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THE EFFECTS OF TRADE AND PRODUCTIVITY ON EMPLOYMENT IN THE MANUFACTURING INDUSTRY OF TURKEY

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ABSTRACT

This study empirically analyzes the effects of international trade and productivity on employment in the Turkish manufacturing industry for the time period of 2003-2010 by using panel data. For this purpose, - the direct effects and - productivity related indirect effects of international trade on employment are estimated. The findings suggest that the direct effects of export demand and import competition on employment are sound and significant; while the increase in export demand leads to an increase in labour demand, the increase in import penetration reduces it. However, the productivity related indirect effects come solely from import competition. The total effects of international trade on emploment is mainly the result of the direct effects of export demand and import penetration. On the other hand, the positive contribution to productivity in the Turkish manufacturing industry comes mainly from investment and research&development expenditures.

Keywords : International Trade, Export Demand, Import Competition, Productivity, Employment, Labour Market, Panel Data Techniques.

JEL Codes: F14, F16.

TÜRK İMALÂT SANAYİİNDE DIŞ TİCARET VE VERİMLİLİĞİN İSTİHDAM ÜZERİNDEKİ ETKİLERİ

ÖZET

Bu çalışma, uluslararası ticaret ve verimliliğin Türk imalât sanayiindeki istihdama olan etkilerini, 2003-2010 dönemi için ve panel veri kullanarak ampirik olarak analiz etmektedir. Bu amaçla, uluslararası ticaretin istihdam üzerindeki doğrudan ve verimlilikle ilgili olarak dolaylı etkileri tahmin edilmektedir. Tahmin sonuçlarına göre, ihracat talebi ve ithalat rekabetinin istihdam üzerindeki doğrudan etkileri önemli ve anlamlıdır; ihracat talebindeki artış emek talebi üzerinde olumlu bir etki yaparken, ithalat rekabetinin artması bu talebi azaltmaktadır. Ancak, verimlilik vasıtasıyla

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olan dolaylı etkileri sadece ithalat rekabetinden gelmektedir. Uluslararası ticaretin istihdam üzerindeki toplam etkileri, esas olarak ihracat talebi ve ithalat rekabetinin doğrudan etkilerinin sonucudur. Diğer taraftan, Türk imalât sanayisinin verimliliğine pozitif katkı, büyük ölçüde, yatırım ve araştırma&geliştirme harcamalarından kaynaklanmaktadır.

Anahtar Kelimeler: Uluslararası Ticaret, İhracat Talebi, İthalat Rekabeti, Verimlilik, İstihdam, Emek Piyasası, Panel Data Teknikleri.

JEL Codes: F14, F16.

I. INTRODUCTION

The Turkish economy underwent a serious transformation in the decade of the 1980's by opening up and directing the output of its existing manufacturing base to foreign markets. A second phase of transformation took place in the 2000's when, in the face of severe competition from other emerging economies, Turkey integrated further with the world markets by realizing productivity increases and structural change. Turkish export flows consist mainly of manufactures, and foreign demand is a crucial determinant of the demand for manufacturing output. The dynamics of the interactions between export demand, import competition and technological change (productivity increase) in the Turkish manufacturing industry is the topic of the present study.

We investigate the employment effects of trade within the framework of the Heckscher-Ohlin-Samuelson (HOS) theory. There is a positive relationship between an expansion in export demand and the demand for skilled labor. On the other hand, imports have adverse effects on sectoral employment resulting from increased competition from countries with a relative abundance of cheap and unskilled labour. In addition to the direct employment effects of trade, trade variables influence productivity and therefore indirectly affect employment.

This study uses the framework developed in Abraham and Brock (2003). Abraham and Brock (2003) estimated the direct and productivity related indirect effects of international trade on sectoral employment in 10 industralized European countries for the period of 1978-1994. They have found significant effects from both international trade directly and productivity indirectly towards sectoral employment in Europe. They

conclude that "…*evidence is found for the hypothesis that international trade induces adjustments in technology*" (Abraham and Brock, 2003, p.223).

Using data for the 20 sectors of the Turkish manufacturing industry for the period covering 2003 to 2010 and employing panel data techniques, the current study analyzes the direct and indirect effects of international trade on sectoral employment. In the next section a review of the literature on the theoretical and empirical relationship between trade, technology (productivity) and labour markets in all over the World and in Turkey is presented. In the third section, there is a European model for employment adjustments serves as a background for Abraham and Brock's empirical analysis which is also the primary focus of this paper. In the fourth section, data and econometric methodology used in this study are explained. The fifth part empirically investigates the relationship between trade and sectoral employment, trade and productivity, and, finally, productivity and sectoral employment in the Turkish manufacturing industry. The final section presents a summary of the empirical analysis and concluding remarks.

II. REVIEW OF THE LITERATURE

The usual framework for the employment effects of trade is the Heckscher–Ohlin–Samuelson (HOS) theory. This theory assumes perfect intersectoral mobility of all production factors and full employment. International trade leads to specialization in the sectors with relative abundance of production factors.

According to the stylized version of the model, while export sector employ more skilled labour, import-competing sector work with relatively more unskilled labour. An expansion of trade leads to an increase in demand for goods of the export sector which creates new jobs in this sector. " The positive relation between an expansion of export demand and total sectoral employment is defined as the *export demand effect* " (Abraham and Brock, 2003, p.224).

On the other hand, in the import-competing sector, due to increased competition from countries with a relative abundance of cheap unskilled labour, jobs are lost. "The negative impact of import competition on total

sectoral employment is defined as the *import competition effect*" (Abraham and Brock, 2003, p.224).

As a result of import competition effect, output or market share of the domestic firm with respect to its foreign competitors decrease, which leads to the reduction in the domestic sectoral employment level. According to the export demand effect, trade integration offers domestic firms the opportunity to enter the foreign market, which increase exports and sectoral employment in the home country (Abraham and Brock, 2003, p.224).

There is an extensive literature comprising studies on trade-related total employment changes at the sectoral level. But these studies mostly focus on the direct effect of foreign trade on sectoral employment.

Sachs and Shatz (1994), analyses the linkage from growing internationalization of the U.S. economy to important trends in the U.S. labor market for the period 1978-90, during which time U.S. trade with developing countries expanded significantly.

They find that internationalization has contributed to the decline of manufacturing employment, particularly of low-skilled workers. According to the estimates, the increase in net imports between 1978 and 1990 is associated with a decline of 7.2 percent in production jobs in manufacturing and a decline of 2.1 percent in nonproduction jobs in manufacturing. Since less highly skilled workers are employed in production jobs, these trends lead to the widening of wage inequalities between skilled and unskilled workers.

> We have seen that U.S. trade with developing countries has grown markedly over the past 15 years and that such trade is broadly characterized by the patterns suggested by the Heckscher-Ohlin-Samuelson theory: the United States exports skill-intensive goods and imports less skill-intensive goods. The increased trade with East Asia, Brazil, and Mexico since 1978 has accentuated these patterns. As a result of increased internationalization, employment has declined sharply in low skill sectors and has increased in high-skill sectors. In addition, the increased trade has contributed to falling relative prices of less skill-intensive goods and to the growing inequality of earnings between low-skilled and high-skilled workers, although the weight of the trade effect is uncertain (Sachs and Shatz, 1994, p. 57).

However, the precise role of international trade in these trends remains

unclear. In the view of some leading trade economists, such as Paul Krugman and Robert Lawrence, the effects of internationalization on labour market have been minimal. Krugman and Lawrence say that , "competition from abroad has played a minor role in the contraction of U.S. manufacturing" (Krugman and Lawrence, 1994, pp. 44-49). Similarly, Robert Lawrence and Matthew Slaughter conclude that the effects of trade on wages and employment have been small (Lawrence and Slaughter,1993, p.165). According to these economists, technological change is much more important than internationalization as the major force behind the labor market trends.

Sachs and Shatz agree with Krugman and Lawrence and with Lawrence and Slaughter (Sachs and Shatz, 1994, p. 4) :

> …that increased internationalization can not, by itself, account for most of the observed labor market trends. The overall changes in employment and in wage inequalities are too large to be explained by the changing trade and price patterns of the past 15 years. It is likely that technological change is playing a role independent of internationalization. Yet, we cannot precisely measure the relative importance of these two factors-trade and technology-mainly because one cannot observe and measure technological change with any precision.

Revenga (1992) investigates the effect of increased import competition on employment and wages in the U.S. manufacturing industry using panel data method over the 1977-1987 period. Revenga finds that changes in import prices have a statistically significant but small effect on sectoral employment.

Revenga (1995) studies the employment and wage effects of trade liberalization on the Mexican manufacturing industry using a panel data set of firms for the 1984-90 period. Mexico initiated a radical liberalization of its external sector in 1985, after decades of an import-substitution industrial strategy.

The paper finds that reductions in quota coverage and in tariff levels lead to only small reductions in firm-level employment. According to the empirical results, a 10 point decrease in tariff levels, such as that experienced by Mexico between 1985 and 1990, is associated with a 2-3% reduction in employment. Although changes in quota coverage appear to

have no significant effect on wages, reductions in tariff levels bring about increases in average wages. This last result seems to reflect productivity increases in the reformed industries due to changes in the composition of labor towards higher-skilled workers.

Neven and Wyplosz (1999) focus also on the import competition effect on labour markets for German, French, Italian and UK manufacturing industries for the period 1976–90. Neven and Wyplosz can not find a strong support for the Heckscher-Ohlin-Samuelson effect of import competition on employment but they do observe a substantial and diverse restructuring in unskilled labour intensive industries.

Larre (1995), investigates the possible relationships between foreign trade, employment and relative wages using data for 21 industries in 12 OECD countries, over the period 1970-89. The findings of this time-series analysis indicate that the impact of trade on labour market conditions seems to be significant but generally small relative to other factors and the most significant relationships are observed in the high-skill industries.

Dutt, Mitra and Ranjan (2009) present a model of trade and unemployment for 92 countries, where trade results from Heckscher–Ohlin comparative advantage based on international differences in relative factor endowments and/or Ricardian comparative advantage based on relative technological differences. They use the 1990s' average for cross-sectional analysis and the time series for each country over the period 1985–2004 for panel analysis.

The results of cross-sectional analysis, which present fairly strong and robust evidence for the Ricardian prediction, show that unemployment and trade openness are negatively related. This effect dominates the positive Heckscher–Ohlin effect of trade openness on unemployment for capital abundant countries, which turns negative for labor-abundant countries. The results of panel data analysis show that trade liberalization increases unemployment in the short-run, but reduces in the long-run.

Castro, Olarreaga ve Saslavsky (2006) attempt to estimate the effects of trade with China and India on Argentina's industrial employment between 1991 and 2003 during which industrial employment declined by 31 percent. They use a dynamic econometric model and industry level

data to estimate the effects of trade with China and India on the level of employment in Argentina's manufacturing sector. The empirical results suggest that import competition from China and India only had a small negative effect on industrial employment, even during the fast trade liberalization of the 1990s. On the other hand, exports do not seem to contribute to the employment in the manufacturing industry of Argentina.

On the other hand, there is a growing literature on the relationship between international trade and productivity. This relationship leads to the *productivity effect of international trade on employment.*

According to the reasoning behind this relationship: (i) exports and/or import competition affect technology (measured by productivity) and (ii) this increase in productivity affects employment. The effect of international trade on productivity can work in both directions. On the one hand, domestic firms that can not cope with foreign competition are faced with falling productivity. Large hiring and firing costs which are present in the European economies may prevent domestic companies facing decline in sales from internal restructuring in the form of lay-offs. On the other hand, international trade can increase productivity if it can induce firms to successfully introduce productivity-enhancing technologies (Abraham and Brock, 2003, p. 224).

Bernard and Jensen (1999), analyze the interaction between exporting and firm performance for the USA over the 1984-1992 period. They ask two key questions: "do good firms become exporters and do exporters outperform non-exporters" (Bernard and Jensen, 1999, p. 2). The answer for the first question is clear but they can not find any positive evidence for the second question (Bernard and Jensen, 1999, pp. 23-24) :

> Good plants become exporters. Several years before they actually ship any goods abroad, future exporters have many of the same, desirable performance characteristics. In addition, in the years just prior to the start of exporting, these plants are growing faster than their non-exporting counterparts. …we conclude that there is substantial evidence that success and new products lead to exporting, and that exporting is associated with growth in plant size. However, the lack of productivity gains suggest that firms entering the export market are unlikely to substantially raise their productivity, even if they export continuously.

Bernard and Jensen (2001), also examines the relationship between

productivity and exporting in the U.S. manufacturing sector for the 1983-1992 period. They can not find again any evidence for a positive impact of exports on productivity :

> …Building on previous research, we have found no evidence that exporting per se is associated with faster productivity growth rates at individual plants. The positive correlation between exporting and productivity levels appears to come from the fact that high productivity plants are more likely to enter foreign markets (Bernard and Jensen, 2001, p.17).

Then, "…causality goes in the other direction: more productive firms become better exporters" (Abraham and Brock, 2003, p.225).

Lawrence (2000), explores the effect of international competition on technological change empirically for the USA during the period 1978-89. Technological change is measured by changes in total factor productivity and the skill ratio in **U.S.** manufacturing

In this study, both the price and the quantity proxies for international competition produce statistically significant effects and the empirical results confirm that import competition has a positive affect on US total factor productivity. The results of Lawrence also show the importance of differentiating between imports from developed and developing countries. In particular, total factor productivity growth is relatively faster in industries with a relatively large share of imports from developing countries.

> …Since such industries also employ relatively higher shares of workers with a high school education or less, this implies that international competition has led to relatively faster productivity growth in unskilled-labor intensive sectors (Lawrence, 2000, p.216).

The studies analyzing the relationship between trade and employment in Turkey are mostly focused on the direct affect of trade or trade liberalization (globalization) on employment.

Yanıkkaya (2008) investigates if trade liberalization is a solution to the unemployment problem in developed and developing countries including Turkey. This study analyzes the relationship between trade openness and employment in agriculture, industry, and services from a consistent cross-country perspective. Yanıkkaya uses panel data for about one hundred developed and developing countries between 1980 and 1999.

The estimation results imply that trade openness in the form of higher trade volumes or lower trade barriers has not been effective in creating jobs in developing countries. Therefore, trade openness, by itself can not be a solution to the unemployment problems of developing countries (Yanıkkaya, 2008, pp. 3-4).

> … Overall, our results thus imply that most of the developing countries have not benefited from trade liberalization, probably due to the absence of strong institutions, adequate levels of physical, human, and social capital, sound macroeconomic policies, and a competitive economy (Yanıkkaya, 2008, p. 17).

Gül And Kamacı (2012), examines the effects of international trade on employment using a panel data analysis for developed and developing countries (including Turkey) in the periods of 1980-2010 and 1993-2010, respectively. As a result of their empirical tests, it has been concluded that there is not any influences of unemployment on import and export in both developed and developing countries. On the other hand, they have found a causality relationship from import and export to unemployment in both developed and developing countries.

Erlat (2000) investigates the impact of export and import flows on the change in employment of the manufacturing industry of Turkey. The analysis covers the periods before 1980 when Turkey switched from a regime of import-substitution based growth to one of export-orientation and after 1980. In this study, manufacturing industry is categorized as net exporting, import competing and noncompeting sectors. The results show that the impact of trade on employment change is more significant in the post-1980 periods and that this is observed more in the net exporting and noncompeting categories rather than the import competing category. The expansion in exports after 1980 has contributed to the increase in employment of Turkish manufacturing industry.

Gunluk-Senesen (1998) evaluates the impact of the 1980 liberalization program on the structure of sectoral employment in Turkey. This study takes 1973 as a representative year for the import substitution period (1960-1979) and 1990 for the export promotion period (1980-). She uses semi-closed demand-side and supply-side input-output models to compare the employment producing capacity of the industries in the two periods. The findings of this study indicate that from 1973 to 1990 there has been

a significant fall in the employment producing capacity of the industries.

Ayaş and Çeştepe (2010) study the effects of foreign trade on employment in the Turkish manufacturing industry for the period of 1998-2002. These effects are examined according to input-output and factor intensity models by using 1998 and 2002 input-output tables. Their calculations reveal that the effects of foreign trade on employment change from sector to sector; while trade increases employment in some sectors, it reduces in some other sectors. But the total effect of foreign trade on employment in the Turkish manufacturing industry is positive.

According to the empirical results, the sectors with the highest employment increase, such as chemicals, chemical products, rubber and plastic products and basic metal sectors, have also the highest increase in import. This result shows that the employment effect in the manufacturing industry is based on the increases in import. Therefore, this study supports the idea that production and employment in the Turkish manufacturing industry depend substantially on imported inputs.

There are few studies analyzing the effect of trade on both employment and productivity in the manufacturing industry of Turkey.

Turco and Maggioni (2012) investigates the impact of trade on the firm employment level and composition by providing evidence for the Turkish manufacturing industry over the period 2003-2008. Authors evaluate Turkey as an interesting case within this framework as it has undergone a continuous and growing integration process in the global economy since 1980s. According to their empirical evidence, productivity gains are associated with the internationalisation of Turkish firms. They also study the effect of the firm trade integration strategies on its employment composition in terms of the ratio of R&D to non R&D workers.

According to Turco and Maggioni :

> Trade may indeed stimulate innovation and firms may engage in innovative efforts and endow themselves with skilled workforce in order to reap the opportunities stemming from international markets. The latter channel may clearly play a relevant role in the future growth pattern of the economy and in the development process, increasingly based on knowledge creation and innovation (Turco and Maggioni, 2012, p. 3).

The empirical findings show that entering the export and the import markets at the same time gives the highest employment growth in the entry and the following years by the existence of complementarity effects between the two strategies. The investigation of the trade intensity reveals that although labour demand is positively affected, regardless of the firm degree of involvement in foreign markets, firms entering both export and import markets with a high intensity experience higher employment growth. Finally, the share of R&D employees increases only by high intensity exporting and such trade activity is the driver of innovation.

Their results do not support decreases in employment due to existing international integration process. On the contrary, the firm trade activity positively affects the evolution of manufacturing employment within the stagnant Turkish labour market. More importantly, they show that entry in both the import and the export markets, relevantly increases the firm scale of operations. Therefore, internationalisation provides firms with higher growth prospects and represents a significant channel for employment creation.

> In conclusion, the evidence of this paper on Turkey suggests that policy makers in emerging economies should be concerned about enhancing the firm involvement in foreign markets, as it represents a powerful tool to foster firm growth (*Turco and Maggioni,* 2012, p. 18).

On the other hand, *Meschi, Taymaz and Vivarelli (2008, 2010)* analyses the relationship between trade openness, technology adoption and relative demand for skilled labour in the Turkish manufacturing industry using firm-level data over the period 1980-2001. They estimate the impact of trade openness on labour demand by using a unique database of 17,462 firms. This dataset covers all manufacturing firms employing 10 or more people and represents about 90% of manufacturing output.

The analysis reveals that in Turkey the relative demand for skills increased substantially over the 1980-2001 period, when Turkey underwent radical policy changes favouring trade liberalisation. According to empirical results, the mutual influence between trade openness and technology adoption was the central factor in shifting the demand for labour towards more skilled workers within each firm. Technology related variables (domestic R&D expenditures and technological transfer from abroad) are positively and significantly related to skill upgrading.

The sectoral analysis shows that increasing export towards more industrialised countries (mainly the E.U.) tends to shift the production toward less skill-intensive activities. While this result is consistent with the Heckscher-Ohlin's theorem and in its Stolper-Samuelson corollary (HOSS theorem); on the other hand, import penetration from more developed countries promotes the adoption of new technologies embodied in capital and intermediate goods; therefore, it switchs the production for more skill-intensive technologies.

Besides, firms belonging to those sectors that most raised their imported inputs from more developed countries also increased their demand for skilled workers. The idea behind this finding is that imports by a middle income country from industrialised countries imply a transfer of new technologies that are more skill-intensive than those previously in use in domestic markets and lead to a higher demand for skilled labour.

The papers on Turkey show that international trade usually affects employment in a positive manner in the manufacturing industry. On the other hand, international trade stimulates innovation and firms may engage in innovative efforts and endow themselves with skilled workforce. The mutual influence between trade openness and technology adoption is the key factor in shifting the demand for labour towards more skilled workers within each firm.

III. A EUROPEAN MODEL FOR EMPLOYMENT ADJUSTMENTS

This study uses the framework developed in Abraham and Brock (2003). A European model for employment adjustments serves as a background for their empirical analysis which is also the primary focus of this paper. This model relates changes in labour and total factor productivity to exports and imports in addition to capturing the export demand and import competition effects on sectoral employment (See Abraham and Brock, 2003, pp. 225-226).

There is one representative sector for which a model of monopolistic competition is constructed. In the derivations, the subscript i refers to a specific country. Assumption is that there are m countries and in each

country, there are n_i identical firms in the representative industry. Therefore, price is the same for the firms within the same country.

Dixit–Stiglitz framework (see Dixit and Stiglitz, 1977) is used to describe the worldwide real consumption (X) of the products of a representative industry. In the following expression, X_i indicates the sectoral production of country i. Because of the assumption of n_i identical firms in the sector of this country i, $X_i = n_i x_i$ where x_i denotes the production of an individual firm. σ (with $\sigma > 1$) : elasticity of substitution.

$$X = \left(\sum_{i=1}^{m} X_i^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)} = \left(\sum_{i=1}^{m} (n_i x_i)^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)} \quad \textbf{(1)}$$

According to standard utility maximization (see Dixit and Stiglitz,1977), demand function for the output of country i:

$$X_i = n_i x_i = \left(\frac{p_i}{P} \right)^{-\sigma} \frac{E}{P} \quad \textbf{(2)}$$

In the equation above,

p_i : the price charged by all firms in country *i*,

$P = \left(\sum_{i=1}^{m} p_i^{1-\sigma} \right)^{1/(1-\sigma)}$: the price index of the representative sector

and $E = \sum_{i=1}^{m} p_i X_i$: the worldwide expenditures on the products of the representative sector.

The inverse demand function is then equal to:

$$p_i = \frac{E}{X} \left(\frac{X_i}{X} \right)^{-1/\sigma} = \frac{E}{X} \left(\frac{n_i x_i}{X} \right)^{-1/\sigma} \quad \textbf{(3)}$$

As for the supply side of the model;

Total costs of an individual firm in country i are the sum of fixed costs (F_i) and variable costs (C_i). The variable costs are determined by the cost

of labour (w_i) and capital (r_i). For the variable cost function, a Constant Returns to Scale Cobb–Douglas function is used (see Varian, 1984, p. 29). Therefore, total costs C_i^{tot} are:

$$C_i^{tot} = F_i + C_i = F_i + K_i A_i^{-1} w_i^{\gamma_i} r_i^{1-\gamma_i} x_i \quad \textbf{(4)}$$

where $K_i = \gamma_i^{-\gamma_i} (1-\gamma_i)^{\gamma_i - 1}$.

In this expression,

A_i : technological progress and K_i : a constant.

Thus, the profits of an individual firm : $\pi_i = p_i x_i - C_i^{tot}$.

From expression (3) and assuming that firms are sufficiently small so that they are not able to influence aggregate production when their individual production rises, the perceived elasticity of demand equals σ.

Then, the first order condition (c_i = marginal costs) :

$$p_i \left(1 - \frac{1}{\sigma}\right) = c_i \quad \textbf{(5)}$$

with $c_i = K_i A_i^{-1} w_i^{\gamma_i} r_i^{1-\gamma_i}$.

When we combine expressions (3) and (5), the equilibrium sectoral demand/output of a representative sector in country i is produced :

$$X_i = \left(\frac{\sigma}{\sigma - 1}\right)^{-\sigma} c_i^{-\sigma} E^{\sigma} X^{1-\sigma} \quad \textbf{(6)}$$

In order to derive the conditional labour demand (l_i) of an individual firm, Shepard's lemma is applied to Equation 4:

$$l_i = K_i A_i^{-1} \gamma_i w_i^{\gamma_i - 1} r_i^{1-\gamma_i} x_i \quad \textbf{(7)}$$

Since firms within a sector are identical, total sectoral employment equals $L_i = n_i l_i$:

$$L_i = K_i A_i^{-1} \gamma_i w_i^{\gamma_i - 1} r_i^{1-\gamma_i} X_i \quad \textbf{(8)}$$

We get the labour demand of a representative sector by substituting Equation 6 into Equation 8 and using the expression for c_i :

$$\ln(L_i) = G_i + \sigma \ln(E) - (\sigma-1)\ln(X) - (\gamma_i(\sigma-1)+1)\ln(w_i) - (1-\gamma_i)(\sigma-1)\ln(r_i) + (\sigma-1)\ln(A_i) \quad \textbf{(9)}$$

with $G_i = (1-\sigma)\ln(K_i) + \ln(\gamma_i) - \sigma\ln(\sigma) + \sigma\ln(\sigma-1)$.

The export demand effect

In Equation 9, the variable E shows the effect of an expansion in world-wide expenditures on sectoral employment. An increase in this variable is expected to positively influence sectoral labour demand because $\sigma > 1$ in the theoretical model. In this paper, the variable E is related to the export demand effect and therefore, E is measured by total sectoral real exports (EXP).

The import competition effect

In the model, improved foreign competition is captured by an increase in the sectoral output of a foreign country j. The effect of increased foreign output on sectoral employment of country i is expressed by the aid of Equations 1 and 9 :

$$\frac{d\ln(L_i)}{d\ln(X_j)} = \frac{d\ln(L_i)}{d\ln(X)} \frac{d\ln(X)}{d\ln(X_j)} = -(\sigma-1)\frac{P_j X_j}{E} < 0 \quad \textbf{(10)}$$

The equation shows that this effect is negative. Moreover, the higher the foreign market share (as measured by P_jX_j / E), the stronger the negative impact on domestic sectoral employment. In empirical work, foreign import competition is measured by the import penetration ratio which is defined as imports divided by the difference between production and net exports : [M / Q - (X - M)]. Import penetration ratio is expressed by P_jX_j / E in the model.

The productivity-related and total effects of international trade on employment

In this theoretical model, A_i measures technology. As an indicator that captures the role of technology, Abraham and Brock use two productivity

variables in the regression equation for sectoral employment. The first variable used is value added per worker (VA), which reflects gains in average labour productivity. The other variable, total factor productivity (TFP), measures gains that raise productivity of all production factors. But since total factor productivity variable needs capital stock data and this data does not exist for Turkey, value added per worker (VA) is used for productivity in this paper. If $PROD_i$ represent the variable used to proxy the A_i-variable of Equation 9 :

$$(\sigma\text{-}1)\ln(A_i) = \lambda \ln(PROD_i) + \varepsilon_i \quad \textbf{(11)}$$

The sectoral employment equation based on Equations 9 and 11 is specified as:

$$\ln(EMPL_{it}) = \alpha_{i1} + \beta_1 \ln(EXP_{it}) + \chi_1 \ln(IMP_{it}) + \eta_1 \ln(WAGE_{it}) + \lambda_1 \ln(PROD_{it}) + u_{1it} \quad \textbf{(12)}$$

In this expression, i and t symbolize industry and time, respectively; u_{it} is the error term which represents a combination of the error term of expression (11) and the error term of Equation 12. This regression equation gives an estimate of the impact of productivity on employment which is one aspect of the productivity effect of international trade on employment.

The other aspect of the productivity effect of international trade on employment is the impact of trade integration on productivity. Therefore, productivity is regressed upon trade and other variables in the second equation:

$$\ln(PROD_{it}) = \alpha_{i2} + \beta_2 \ln(EXP_{it}) + \chi_2 \ln(IMP_{it}) + \delta_2 \ln(RD_{it}) + \phi_2 PAT_{it} + \varphi_2 \ln CAP_{it} + u_{2it} \quad \textbf{(13)}$$

In Equation 13, regression coefficients for the export and import variables are important. These coefficients can be positive or negative depending on whether companies succeed to improve productivity when they meet international competition or they endeavour to restructure inside instead. The other variables in the equation 13 are described as follows :

CAP : capital stock per employee. It is included because labour-saving technologies are usually accompanied by investment in new machinery. Because of the lack of capital stock data for Turkey, the gross investment expenditures in tangible goods (INV) per worker in the manufacturing industry are used instead in this study.

RD : Research and Development (R&D) expenditures per employee which is the indicator of innovation and

PAT : the relative granted patents which are a measure for innovative output.

Combining these two aspects yields the productivity effects of international trade on employment. For this purpose, Equation 13 is substituted into Equation12 :

$$\ln(EMPL_{it}) = \alpha_i + \beta\ln(EXP_{it}) + \chi\ln(IMP_{it}) + \eta\ln(WAGE_{it}) + \varphi\ln(CAP_{it}) + \delta\ln(RD_{it}) + \phi PAT_{it} + u_{it} \quad (14)$$

$\alpha_i = \alpha_{i1} + \lambda_1 \alpha_{i2}$, $\beta = \beta_1 + \lambda_1 \beta_2$, $\chi = \chi_1 + \lambda_1 \chi_2$, $\eta = \eta_1$, $\phi = \lambda_1 \phi_2$, $\delta = \lambda_1 \delta_2$, $\varphi = \lambda_1 \varphi_2$ and $u_{it} = u_{1it} + u_{2it}$.

In this equation, an increase in export demand affects employment via an increase in productivity, which is equal to $\lambda_1 \beta_2$. Similarly, $\lambda_1 \chi_2$ refers to the productivity effect of increased import competition on employment. Equation 14 also produces the total impact of export demand and import competition on employment as measured by the β and χ parameters, respectively. This total effect for export (β) is the sum of the export demand effect, β_1 , and the productivity effect of exports on employment, $\lambda_1 \beta_2$. Similarly, total impact of import competition on trade (χ) consists of the direct (χ_1) and the productivity induced effects ($\lambda_1\chi_2$) of import competition on sectoral employment.

IV. EMPIRICAL ANALYSIS

EMPIRICAL MODEL AND DATA DESCRIPTION

The effects of international trade and productivity (technology) on the sectoral employment in the manufacturing industry of Turkey is measured for the time period of 2003-2010. For this purpose, two regression equations explained above are estimated :

$$\ln(EMP_{it}) = \alpha_{i1} + \beta_1 \ln(EXP_{it}) + \chi_1 \ln(IMP_{it}) + \eta_1 \ln(WAGE_{it}) + \lambda_1 \ln(PROD_{it}) + u_{1it} \quad (12)$$

$$\ln(PROD_{it}) = \alpha_{i2} + \beta_2 \ln(EXP_{it}) + \chi_2 \ln(IMP_{it})) + \varphi_2 \ln(INV_{it}) + \delta_2 \ln(RD_{it}) + \phi_2 PAT_{it} + u_{2it} \quad (13)$$

While in the first equation, the effects of international trade (export

and import) and productivity on sectoral employment are investigated, the second equation estimates the effects of international trade on productivity. This equation also includes investment and research-development expenditures with the relative number of patents given to the sectors in the manufacturing industry, which show the impact of technological innovations on productivity.

In the equations above,

EMP : the number of persons employed in the sectors of the manufacturing industry (i and t refer respectively to industry and time).

The data for employment include annual average number of employees at work as well as self employed and partners, unpaid family workers and apprentices.

EXP : sectoral real exports which shows the export demand effect.

IMP : import penetration ratio which is defined as real imports divided by the difference between sectoral real production and sectoral real net exports. Import competition is measured by the import penetration.

WAGE : Real wages and salaries paid per person employed in the manufacturing industry.

The data for wage covers total provisions, as cash or in kind, paid all people working during the account period in exchange for the business (including the persons working at home).

PROD : Labour productivity which is measured by the value added at factor cost per person employed in the manufacturing industry.

The data for value added at factor cost show gross income obtained from business activities after the corrections in business subsidies and indirect taxes.

INV[1] : Gross investment expenditures in tangible goods per person employed in the manufacturing industry.

1 Abraham and Brock use capital stock per employee in order to measure the effect of labour-saving technologies on employment. Because of the lack of capital stock data for Turkey, the gross investment expenditures in tangible goods per worker in the manufacturing industry are used instead in this study.

RD : Research and Development Expenditures per person employed in the manufacturing industry.

PAT : The number of relative granted patents given to the sectors in the manufacturing industry.

Relative granted patents are the number of granted patents in one industry for a certain year relative to the total granted patents in that year.

The data for employment, export, import, labour cost, production, value added and investment are obtained from the Turkish Statistical Institute (TUIK) Databases for Annual Industry And Service Statistics and Foreign Trade Statistics. The data for research and development are from the OECD Stan Database for R&D expenditures in Industry and the data for patent variable come from the Turkish Patent Institute Statistics.

Except for relative granted patents, all variables are expressed in constant prices and in logaritms. The deflators used for all variables, except for foreign trade variables, are sectoral producer price indexes (PPI); export and import variables are deflated by using export and import unit value indexes.

This data set covers 20 sectors in Turkish manufacturing industry which are classified according to the "Statistical Classification of Economic Activities in the European Community" (NACE), Revision 2.[2] The differences between data series on the classification are solved by the aid of correspondence tables of Eurostat and Turkish Statistical Institute.

Because of the difficulties in obtaining data, the study covers the years from 2003 to 2010.

2 The sectors according to the NACE Rev.2 classification are: Manufacture of food products and beverages (10+11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture (16), Manufacture of paper and paper products (17), Printing and reproduction of recorded media (18), Manufacture of coke and refined petroleum products (19), Manufacture of chemicals, chemical products and Manufacture of basic pharmaceutical products and pharmaceutical preparations (20+21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metals (24), Manufacture of fabricated metal products, except machinery and equipment (25), Manufacture of computer, electronic and optical products (26), Manufacture of electrical equipment (27), Manufacture of machinery and equipment n.e.c (28), Manufacture of motor vehicles, trailers and semi-trailers (29), Manufacture of other transport equipment (30), Manufacture of furniture and Other manufacturing (31+32).

Descriptive statistics for all the variables used in estimations are presented sector by sector in the Appendix.

ECONOMETRIC METHODOLOGY

The employment and productivity equations (Equation 12 and 13) are estimated by using panel data techniques. The empirical analysis of the 20 sectors of Turkish manufacturing industry during 2003 to 2010 constitutes 160 observations.

In this model, employment (or labour demand) is explained by export demand, import penetration, wage per person employed and productivity that is measured by value added per person employed (Equation 12). Employment equation estimates the direct impact of export demand (β_1) and import competition (χ_1) on the sectoral employment in the manufacturing industry of Turkey. This regression equation also estimates the effect of productivity (λ_1) on employment which is one aspect of the productivity effect of international trade on employment.

On the other hand, productivity is explained by export demand, import penetration, investment expenditures per person employed, research&development expenditures per person employed and relative granted patents (Equation 13). The important point here is the impact of trade integration on productivity which is the other aspect of the productivty effect of international trade on employment. The coefficients for the export (β_2) and import (χ_2) that shows the impact of trade integration on productivity can be positive or negative. If the companies faced with international competition improve productivity successfully, this impact becomes positive whereas it can be negative if they prefer to struggle with internal structuring instead (Abraham and Brock, 2003, p.226).

The other variables in the productivity equation are used for measuring the effect of the changes in investment expenditures that affect capital stock finally, of new technologies and innovations on productivity.

The equations above show that the productivity equation does not contain any endogenous variables from the labour demand equation, while this latter equation contains endogenous variables coming from the former equation. More specifically, the productivity that is an exogenous

explanatory variable in the employment equation, is explained by a set of exogenous explanatory variables in the second equation, which means that it is also an endogenous variable in the second equation. Following Abraham and Brock, a two stage least squares approach is used in order to capture in the employment equation only the productivity changes that are explained by export demand, import penetration and technology variables (Abraham and Brock, 2003, p.227).

For this purpose, the fitted values of the productivity variable obtained by the estimation of the second equation are substituted into the first Equation. In other words, productivity variable is used as an instrumental variable in the first equation.

But before estimating these equations, various econometric tests are applied to determine first - whether individual and time effects exist and second - fixed or random effect approach is appropriate for these two equations (Baltagi, 2005; Hill, Griffiths and Guay, 2011; Greene, 2003; Tatoğlu, 2012). After F, likelihood-ratio (LR), Breusch-Pagan Lagrangian Multiplier (LM) and Score tests are applied, both individual and time effects are identified for the productivity equation. As a result of Hausman test, fixed effects is found to be more appropriate than random effects.

Then, productivity equation is estimated by Least Squares and the fitted values of productivity variable (dependent variable of this equation) are determined. These fitted values are substituted into the employment equation. Before estimating this equation, the same tests determining individual-time effects and fixed-random effects are applied. Fixed individual effects approach is decided for employment equation.

After productivity equation and employment equation with the fitted values of the productivity variable are estimated separately, the necessary tests are run to detect heteroscedasticity, otocorrelation and crosssection correlation for each equation and remedial measures are taken. The explanations about these tests take place in the end of every table.

For both tests and estimations, STATA and E-Views programmes are used and the estimation results are checked mutually.

V. ESTIMATION RESULTS

TRADE AND EMPLOYMENT

$$\ln(EMP_{it}) = \alpha_{i1} + \beta_1 \ln(EXP_{it}) + \chi_1 \ln(IMP_{it}) + \eta_1 \ln(WAGE_{it}) + \lambda_1 \ln(PROD_{it}) + u_{1it} \quad \textbf{(12)}$$

The first topic of this paper is the relationship between international trade and sectoral employment in the manufacturing industry of Turkey.

The estimated results in **Table 1** for the export demand, import penetration and labour cost are significant and have the theoretically expected signs. The regression coefficients for export demand (β_1), import penetration (χ_1) and labour cost (η_1) are 0.23, -0.33 and -0.17 respectively. While export demand affects sectoral employment in the manufacturing industry of Turkey positively, import competition makes a negative affect on it. The negative sign before labour cost variable, which is measured by the wage paid per person employed in this study, shows the negative relationship between labour demand and wages.

According to these findings, as 1% increase in export demand causes sectoral employment to increase by 0.23 %, the same amount of increase in import competition causes a 0.33 % decrease in sectoral employment (Table 1).

The productivity variable in the employment equation is obtained from the second equation; after this equation is estimated, employment equation is estimated where the productivity variable is instrumented by using the fitted values from the productivity regression. This variable shows the response of employment to productivity changes. The impact of productivity on employment is one aspect of the productivity effect of international trade on employment.

However, the estimation results show that productivity variable does not make a significant effect on employment in the Turkish manufacturing industry. The coefficient before productivity is very small and also insignificant. This result suggests that productivity variable, which is measured by value added per person employed in this study, does not make a statistically significant effect on sectoral employment.

Table 1: The Regression Results of the Employment Equation

$\ln(EMP_{it}) = \alpha_{i1} + \beta_1 \ln(EXP_{it}) + \chi_1 \ln(IMP_{it}) + \eta_1 \ln(WAGE_{it}) + \lambda_1 \ln(PROD_{it}) + u_{1it}$

Method: Fixed-effects regression
Cross-section fixed (dummy variables)[1]
Sample: 2003 2010
Periods included: 8
Cross-sections included: 20
Total panel (balanced) observations: 160
Regression with Driscoll-Kraay standard errors[2]

Variable	Coefficient	Drisc/Kraay Std. Error	t-Value	p-value
Constant	7.011755***	1.539272	4.56	0.000
ln (EXP)	0.229402***	0.0777562	2.95	0.008
ln (IMP)	-0.331375***	0.0859224	-3.86	0.001
ln (WAGE)	-0.166796*	0.0808731	-2.06	0.053
ln (PROD)	0.046587	0.1140017	0.41	0.687
within R^2 : 0.1748				

*** Significance at the 1 % level ; *Significance at the 10 % level.

Notes :**1.** As a result of the various tests used in order to determine the correct estimation method **-** F, likelihood-ratio (LR), Lagrangian Multiplier (LM), Score and Hausmann tests **-**, fixed individual effects method is found to be appropriate. **2.** The problems of heteroscedasticity, otocorelation and cross sectional correlation which have been detected by the relevant tests (**-**Modified Wald test for **heteroscedasticity** , **-**Durbin Watson test of Bhargava, Franzini and Narendranathan with LBI test of Baltagi-Wu for **otocorrelation** and Breusch-Pagan Lagrange Multiplier test with the tests of Pesaran, Friedman and Frees for **cross sectional correlation**) in the employment model are corrected by **Driscoll and Kraay Estimator**.

TRADE AND PRODUCTIVITY

$$\ln(PROD_{it}) = \alpha_{i2} + \beta_2 \ln(EXP_{it}) + \chi_2 \ln(IMP_{it})) + \varphi_2 \ln(INV_{it}) + \delta_2 \ln(RD_{it}) + \phi_2 PAT_{it} + u_{2it} \quad \textbf{(13)}$$

While the impact of productivity on employment is one aspect of the productivity effect of international trade on employment, the other aspect of this effect concerns the impact of trade integration on productivity. Therefore, a second equation is introduced where productivity is regressed on trade and other variables.

In the analysis of these effects, one important point is related to the impact of exports and imports on productivity. This impact can be positive or negative depending on the behaviour of companies facing

with international competition about improving productivity successfully instead of struggling with internal restructuring (Abraham and Brock, 2003, p. 226).

The regression results of the productivity equation are given in **Table 2**. One unexpected result is about the relationship between exports and productivity: This result displays that export demand is not a statistically significant source of productivity in the manufacturing industry of Turkey. The regression coefficients for export demand variable (β_2) are always statistically insignificant. This result implys that the increases in export demand do not make a positive contribution to labour productivity (value added per person employed) in the Turkish manufacturing industry.

On the other hand, the productivity effect of import penetration is very strong and statistically significant. The coefficient for import penetration (χ_2) is -1.19 (**Table 2**). The large and negative coefficient before import competition variable suggests that increased import competition causes a loss in productivity in Turkey's manufacturing industry. This supports the view that restructuring is a difficult process in Turkey as well as in Europe: Companies going through rising foreign competition that reduces their sales are unable to scale down their factor use at the same rate (Abraham and Brock, 2003, p.229).

As Lawrence (2000) and Bernard and Jensen (1999 and 2001) point out, the relationship between international trade and productivity can work in both directions. On the one hand, import and export competition can lead to higher productivity, sectors confronted with growing productivity may tend to have high levels of exports on the other.

As to the other independent variables in the productivity equation, research- development and investment expenditures per worker have always positive impact on the productivity of the manufacturing industry of Turkey. The coefficients for these variables are statistically significant. The last independent variable in this equation, which shows the relative numbers of patents given to the sectors, has an unexpected sign. Actually, patent variable does not seem to make a sound effect on the Turkish manufacturing industry.

In order to check the robustness of the results of productivity equation,

the lagged values of trade and other variables are used. This clearly leads to lower significance of the trade and research development variables in the productivity equation with high standard errors.

In the light of these estimations, it is possible to conclude that the main contributors of productivity in the manufacturing industry of Turkey are new investments and new technologies produced in the related sectors.

Table 2: The Regression Results of the Productivity Equation

$$\ln(PROD_{it}) = \alpha_{i2} + \beta_2 \ln(EXP_{it}) + \chi_2 \ln(IMP_{it})) + \varphi_2 \ln(INV_{it}) + \delta_2 \ln(RD_{it}) + \phi_2 PAT_{it} + u_{2\,it}$$

Method: Fixed-effects regression
Cross-section fixed (dummy variables)[1]
Period fixed (dummy variables)[1]
Sample: 2003 2010
Periods included: 8
Cross-sections included: 20
Total panel (balanced) observations: 160
(Std. Err. adjusted for 20 clusters in id)[2]

Variable	Coefficient	Robust Std. Error	t-Value	p-value
Constant	3.901547	4.378516	0.89	0.384
ln (EXP)	0.072647	0.196934	0.35	0.716
ln (IMP)	-1.188928***	0.330880	-3.59	0.002
ln (INV)	0.323002***	0.113221	2.85	0.010
ln (RD)	0.115033***	0.036694	3.13	0.005
PAT	-3.393357	3.173467	-1.07	0.298
within R^2 : 0.8743				

*** Significance at the 1 % level.

Notes :**1.** As a result of the various tests used in order to determine the correct estimation method **-** F, likelihood-ratio (LR), Lagrangian Multiplier (LM), Score and Hausmann tests **-**, both fixed individual and fixed time effects are found. **2.** The problems of heteroscedasticity and otocorrelation which have been detected by the relevant tests (**-**Modified Wald test for **heteroscedasticity** , -Durbin Watson test of Bhargava, Franzini and Narendranathan with LBI test of Baltagi-Wu for **otocorelation**) in the productivity model are corrected by **Arellano, Froot and Rogers Estimator**.

Productivity Related And Total Effects of International Trade on Employment

Combining two aspects of this model produces the productivity effects of international trade on employment. When we substitute productivity equation into employment equation :

$$\ln(EMP_{it}) = \alpha_i + \beta \ln(EXP_{it}) + \chi \ln(IMP_{it}) + \eta \ln(WAGE_{it}) + \varphi \ln(INV_{it}) + \delta \ln(RD_{it}) + \phi PAT_{it} + u_{it} \quad \textbf{(14)}$$

$\alpha_i = \alpha_{i1} + \lambda_1 \alpha_{i2}$, $\beta = \beta_1 + \lambda_1 \beta_2$, $\chi = \chi_1 + \lambda_1 \chi_2$, $\eta = \eta_1$, $\phi = \lambda_1 \phi_2$, $\delta = \lambda_1 \delta_2$, $\varphi = \lambda_1 \varphi_2$ and $u_{it} = u_{1it} + u_{2it}$.

This equation produces the productivity effect of international trade on employment by combining the effect of productivity (λ_1) on employment with the effect of trade integration (β_2 and χ_2) on productivity.

In this equation, the total impact of export demand on employment is measured by the β coefficient which is the sum of the direct effect of export demand on employment (β_1) and the effect of an increase in export demand on employment that occurs via an increase in productivity ($\lambda_1\beta_2$). Similarly, χ refers to the total impact of import competition on employment and consists of the direct (χ_1) and the productivity induced effects ($\lambda_1 \chi_2$) of import competition on sectoral employment.

The estimation results of Equation 14 are summarized in **Table 3**. Actually, the estimations here are the combination of the results exhibited in Table 1 and Table 2 since the Equation 14 is the substitution of Equation 13 into Equation 12. Both trade variables and technology variables are similar in terms of their sign, size and statistical significance.

Table 3: The Regression Results of the Employment Equation (Equation 14)

$\ln(EMP_{it}) = \alpha_i + \beta \ln(EXP_{it}) + \chi \ln(IMP_{it}) + \eta \ln(WAGE_{it}) + \varphi \ln(INV_{it}) + \delta \ln(RD_{it}) + \phi PAT_{it} + u_{it}$

Method: Fixed-effects regression
Cross-section fixed (dummy variables)[1]
Sample: 2003 2010
Periods included: 8
Cross-sections included: 20
Total panel (balanced) observations: 160
Regression with Driscoll-Kraay standard errors[2]

Variable	Coefficient	Drisc/Kraay Std. Error	t-Value	p-value
Constant	8.299488***	1.437506	5.77	0.000
ln (EXP)	0.196992***	0.056540	3.48	0.002
ln (IMP)	-0.447188***	0.086876	-5.15	0.000
ln (WAGE)	-0.295650***	0.057567	-5.14	0.000
ln (INV)	0.066154***	0.009962	6.64	0.000
ln (RD)	0.055108***	0.017596	3.13	0.005
ln (PAT)	1.171611	0.976793	1.20	0.245
within R^2 : 0.2952				

*** Significance at the 1 % level.

Notes :**1.** As a result of the various tests used in order to determine the correct estimation method **-** F, likelihood-ratio (LR), Lagrangian Multiplier (LM), Score and Hausmann tests **-**, fixed individual effects method are found. **2.** The problems of heteroscedasticity, otocorrelation and cross sectional correlation which have been detected by the relevant tests (**-**Modified Wald test for **heteroscedasticity** , **-**Durbin Watson test of Bhargava, Franzini and Narendranathan with LBI test of Baltagi-Wu for **otocorrelation** and Breusch-Pagan Lagrange Multiplier test with the tests of Pesaran, Friedman and Frees for **cross sectional correlation**) in the employment model are corrected by **Driscoll and Kraay Estimator**.

In the **Tables 4 and 5** below, direct and productivity-related employment effects of export demand and import competition are calculated by the aid of the parameter coefficients produced by employment and productivity equations. The first columns in the tables come from **Table 1**, which show the estimated values for export demand (β_1) and import competition (χ_1) in the employment equation. The second columns show the elasticities that measure the productivity effect of exports and import competition on employment; these values are computed from the parameter values for productivity variable (λ_1) in the employment equation (**Table 1**) and from the parameter values for export demand (β_2) and import competition (χ_2)

variables in the productiviy equation (**Table 2**). Finally, the last columns in the tables show the total elasticities of export demand and import competition on employment, which are calculated by summing up the figures in the previous two columns.

Since there is not a significant relationship between export demand and productivity in the Turkish manufacturing industry according to our estimations, productivity related effects of exports on employment are ignorable. Actually, total effect in the table below is mainly the result of the direct effect of export demand on employment, which is positive and statistically significant (**Table 4**).

Table 5 below gives the direct and indirect effects of import competition on employment. The productivity related effect of import penetration is statistically significant and negative. As the productivty related effect is not estimated directly, statistical significance can not be calculated and reported. Although the robustness of this estimation is open to discussion, it is possible to conclude that increasing import competition results in decreasing jobs in the manufacturing industry of Turkey when we take into consideration the direct employment and productivity effects of import competition (χ_1 and χ_2 parameters).

The coefficient values displaying the total effects of export and import calculated by using the estimated coefficients of Equation 12 and 13 are in harmony with those estimated by Equation 14.

The calculated coefficient for export in **Table 4** is 0.2328 whereas the estimated value for it in **Table 3** is 0.1970. The calculated coefficient for import is -0.3868 in **Table 5** but the estimated value for it in **Table 3** is -0.4472. The results are rather close.

Table 4: The Productivity And Total Effects of Exports on Employment

$$\beta = \beta_1 + \lambda_1 \beta_2$$

Export Demand Effect β_1	Productivity-Related Effect $\lambda_1 \beta_2$	Total Effect β
0.2294	**0.0034**	**0.2328**

Source : Tables 1 and 2.

Table 5: The Productivity And Total Effects of Import Competition on Employment

$$\chi = \chi_1 + \lambda_1 \chi_2$$

Import Competition Effect χ_1	Productivity-Related Effect $\lambda_1 \chi_2$	Total Effect χ
-0.3314	**-0.0554**	**-0.3868**

Source : Tables 1 and 2.

IV. CONCLUSION

This paper investigates the sectoral employment effects of international trade and productivity in the manufacturing industry of Turkey. There are several important conclusions of this study:

First of all, international trade is effective on sectoral employment in the Turkish manufacturing industry. Our empirical results show that both export demand and import penetration have a significant impact on sectoral employment in Turkey. While the increase in export demand leads to an increase in labour demand, the incerase in import penetration reduces it.

Secondly, the relationship between productivity and international trade does not make any contribution to sectoral employment. Our findings suggest that export demand is not a determinant of productivity, but import competition and productivity are related. The strong negative relationship between import competition and productivity, measured by value added per worker, suggests that firms, when faced with international competition, can not adjust the level of employment to decreased demand. This result is similar to the findings of Abraham and Brock who explain it by the rigid labour markets in Europe constrained by strict hiring and firing conditions (Abraham and Brock, s.232).

Third, the main determinants of productivity in the Turkish manufacturing industry are investment and research&development expenditures. The productivity equation shows that these variables are always positive and statistically significant.

Fourth, the findings suggest that there is not a statistically significant relationship between productivity and sectoral employment in the Turkish manufacturing industry. The effect of productivity on employment comes from import demand and this relationship is negative. However, when we combine the direct effects of trade on employment and productivity, total productivity effect on employment does not seem to be significant.

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APPENDIX

DESCRIPTIVE STATISTICS FOR THE SECTORS IN THE MANUFACTURING INDUSTRY OF TURKEY (NACE REV.2 CLASSIFICATION)

Manufacture of food products and beverages				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	317614	275773	384484	36164
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	8.536,30	7.746,75	9.188,14	479,69
REAL SECTORAL PRODUCTION (TL)	40.437.478.243	34.069.239.629	48.459.886.687	4.739.517.273
REAL VALUE ADDED PER EMPLOYEE (TL)	21.899,76	19.343,80	26.791,14	2.322,49
REAL EXPORT (TL)	5.976.242.433	4.589.280.713	7.025.379.099	763.758.036
REAL IMPORT (TL)	3.439.749.197	2.601.955.468	3.980.786.371	505.866.724
NET REAL EXPORTS Real Export- Real Import (TL)	2.536.493.236	1.987.325.245	3.137.088.010	427.476.315
IMPORT PENETRATION RATIO - Real Import / Real Production - Net Real Exports	0,09059	0,08110	0,09892	0,00634
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	7.778,84	5.897,98	11.498,40	1.863,54
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	105,00	62,70	149,80	28,28
RELATIVE GRANTED PATENTS	0,0204	0,0184	0,0230	0,0017

Manufacture of tobacco products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	18056	6758	22418	5017
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	26.119,79	20.288,88	43.611,47	7.412,78
REAL SECTORAL PRODUCTION (TL)	2.816.737.164	2.594.845.459	3.163.127.025	197.142.133
REAL VALUE ADDED PER EMPLOYEE (TL)	52.434,29	35.140,88	108.429,56	23.722,11
REAL EXPORT (TL)	209.666.491	112.007.826	299.702.911	68.167.553
REAL IMPORT (TL)	335.574.139	290.528.855	385.050.494	35.389.917
NET REAL EXPORTS Real Export- Real Import (TL)	-125.907.647	-209.732.328	-64.413.039	47.756.541
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,11460	0,09289	0,14367	0,01543
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	27.841,55	6.811,79	56.281,76	19.158,27
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	37,31	0,00	71,19	28,10
RELATIVE GRANTED PATENTS	0,0026	0,0013	0,0038	0,0008

Manufacture of textiles				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	376024	282459	409128	46105
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	7.130,80	5.907,32	7.661,48	583,03
REAL SECTORAL PRODUCTION (TL)	29.703.177.827	22.970.202.733	32.651.021.199	3.009.135.672
REAL VALUE ADDED PER EMPLOYEE (TL)	17.379,88	14.979,80	19.548,89	1.486,92
REAL EXPORT (TL)	9.183.990.016	7.496.010.672	10.217.572.581	955.993.616
REAL IMPORT (TL)	5.381.945.425	4.527.738.909	6.391.754.822	680.181.338
NET REAL EXPORTS Real Export- Real Import – (TL)	3.802.044.591	2.968.271.763	4.563.223.620	530.903.285
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,21034	0,16425	0,25746	0,03371
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	9.777,37	4.920,87	31.810,75	8.968,12
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	73,15	28,49	125,21	32,48
RELATIVE GRANTED PATENTS	0,0074	0,0051	0,0111	0,0019

Manufacture of wearing apparel				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	388239	348559	409795	19740
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	6.184,66	4.669,63	7.760,84	926,04
REAL SECTORAL PRODUCTION (TL)	22.774.732.487	19.955.323.257	27.153.960.323	2.114.976.331
REAL VALUE ADDED PER EMPLOYEE (TL)	12.028,67	10.124,87	14.702,68	1.458,06
REAL EXPORT (TL)	14.636.152.776	13.451.019.729	15.984.901.621	716.948.204
REAL IMPORT (TL)	1.558.686.620	599.887.365	2.892.723.803	783.846.483
NET REAL EXPORTS Real Export- Real Import – (TL)	13.077.466.156	11.288.975.451	14.357.336.074	1.164.443.957
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,15272	0,10216	0,18914	0,03813
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	2.547,86	1.843,62	3.251,46	502,48
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	11,68	0,00	26,56	12,66
RELATIVE GRANTED PATENTS	0,0047	0,0037	0,0065	0,0009

Manufacture of leather and related products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	48621	41523	55550	4492
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	5.059,98	3.954,67	6.098,72	695,06
REAL SECTORAL PRODUCTION (TL)	2.826.284.094	2.473.520.854	3.271.811.230	298.277.651
REAL VALUE ADDED PER EMPLOYEE (TL)	12.252,35	10.799,35	14.689,98	1.417,40
REAL EXPORT (TL)	521.653.194	422.708.147	675.535.870	89.632.402
REAL IMPORT (TL)	1.149.842.696	804.361.594	1.392.228.390	224.936.462
NET REAL EXPORTS Real Export- Real Import – (TL)	-628.189.503	-817.881.499	-376.775.227	159.621.373
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,33073	0,28220	0,37745	0,03479
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	2.937,77	2.053,81	4.638,64	788,83
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	24,13	0,00	82,43	32,60
RELATIVE GRANTED PATENTS	0,0036	0,0024	0,0059	0,0011

Manufacture of wood and of products of wood and cork, except furniture				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	67075	52548	72669	7332
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	3.577,78	2.689,54	5.340,95	867,93
REAL SECTORAL PRODUCTION (TL)	3.814.548.582	2.095.929.201	5.215.790.191	1.103.191.991
REAL VALUE ADDED PER EMPLOYEE (TL)	11.778,27	9.593,20	15.904,73	2.322,63
REAL EXPORT (TL)	426.124.658	219.044.802	647.416.308	145.252.349
REAL IMPORT (TL)	787.475.933	357.910.822	1.026.819.525	230.908.872
NET REAL EXPORTS Real Export- Real Import – (TL)	-361.351.275	-517.443.464	-138.866.020	145.530.884
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,18814	0,16015	0,21380	0,01864
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	6.349,62	4.711,17	8.287,98	1.061,13
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	9,74	0,00	30,70	11,53
RELATIVE GRANTED PATENTS	0,0035	0,0030	0,0042	0,0004

Manufacture of paper and paper products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	38689	30141	45087	4812
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	12.911,20	11.485,77	14.014,69	1.038,42
REAL SECTORAL PRODUCTION (TL)	6.003.311.124	3.814.289.946	8.045.869.504	1.326.202.998
REAL VALUE ADDED PER EMPLOYEE (TL)	31.666,91	28.815,42	35.735,52	2.406,93
REAL EXPORT (TL)	930.580.586	574.785.475	1.326.995.799	265.613.721
REAL IMPORT (TL)	2.929.404.837	1.995.220.832	3.772.732.722	564.819.100
NET REAL EXPORTS Real Export- Real Import – (TL)	-1.998.824.252	-2.445.736.924	-1.420.435.357	323.574.449
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,36702	0,35732	0,38676	0,01093
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	14.548,82	7.373,27	25.907,28	6.053,46
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	79,50	25,64	178,93	53,66
RELATIVE GRANTED PATENTS	0,0051	0,0030	0,0069	0,0012

Printing and reproduction of recorded media				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	58421	44079	70709	10097
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	6555.16	5492.14	7596.41	737.44
REAL SECTORAL PRODUCTION (TL)	4.012.117.511	2.779.173.397	4.951.955.646	879.936.356
REAL VALUE ADDED PER EMPLOYEE (TL)	17.426,24	12.999,35	23.400,37	3.832,55
REAL EXPORT (TL)	12.665.044	4.790.805	22.051.247	6.152.149
REAL IMPORT (TL)	43.586.572	34.251.082	54.126.622	7.227.254
NET REAL EXPORTS Real Export- Real Import – (TL)	-30.921.528	-37.922.893	-21.588.942	4.696.312
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,01141	0,00715	0,01791	0,00387
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	7.204,13	2.752,13	19.565,66	5.399,31
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	28,97	0,00	82,34	35,63
RELATIVE GRANTED PATENTS	0,0000	0,0000	0,0000	0,0000

Manufacture of coke and refined petroleum products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	6465	5998	6940	325
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	27.300,10	19.972,35	39.441,35	6.605,67
REAL SECTORAL PRODUCTION (TL)	9.299.163.592	7.408.626.401	10.318.444.638	1.084.635.216
REAL VALUE ADDED PER EMPLOYEE (TL)	148.519,99	94.693,66	245.428,46	52.257,70
REAL EXPORT (TL)	2.474.287.543	1.422.076.312	3.535.243.020	729.775.720
REAL IMPORT (TL)	5.994.789.429	4.166.340.303	8.535.295.719	170.3633.239
NET REAL EXPORTS Real Export- Real Import – (TL)	-3.520.501.886	-6.004.540.127	-2.362.449.645	1.441.097.089
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,46446	0,32911	0,63460	0,11506
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	89.373,68	14.607,70	414.170,44	136.759,68
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	79,45	0,00	607,72	213,67
RELATIVE GRANTED PATENTS	0,0026	0,0015	0,0039	0,0008

Manufacture of chemicals, chemical products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	85645	78865	92348	4586
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	23.650,95	20.752,23	27.890,05	2.653,59
REAL SECTORAL PRODUCTION (TL)	22.214.095.585	19.823.407.756	27.782.452.676	2.602.219.071
REAL VALUE ADDED PER EMPLOYEE (TL)	58.040,50	40.618,85	69.488,59	9.426,92
REAL EXPORT (TL)	4.117.781.401	2.870.811.729	5.617.475.571	862.469.308
REAL IMPORT (TL)	24.640.492.176	16.748.737.616	31.948.064.398	4.839.268.662
NET REAL EXPORTS Real Export- Real Import (TL)	-20.522.710.775	-26.330.588.827	-13.877.925.887	3.999.804.398
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,57291	0,49183	0,63381	0,04685
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	19.573,77	11.854,33	30.167,87	6.660,30
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	1.276,32	632,26	1.968,15	500,81
RELATIVE GRANTED PATENTS	0,1873	0,1450	0,2033	0,0195

Manufacture of rubber and plastic products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	127300	94639	159616	21907
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	8.420.46	7.049.21	9.782.16	792.03
REAL SECTORAL PRODUCTION (TL)	13.354.462.734	9.008.140.434	17.762.372.147	2.791.057.629
REAL VALUE ADDED PER EMPLOYEE (TL)	23.124,59	20.468,62	26.831,00	2.294,29
REAL EXPORT (TL)	3.718.738.137	2.197.323.995	5.064.708.482	970.123.042
REAL IMPORT (TL)	3.024.154.392	2.149.747.086	3.653.264.630	511.248.773
NET REAL EXPORTS Real Export- Real Import (TL)	694.583.744	8.264.469	1.411.443.852	535.734.172
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,23972	0,22343	0,26399	0,01341
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	13.378,28	8.336,48	31.957,05	7.855,84
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	247,40	195,17	288,66	29,83
RELATIVE GRANTED PATENTS	0,0644	0,0572	0,0703	0,0046

Manufacture of other non-metallic mineral products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	160115	116896	192095	25512
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	8.317,79	7.933,84	8.799,74	304,25
REAL SECTORAL PRODUCTION (TL)	14.279.785.698	11.105.201.546	17.120.793.499	2.070.733.186
REAL VALUE ADDED PER EMPLOYEE (TL)	25.880,06	22.808,56	29.576,37	2.688,75
REAL EXPORT (TL)	3.629.366.132	2.682.103.123	4.555.365.465	648.753.251
REAL IMPORT (TL)	1.371.409.559	777.617.089	1.772.030.705	370.229.347
NET REAL EXPORTS Real Export- Real Import (TL)	2.257.956.574	1.474.282.032	3.072.968.717	550.530.900
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,11225	0,08452	0,12804	0,01470
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	11.773,28	7.073,72	22.612,79	4.955,19
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	168,43	146,66	218,74	24,45
RELATIVE GRANTED PATENTS	0,0559	0,0514	0,0642	0,0047

