EXPORTING AND EMPLOYMENT GENERATION: A STUDY ON TURKISH MANUFACTURING

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EXPORTING AND EMPLOYMENT GENERATION: A STUDY ON TURKISH MANUFACTURING

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M.S. DISSERTATION

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İHRACAT VE İSTİHDAM YARATIMI:
TÜRKİYE İMALAT SANAYİİ ÜZERİNE BİR ÇALIŞMA

Mustafa ÖZSARI
İktisat Anabilim Dalı
Anadolu Üniversitesi Sosyal Bilimler Enstitüsü, Mayıs, 2017
Danışman: Doç. Dr. Yılmaz KILIÇASLAN

Bu tezin amacı, Türkiye imalat sanayinde ihracatın emek talebi üzerindeki etkisini analiz etmektir. Analizlerde Türkiye İmalat Sanayiinin 2003-2013 yılları arası firma düzeyindeki üretim ve ticaret veri seti kullanılmıştır. İhracatın emek talebi üzerindeki etkisini ortaya çıkarmak için GMM (Generalized Method of Moments) ve Rassal Etkiler modelleri kullanılmıştır. Emek talebi dinamiklerinin değişip değişmediğini görmek için farklı teknoloji yönelimli endüstriler, farklı firma büyüklükleri ve 2-basamak NACE alt-endüstrileri için tahminler yapılmıştır. Sonuçlar ihracat ve ithalatın imalat sanayiinde firmanın emek talebini istatistiksel olarak anlamlı bir şekilde olumlu etkilediğini göstermektedir. Diğer taraftan, bu etkinin hem farklı teknoloji yönelimli endüstrilerde faaliyet gösteren firmalarda hem de farklı alt-endüstrilerde ve farklı firma büyüklüklerinde değiştiği bulunmuştur.

Anahtar Kelimeler: Ticaret ve İşgücü Piyasası Etkileşimleri, İşgücü Talebi, İmalat Sanayii, