic firms to compete in international market depends on various factors. These factors include essentially productivity, wage, technological innovation, and exchange rate. In this study, emphasis will be placed on the role of cost competition. As argued by Turner and Golub (1997), since the most important non-tradable input is labor, the Unit Labor Cost (ULC) is the most crucial cost element determining the international competitiveness of an industry[3].

The ULC, as a fundamental measure of international competitiveness, has been broadly used for international comparisons of cost competitiveness. In the Key Indicators of the Labor Market (KILM) database, which is a multi-functional research tool of the International Labor Organization (ILO), the ULC is defined as "the cost of labor required to produce one unit of output in a particular industry, sector or the total economy". Alternatively, and probably more clearly, the ULC is defined as the ratio of labor compensation per unit of labor (measured as the wage per employed person or per hour worked) to the productivity of labor (measured as output per employed person or per hour) as follows:

[3] In fact, the relative unit labor cost (RULC) has been used as the measure for the international competitiveness (Fagerberg, 1988).

$$\mathbf{ULC}^{\mathbf{D(U)}} = [\mathbf{LCH}^{\mathbf{DD}} / \mathbf{ER}^{\mathbf{DU}}] / [\mathbf{OH}^{\mathbf{D(D)}} / \mathbf{PPP}^{\mathbf{DU}}] \quad \textbf{(1)}$$

where $ULC^{D(U)}$ is unit labor cost of country D in terms of dollars, ER^{DU} is the exchange rate between country D and the United States, PPP^{DU} is the purchasing power parity between country D and the United States, LCH^{DD} is the wage per hour in country D in prices of D and $OH^{D(D)}$ is the output per hour in country D in prices of country D.

Based on the equation (1), countries with a low level of ULC relative to other countries are evaluated as cost competitive. The ratio indicates that a country can enhance its cost competitiveness either by decreasing its wage level (the numerator) or raising the labor productivity (the denominator). Hence, changes in ULC reflect the net effect of changes in wage level and labor productivity.

The ULC indices may be calculated both in terms of the domestic currency basis as well as in US dollars (common currency). When ULC indices are directly compared between countries wages are converted to common currency using the official exchange rate and labor productivity is converted to common currency using purchasing power parity. Note that exchange rate is not used for the conversion of labor productivity in equation (1); because movements in exchange rates affect relative wages but not the physical productivity of labor.

In this study, we assume that Turkey is a small price taking country. Since Turkey's manufacturing exporters are predominantly price-takers in the international market they are assumed to face an infinite demand for their products. Hence, our approach is more related to the supply side of the export. This assumption has two important implications. First, the profitability of export supply determines export volumes. Second, depreciation in domestic currency has a positive effect on export performance because of the increase in the profitability of export supply, and not because of the rise in the cost competitiveness of

Turkish products. On the other hand, since Turkey is a labor abundant country and the most important non-tradable input is labor, it is reasonable to emphasize the labor side of the production. Hence, our model assumes a perfectly competitive market in which labor is the only factor of production. The profitability of export supply depends on both output prices and variable costs of production. In the econometric analysis of the determinants of export supply, variable production costs are captured with ULC and producer prices (see, Edwards and Alves, 2006). Therefore, export supply is a function of the ULC and relative price variable (the real effective exchange rate). This approach is especially worthwhile in the Turkish case where labor costs are still an issue of contention.

It is often believed that export performance is related to the REER of a nation's currency (Fagerberg, 1988). However, since Turkey has had record high levels of export growth despite the overvalued Turkish currency in recent years, REER fails to gauge the export performance. Hence, the ULC also needs to be taken into account. In fact, the relative unit labor cost (RULC) has been used as the measure for the international competitiveness (Fagerberg, 1988). However, we incorporate the ULC (not RULC) as an explanatory variable in our empirical model given that our main concern is to focus on Turkey. Moreover, we do not analyze the competitiveness of Turkey vis-à-vis other countries. Hence, we omit the **[PPP ^{DU}/ ER ^{DU}]** part of the equation (1) in computing the ULC. This enables us to extend Edwards and Golub (2004) model by including the REER.

In this study, we used export, wages, and labor productivity data related to sectoral manufacturing industry for the aim of the study. The data covers the time period of 1996 to 2006 for Turkish manufacturing sector. We analyzed Turkish export on a two-digit level, based on the International Standard Industry Classification (ISIC). The data set related to wages and productivity of manufacturing sector was obtained from Turkish Statistical

Foundation (TURKSTAT)[4]. In addition, CPI-based REER data was obtained from Central Bank of Republic of Turkey (CBRT).

As we have explained in part 1 growth in manufacturing export in Turkey is more than the world average (8.1%) in 1996-2006 period. In order to control for the export growth which stems neither from productivity nor from price competitiveness but from the growth in the world economy, we include world GDP in the analysis. World GDP data from the Groningen Growth and Development Centre (GGDC) of the University of Groningen covers the total GDP of 129 countries in millions of 1990 US dollars. ULC is calculated as an index form (1997 average = 100) by dividing wage index to productivity index.

In order to analyze the factors behind Turkey's export growth, we first run the following regression as a benchmark model.

$$\mathbf{X_{it}=\alpha + \beta_1 X_{i,t-1} + \beta_2 ULC_{it} + \beta_3 Y_{it} + \beta_4 Crisis_{it} + \epsilon_{it}} \qquad \mathbf{(2)}$$

where *i* stands for sector and *t* stands for time period. The left hand side is log of the volume of export and on the right-hand side $X_{i,t-1}$ is log of the lag value of export, ULC is the log of the ULC index which is obtained by dividing wage index to productivity index. Finally crisis is the dummy variable which takes the value zero for pre-2001 period and one otherwise. We expect the coefficient of ULC to be negative, that is to say, the lower the ULC, the higher the export, ceteris paribus. The sign of Y is expected to be positive. This can be interpreted as such that growth in world export volume is expected to affect Turkey's export positively. The Crisis variable is used in order to take into account the omitted factors other than wage, productivity and REER that determine the export volume after 2000. The coefficient of crisis is expected to have a positive sign. Following Edwards and Golub (2004), we use two

[4] It is worth reminding that wage and productivity variables used are the averages of four quarter within a year and expressed in index form (1997 average = 100).

different specifications to test the determinants of export considering the unprecedented export growth in recent years.

In the second model we decompose the ULC into its two components, wage and productivity.

$$X_{it}=\alpha + \beta_1 X_{i,t-1} + \beta_2 Wage_{it} + \beta_3 Productivity_{it} + \beta_4 Y_{it} + \beta_5 Crisis_{it} + \epsilon_{it} \quad (3)$$

where wage is the log of the wage index, and productivity is the log of the labor productivity index. The wage coefficient is expected to be negative while the productivity coefficient is expected to be positive.

Finally in the third model, the augmented ULC model, we extend the model by including the REER so as to see the impact of exchange rate on Turkish export performance and explore critically the current debate on the adverse impact of overvalued currency on Turkey's export.

$$X_{it}=\alpha + \beta_1 X_{i,t-1} + \beta_2 Wage_{it} + \beta_3 Productivity_{it} + \beta_4 REER_{it} + \beta_5 Y_{it} + \beta_6 Crisis_{it} + \epsilon_{it} \quad (4)$$

where REER is log of the CPI-based REER. Since an increase in the REER implies an appreciation of the Turkish currency a negative sign of REER is expected. Since the variables are in logs, the coefficients represent elasticities.

Each equation is estimated using dynamic panel data technique, so that variations over both the cross section and time series dimensions are jointly considered in a dynamic manner. There are various advantages of using panel data estimation. First, panel data estimation considers variations over both the cross-section and time series dimensions jointly. This is not

possible in pure cross-sections or in pure time series data. Second, panel data estimation improves coefficient estimates by increasing the power of the tests.

Following the Edwards and Golub (2004) article, lagged value of export is used as an explanatory variable as well as others in estimations. An econometric model which contains the lag values of dependent variable as explanatory variable has a dynamic character in nature. In order to have unbiased estimation coefficients, these types of models require the use of generalized method of moments (GMM) dynamic panel data technique developed by Arellano and Bond (1991)[5]. The OLS estimation technique cannot be used in a dynamic model because of two reasons. First, *strict exogeneity of the regressors* assumption does not hold in the dynamic model. Second, right hand side of the regression equation is correlated with the disturbance term which causes the OLS estimates to be biased upward and inconsistent.

Arellano-Bond estimators have one- and two-step variants. The one-step GMM estimator is efficient when the errors are homoskedastic and not correlated over time. The two-step estimator is efficient under more general conditions, like heteroscedasticity. However, in small samples the estimated standard errors of the two-step GMM estimator tend to be too small and in practice, the asymptotic standard errors for the one-step estimator are more reliable for making inference in small samples. Hence, Arellano and Bond recommend using one-step results for inference on coefficients.

If the error term at time t has some feedback on the subsequent realization of an explanatory variable then this explanatory variable is a predetermined variable. Since unforecastable errors today might affect future changes in the ULC, wage, productivity, and REER, we might suspect that the log of the ULC, the log of the wage, the log of the productivity, and the log of the REER are predetermined.

[5] See Baltagi (2001) for the details of Arellano and Bond (2001) study and the other estimation techniques of dynamic panel data models.

In Table 1, we present the empirical findings for Turkish manufacturing export based on equations (2), (3) and (4). *Sargan test* shows the validity of the instruments in the sense that they are not correlated with the errors in the first-differenced equation. Based on the Sargan results we fail to reject the null hypothesis that the over-identifying restrictions are valid in all cases. *Average autocovariance in residuals of order 1 is equal to 0* shows the first order autocorrelation in residuals. *Average autocovariance in residuals of order 2 is equal to 0* shows the second order autocorrelation in residuals[6]. The validity of the GMM estimation is based on the condition of no second-order autocorrelation. The results confirm that there is no second-order autocorrelation. *Wald test* shows all coefficients except the constant are zero. Based on the Wald test we reject the null hypothesis of joint non-significance in all cases at the 1-percent or 5-percent level.

In the first model, the coefficients of lagged export, ULC and world income have the correct sign and they are significant. We find that the manufacturing export intensity is negatively related to ULC, indicating that a high ULC hurts Turkey's manufacturing export performance. The positive and significant coefficient of world GDP can be interpreted as such that an increase in the world GDP affects Turkey's export positively and significantly. On the other hand, the crisis is insignificant.

In the second model, all variables have the expected signs and only the variable crisis is insignificant. Finally, in the third model, all variables have the expected signs and the variables other than the crisis and REER are statistically significant. This gives support for the hypothesis that the exchange rate policies may not be successful in promoting export growth. Moreover, acclaimed exchange rate appreciation may not be as significant as commonly pronounced. In addition, since the variable crisis is insignificant in all three models the factors

[6] First-order autocorrelation in the differenced residuals does not imply that the estimates are inconsistent, but the second-order autocorrelation would imply that the estimates are inconsistent.

other than wage, productivity and REER do not have a direct effect on the export volume after 2000.

TABLE 1

Dependant Variable Estimates	**Model 1** LNEXPORT	**Model 2** LNEXPORT	**Model 3** LNEXPORT
$Export_{t-1}$	0.681***	0.642***	0.644***
	(0.059)	(0.054)	(0.053)
	[0.000]	[0.000]	[0.000]
ULC	-0.153***		
	(0.031)		
	[0.000]		
Wage		-0.150***	-0.154***
		(0.042)	(0.043)
		[0.000]	[0.000]
Productivity		0.109***	0.106***
		(0.040)	(0.040)
		[0.007]	[0.009]
World income	0.444***	0.415**	0.566**
	(0.167)	(0.164)	(0.253)
	[0.008]	[0.011]	[0.025]
REER			-0.333
			(0.420)
			[0.427]
Crisis	0.016	0.003	-0.098
	(0.047)	(0.046)	(0.135)
	[0.731]	[0.948]	[0.468]
Constant	0.091***	0.100***	0.124***
	(0.015)	(0.018)	(0.036)
	[0.000]	[0.000]	[0.001]
Sargan test	chi2(97)=114.00	chi2(150)=142.62	chi2(203)=142.68
	Prob>chi2=0.1145	Prob>chi2=0.6534	Prob>chi2=0.9996
1. order autocorrelation	z = -5.24	z = -5.27	z = -5.32
	Pr>z = 0.0000	Pr>z = 0.0000	Pr>z = 0.0000
2. order autocorrelation	z = -0.16	z = -0.09	z = -0.06
	Pr>z = 0.8704	Pr>z = 0.9280	Pr>z = 0.9494
Wald test	chi2(4)=201.61	chi2(5)=231.45	chi2(6)=234.88

Note: The first parenthesis below the estimated coefficients is standard errors and the second one is the Z statistics.
***, ** indicate statistical significance at the 1 %, and 5 % levels, respectively.

To conclude it can be said that real exchange rate depreciation in Turkish exchange rate does not induce a huge increase in export. Since the ULC is the basic determinant, for obtaining a sustainable and stabilized export growth, public and private policy measures toward inducing productivity growth need to be given priority.

In addition to overall increase in total manufacturing exports what a country export is also crucial. In today's world, "it matters a great deal today whether a country specializes in the production of potato chips or micro chips" (Haque, 1995: 22). To this end, we classify sectors as rising and declining sectors based on the percentage increase in export volume in the last four years in order to analyze the technological composition of Turkish manufacturing export.

TABLE 2: Rising and Declining Sectors

	ISIC Rev.3	relative position	ranking
15	Food products and beverages	declining	16
16	Tobacco products	rising	9
17	Textiles	declining	21
18	Wearing apparel	declining	22
19	Luggage, saddlery and footwear	declining	20
20	Products of wood and cork	rising	5
21	Paper and paper products	declining	15
22	Printing and publishing	declining	17
23	Coke, petroleum products and nuclear fuel	rising	1
24	Chemicals and chemical products	declining	13
25	Rubber and plastic products	rising	8
26	Other non-metallic minerals	declining	19
27	Manufacture of basic metals	rising	2
28	Manufacture of fabricated metal prod (exc machinery)	rising	6
29	Manufacture of machinery and equipment	rising	10
30	Office, accounting and computing machinery	rising	7
31	Electrical machinery and apparatus	rising	4
32	Communication and apparatus	declining	18
33	Medical,precision and optical instruments, watches	declining	12
34	Motor vehicles and trailers	rising	3
35	Other transport	rising	11
36	Furniture	declining	14

Source: TURKSTAT and Authors' calculations

Table 2 highlights the fact that textiles and food processing are not particularly dynamic sectors given their low growth rates within the last four years. Sectors 23 (Coke, petroleum products and nuclear fuel), 27 (Manufacture of basic metals), 34 (Motor vehicles and trailers) and 31 (Electrical machinery and apparatus) can be considered to be the most dynamic export sectors. These new rising sectors become new leading sectors in Turkey's export. Conventional sectors, 15 (Food products and beverages), 17 (Textiles), 18 (Wearing apparel) started to be losing their importance. These findings suggest that in recent years Turkey experienced a structural change and its export shifted from conventional and unskilled labor intensive sectors to more technology intensive sectors requiring more skilled labor. This structural change has important implications for the sustainability of long run export growth.

In this section, we run our third model for both the rising and the declining sectors. Our findings indicate that nominal wage is an important factor in the declining sectors while productivity is important in rising sectors. Therefore, enhancing the productivity appears to be the sole driving force for sustainable export growth.

In order to determine the robustness of our analysis for different ULC calculations, we have estimated the ULC both in terms of dollar and by using real wage indexes,[7] with similar explanatory variables. Our results are robust to these alternatives. In both types of calculations ULC is statistically significant. However, since both ULC and REER variables contain dollar estimating ULC in terms of dollar may cause multicollinearity between the ULC and REER. On the other hand since REER is a CPI based index estimating ULC by using the real wage index may also cause multicollinearity between the ULC and REER. Hence, our benchmark model is the most robust to these considerations.

Finally, following Edwards and Golub (2004), capacity utilization is included so as to test the "vent-for-surplus" hypothesis. The hypothesis implies that the rise in export is partly

[7] In this model, nominal export data is also converted to real variable by dividing the US CPI.

in response to declines in domestic demand and accompanied by low rates of capacity utilization. Therefore a negative sign for this variable is expected. Capacity utilization data is taken from the CBRT on a sectoral basis. However, we cannot find a significant coefficient for the capacity utilization variable, while other results remain unaltered.

TABLE 3

	Rising sectors	**Declining sectors**
Dependant Variable	LNEXPORT	LNEXPORT
Estimates		
$Export_{t-1}$	0.653***	0.676***
	(0.076)	(0.054)
	[0.000]	[0.000]
Wage	-0.115	-0.196***
	(0.070)	(0.048)
	[0.102]	[0.000]
Productivity	0.168***	-0.043
	(0.051)	(0.089)
	[0.001]	[0.623]
World income	0.527	0.657***
	(0.456)	(0.256)
	[0.248]	[0.010]
REER	-0.561	-0.049
	(0.757)	(0.427)
	[0.459]	[0.909]
Crisis	-0.209	0.042
	(0.244)	(0.139)
	[0.392]	[0.757]
Constant	0.151***	0.092***
	(0.062)	(0.038)
	[0.016]	[0.016]
Sargan test	chi2(203) = 75.75 Prob > chi2 = 1.0000	chi2(203) = 70.44 Prob > chi2 = 1.0000
1. order autocorrelation	z = -3.98 Pr > z = 0.0001	z = -4.22 Pr > z = 0.0000
2. order autocorrelation	z = -0.18 Pr > z = 0.8536	z = 0.93 Pr > z = 0.3508
Wald test	chi2(6) = 127.85	chi2(6) = 280.30

Note: The first parenthesis below the estimated coefficients is standard errors and the second one is the Z statistics.
***, ** indicate statistical significance at the 1 %, and 5 % levels, respectively.

5. Conclusion

In this study, we have employed dynamic panel data method to measure the causes of manufacturing export increase in Turkey at the sectoral level for the time period 1996-2006. The results indicate that the main driving force behind the Turkish export growth after 2000 is the productivity. In addition to this main result, the findings of the study also indicate that the rise in nominal wages has negatively affected export. Hence, one can say that promoting productivity is required to provide a sustainable export growth in manufacturing sector.

Another interesting results obtained from empirical analysis is that Turkey experienced a structural change and its export shifted from conventional and unskilled labor intensive sectors to more technology intensive sectors requiring more skilled labor.

Nominal wage is an important factor in the declining sectors while productivity is important in rising sectors. Since traditional sectors such as textile are not sensitive to productivity they appear to suffer more from the rising wages due to appreciation of exchange rate.

Finally, there are arguments that overvalued currency reduces the export growth. However, we could not find a statistically significant effect of exchange rate on export. If the improvement in productivity is sustainable, export growth can be sustainable as well even in the case of appreciated Turkish currency

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APPENDIX

TABLE A1

Detailed Turkish Export

	Exports by ISIC, Rev.3											
	Value 000 $											
	ISIC Rev.3	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
	TOTAL	**85141517**	**73476408**	**63167153**	**47252836**	**36059089**	**31334216**	**27774906**	**26587225**	**26973952**	**26261072**	**23224465**
A	**AGRICULTURE AND FORESTRY**	**3447710**	**3328814**	**2541777**	**2120690**	**1754287**	**1976410**	**1659092**	**2057511**	**2357425**	**2353848**	**2152577**
01	Agriculture and farming of animals	**3433842**	**3314031**	**2525828**	**2104662**	**1743890**	**1967606**	**1651912**	**2049297**	**2350866**	**2348640**	**2147424**
02	Forestry and logging	**13868**	**14784**	**15949**	**16028**	**10398**	**8804**	**7180**	**8214**	**6558**	**5208**	**5153**
B	**FISHING**	**130061**	**139500**	**103118**	**80746**	**51419**	**29745**	**24506**	**37896**	**17182**	**33171**	**26507**
05	Fishing	**130061**	**139500**	**103118**	**80746**	**51419**	**29745**	**24506**	**37896**	**17182**	**33171**	**26507**
C	**MINING AND QUARRYING**	**1142035**	**810241**	**649237**	**469089**	**387193**	**348652**	**400269**	**384993**	**363652**	**404261**	**368625**
10	Mining of coal, lignite and peat	**1182**	**2600**	**2317**	**1340**	**1453**	**3833**	**1640**	**801**	**294**	**337**	**694**
11	Crude petroleum and natural gas	**1131**	**12170**	**0**	**2773**	**3219**	**2929**	**4650**	**5137**	**2597**	**489**	**1**
12	Uranium and torium ores	**0**								**2**		
13	Metal ores	**467324**	**247949**	**186657**	**101048**	**101503**	**80950**	**127505**	**112059**	**110722**	**147766**	**117963**
14	Other mining and quarrying	**672399**	**547522**	**460263**	**363929**	**281018**	**260940**	**266473**	**266996**	**250036**	**255669**	**249968**
D	**MANUFACTURING**	**79886588**	**68813408**	**59579116**	**44378429**	**33701646**	**28826014**	**25517540**	**23957813**	**24064586**	**23312800**	**20525761**
15	Food products and beverages	**4315063**	**4271660**	**3349424**	**2649558**	**1880733**	**2016235**	**1835504**	**2039929**	**2356634**	**2734175**	**2455094**
16	Tobacco products	**181241**	**121787**	**78045**	**89833**	**99719**	**81052**	**123056**	**83331**	**68388**	**118231**	**95111**
17	Textiles	**9260744**	**8742704**	**7998061**	**6841165**	**5532758**	**4943497**	**4614078**	**4557626**	**4794000**	**4450117**	**3817823**
18	Wearing apparel	**10169116**	**9924749**	**9340151**	**8153895**	**6615232**	**5397509**	**5417141**	**5270104**	**5715620**	**5442138**	**4829702**
19	Luggage, saddlery and footwear	**435813**	**370192**	**327960**	**285836**	**214188**	**211786**	**189515**	**180893**	**271494**	**299168**	**220876**
20	Products of wood and cork	**331777**	**249941**	**203728**	**145984**	**118478**	**109402**	**63049**	**68496**	**71015**	**75108**	**68537**
21	Paper and paper products	**600206**	**559167**	**457442**	**367209**	**302575**	**241729**	**164294**	**148674**	**150018**	**154163**	**125667**

TABLE A1 *Continued*

	Exports by ISIC, Rev.3											
	Value 000 $											
	ISIC Rev.3	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
22	Printing and publishing	**106852**	**105048**	**82146**	**66989**	**48737**	**42737**	**42645**	**47624**	**40819**	**40112**	**47725**
23	Coke, petroleum products and nuclear fuel	**3401368**	**2518943**	**1364348**	**953544**	**670126**	**416421**	**300716**	**315195**	**240626**	**179059**	**259199**
24	Chemicals and chemical products	**3475219**	**2818310**	**2556412**	**1926341**	**1580672**	**1480503**	**1397489**	**1234778**	**1277470**	**1362510**	**1244289**
25	Rubber and plastic products	**3010086**	**2485789**	**1958873**	**1464382**	**1084530**	**940519**	**781451**	**667851**	**685440**	**621233**	**510218**
26	Other non-metallic minerals	**2786214**	**2686826**	**2317150**	**1800400**	**1467603**	**1231260**	**1121223**	**957312**	**944522**	**931944**	**780908**
27	Manufacture of basic metals	**9318471**	**6887671**	**6815628**	**3884446**	**3239350**	**2921211**	**2247065**	**2063810**	**2197973**	**2597253**	**2233719**
28	Manufacture of fabricated metal prod (exc machinery)	**3342349**	**2684603**	**2199705**	**1503095**	**932339**	**733472**	**660770**	**647923**	**664303**	**522021**	**461909**
29	Manufacture of machinery and equipment	**5990779**	**4865027**	**3913354**	**3118511**	**2077511**	**1564386**	**1375956**	**1211737**	**1107452**	**1000337**	**828739**
30	Office, accounting and computing machinery	**87652**	**69500**	**52137**	**40822**	**39665**	**52468**	**63096**	**60038**	**42619**	**28863**	**21287**
31	Electrical machinery and apparatus	**2811511**	**1932751**	**1575589**	**1220629**	**1057077**	**1038402**	**825248**	**692201**	**755875**	**743381**	**771656**
32	Communication and apparatus	**3084874**	**3150196**	**2883024**	**1947749**	**1574973**	**1002269**	**961870**	**770693**	**862119**	**469534**	**316493**
33	Medical,precision and optical instruments, watches	**242725**	**197504**	**173412**	**129203**	**88978**	**77352**	**75201**	**66834**	**75284**	**60997**	**56633**
34	Motor vehicles and trailers	**12673851**	**10226102**	**8812615**	**5436950**	**3602800**	**2656691**	**1745046**	**1614792**	**1049170**	**879948**	**975877**
35	Other transport	**1980224**	**1706833**	**1348708**	**1037310**	**528738**	**948202**	**882097**	**770888**	**315022**	**302558**	**155051**
36	Furniture	**2280453**	**2238104**	**1771206**	**1314580**	**944864**	**718910**	**631033**	**487083**	**378723**	**299949**	**249247**
E	**ELECTRICITY, GAS AND WATER SUPPLY**	**128202**	**103449**	**60173**	**20093**	**15841**	**20487**	**20386**	**14265**	**14911**	**11101**	**15488**
40	Electricity, gas and steam	**128202**	**103449**	**60173**	**20093**	**15841**	**20487**	**20386**	**14265**	**14911**	**11101**	**15488**
G	**WHOLESALE AND RETAIL TRADE**	**405146**	**279812**	**230758**	**182738**	**147246**	**127495**	**136408**	**133714**	**151160**	**144486**	**134515**
51	Waste and scrap	**405146**	**279812**	**230758**	**182738**	**147246**	**127495**	**136408**	**133714**	**151160**	**144486**	**134515**
K	**OTHER BUSINESS ACTIVITIES**	**425**	**258**	**1354**	**81**	**55**	**1276**	**403**	**156**	**491**	**975**	**23**
74	Other business activities	**425**	**258**	**1354**	**81**	**55**	**1276**	**403**	**156**	**491**	**975**	**23**
O	**SOCIAL AND PERSONAL ACTIVITIES**	**1350**	**926**	**1619**	**970**	**1400**	**4137**	**16302**	**881**	**4545**	**429**	**969**
92	Recreational, cultural and sporting activities	**1350**	**0**	**1619**	**970**	**1333**	**4099**	**16231**	**758**	**4224**	**214**	**848**
93	Other service activities	**0**	**926**	**0**	**0**	**68**	**38**	**71**	**123**	**322**	**214**	**121**

Source: TURKSTAT

TABLE A2						
Summary Statistics						
Variable		**Mean**	**Std. Dev.**	**Min**	**Max**	**Observations**
Export	overall	1787453	2319151	21286.68	1.27e+07	N = 242
	between		1946108	50740.5	6934123	n = 22
	within		1322224	1848402	9945500	T = 11
Wage	overall	812.6433	619.2874	46.36995	2545.215	N = 242
	between		155.4722	550.0121	1165.765	n = 22
	within		600.2901	301.656	2224.096	T = 11
Productivity	overall	119.2263	35.16267	7.62432	241.5668	N = 242
	between		20.558	56.31561	160.2996	n = 22
	within		28.83259	35.74768	252.5671	T = 11
REER	overall	1.336.818	19.97734	101.7	4.66e+07	N = 242
	between		0	133.6818	3.88e+07	n = 22
	within		19.97734	101.7	4.66e+07	T = 11
World GDP	overall	3.88e+07	3901518	3.44e+07	171.4	N = 242
	between		0	3.88e+07	133.6818	n = 22
	within		3901518	3.44e+07	171.4	T = 11