Manufacture of basic metals				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	91650	73288	102833	10745
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	12.293,76	10.081,10	14.695,03	1.485,66
REAL SECTORAL PRODUCTION (TL)	23.460.511.604	18.443.291.891	28.295.921.193	3.642.338.469
REAL VALUE ADDED PER EMPLOYEE (TL)	42.533,51	27.823,32	57.128,62	10.207,41
REAL EXPORT (TL)	9.123.995.305	5.813.609.206	13.818.249.555	2.785.265.539
REAL IMPORT (TL)	13.204.545.645	10.259.432.036	16.594.838.912	2.164.282.290
NET REAL EXPORTS Real Export- Real Import – (TL)	-4.080.550.340	-7.453.892.287	3.558.817.519	3.753.009.694
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,48072	0,41799	0,52221	0,03076
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	23.481,86	8.381,09	64.796,46	17.694,29
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	100,81	63,70	137,49	28,14
RELATIVE GRANTED PATENTS	0,0183	0,0149	0,0214	0,0025

Manufacture of fabricated metal products, except machinery and equipment				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	200160	131860	251936	41110
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	5.317,55	4.750,19	6.337,92	486,51
REAL SECTORAL PRODUCTION (TL)	11.735.776.505	7.783.006.940	15.180.077.532	2.310.609.083
REAL VALUE ADDED PER EMPLOYEE (TL)	12.931,19	11.310,95	14.955,80	1.319,91
REAL EXPORT (TL)	3.678.635.849	2.408.249.596	4.704.984.689	789.230.221
REAL IMPORT (TL)	3.290.902.191	2.153.724.819	4.118.764.210	667.341.658
NET REAL EXPORTS Real Export- Real Import – (TL)	387.733.658	144.313.397	888.973.046	265.661.873
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,28985	0,27083	0,31702	0,01521
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	4.490,94	3.074,45	7.553,07	1.347,89
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	107,10	53,50	360,71	105,69
RELATIVE GRANTED PATENTS	0,0730	0,0623	0,0942	0,0109

Manufacture of computer, electronic and optical products				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	19316	12600	26130	5236
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	14.055,40	6.547,29	27.103,31	7.080,50
REAL SECTORAL PRODUCTION (TL)	3.172.894.892	1.200.663.528	6.539.703.877	2.094.678.043
REAL VALUE ADDED PER EMPLOYEE (TL)	35.635,92	24.214,48	67.176,43	16.953,52
REAL EXPORT (TL)	2.514.565.421	1.072.656.975	4.108.654.633	1.245.811.275
REAL IMPORT (TL)	12.129.801.786	7.613.607.990	14.776.353.104	2.279.609.342
NET REAL EXPORTS Real Export- Real Import – (TL)	-9.615.236.365	-13.703.696.129	-4.525.441.774	3.230.640.313
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	1,03479	0,71580	1,35314	0,25475
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	7.461,18	2.542,24	12.200,02	3.010,72
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	3.282,72	187,94	17.428,29	5.907,55
RELATIVE GRANTED PATENTS	0,0967	0,0816	0,1152	0,0131

Manufacture of electrical equipment				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	93927	70757	116389	14532
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	8,818,84	14,22	15.851,46	7.340,12
REAL SECTORAL PRODUCTION (TL)	8.808.253.771	17.244.038	17.264.517.035	7.554.768.650
REAL VALUE ADDED PER EMPLOYEE (TL)	21.422,67	30,82	37.411,88	17.856,49
REAL EXPORT (TL)	6.733.704.713	3.546.569.684	9.369.159.863	2.155.421.859
REAL IMPORT (TL)	8.408.084.933	3.353.245.275	12.101.676.154	3.101.187.105
NET REAL EXPORTS Real Export- Real Import – (TL)	-1.674.380.220	-2.832.598.390	193.324.409	1012140899
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	2,16441	0,34025	5,71864	2,40949
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	5.473,14	7,82	11.016,06	4.809,17
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	1.185,93	1,42	2.684,99	1.061,17
RELATIVE GRANTED PATENTS	0,0560	0,0512	0,0642	0,0044

Manufacture of machinery and equipment n.e.c				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	175025	132844	232936	33441
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	9.282,67	8.087,70	10.085,79	605,69
REAL SECTORAL PRODUCTION (TL)	16.504.978.084	10.287.833.462	22.064.385.205	4.196.470.071
REAL VALUE ADDED PER EMPLOYEE (TL)	23.309,23	21.390,21	25.522,50	1.662,68
REAL EXPORT (TL)	4.409.268.225	2.360.871.905	6.017.975.473	1.309.140.371
REAL IMPORT (TL)	17.420.311.053	11.449.996.947	21.841.614.669	3.676.004.148
NET REAL EXPORTS Real Export- Real Import – (TL)	-13.011.042.827	-16.625.983.387	-9.089.125.042	2.611.128.833
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,59500	0,51889	0,74344	0,08337
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	7.586,58	4.387,09	16.561,02	3.745,34
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	706,73	390,45	952,10	197,94
RELATIVE GRANTED PATENTS	0,2893	0,2731	0,3194	0,0162

Manufacture of motor vehicles, trailers and semi-trailers				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	119788	84315	136278	18367
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	17.602,90	14.360,30	20.584,03	2.076,25
REAL SECTORAL PRODUCTION (TL)	29.171.738.668	17.330.239.900	35.421.192.989	5.957.315.299
REAL VALUE ADDED PER EMPLOYEE (TL)	50.282,51	43.715,01	61.663,49	5.999,57
REAL EXPORT (TL)	15.604.246.406	8.258.238.287	21.160.283.019	4.314.813.258
REAL IMPORT (TL)	16.491.429.601	9.639.521.020	20.090.227.751	3460091228
NET REAL EXPORTS Real Export- Real Import – (TL)	-887.183.195	-4.521.163.045	2.766.730.968	2.730.151.488
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,54608	0,49655	0,58863	0,03024
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	15.697,76	11.454,14	22.114,81	4.261,52
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	3.021,93	1.157,05	4.661,81	1.289,73
RELATIVE GRANTED PATENTS	0,0462	0,0430	0,0485	0,0020

Manufacture of other transport equipment				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	38864	21553	61696	13787
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	20.789,34	7.216,98	43.626,07	13.034,97
REAL SECTORAL PRODUCTION (TL)	5.128.800.823	1.658.143.147	11.149.378.219	3.755.103.789
REAL VALUE ADDED PER EMPLOYEE (TL)	41.183,36	13.662,00	90.607,79	28.098,64
REAL EXPORT (TL)	2.639.781.869	1.834.071.949	3.874.099.177	755.102.063
REAL IMPORT (TL)	3.461.340.127	784.547.002	6.942.222.421	1.790.594.596
NET REAL EXPORTS Real Export- Real Import – (TL)	-821.558.258	-4.840.955.728	1.049.524.947	1.764.044.774
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,82452	0,36541	1,28906	0,38664
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	21.339,02	5.052,81	55.755,10	18.150,24
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	3.051,53	321,76	11.232,69	4.021,68
RELATIVE GRANTED PATENTS	0,0102	0,0069	0,0126	0,0017

Manufacture of furniture and Other manufacturing				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	174738	134431	201931	21582
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	4.747,96	3.573,81	6.287,02	845,17
REAL SECTORAL PRODUCTION (TL)	9.786.712.305	6.183.130.343	12.815.434.049	2.216.348.463
REAL VALUE ADDED PER EMPLOYEE (TL)	11.104,50	8.626,67	13.216,33	1.631,81
REAL EXPORT (TL)	2.006.944.918	1.455.122.280	2.652.393.102	432.597.660
REAL IMPORT (TL)	2.806.621.063	2.133.236.561	3.236.808.774	392.744.307
NET REAL EXPORTS Real Export- Real Import – (TL)	-799.676.145	-1.549.493.001	-91.462.997	608.442.510
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,27548	0,19779	0,33285	0,04919
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	2.827,01	2.002,62	4.223,92	725,99
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	100,77	23,10	214,94	66,74
RELATIVE GRANTED PATENTS	0,0526	0,0491	0,0560	0,0027

ALL - 20 SECTORS (PANEL DATA)				
YEARS (2003-2010)	MEAN	MIN.	MAX.	STANDARD DEVIATION
EMPLOYMENT (Number of Persons)	130287	5998	409795	113868
REAL WAGES AND SALARIES PER EMPLOYEE (TL)	11.833,67	14,22	43.626,07	8.348,30
REAL SECTORAL PRODUCTION (TL)	13.965.278.065	17.244.038	48.459.886.687	10.959.531.725
REAL VALUE ADDED PER EMPLOYEE (TL)	33.541,72	30,82	245.428,46	33.535,09
REAL EXPORT (TL)	4.627.419.556	4.790.805	21.160.283.019	4.570.651.730
REAL IMPORT (TL)	6.393.507.369	34.251.082	31.948.064.398	6.936.773.967
NET REAL EXPORTS Real Export- Real Import – (TL)	-1.766.087.813	-26.330.588.827	14.357.336.074	6.776.493.765
IMPORT PENETRATION RATIO Real Import / Real Production - Net Real Exports	0,45329	0,00715	5,71864	0,69670
REAL INVESTMENT EXPENDITURES PER EMPLOYEE (TL)	15.072,12	7,82	414.170,44	35.019,40
REAL RESEARCH and DEVELOPMENT EXPENDITURES PER EMPLOYEE (TL)	684,93	0,00	17.428,29	1.889,69
RELATIVE GRANTED PATENTS	0,0500	0,0000	0,3194	0,0712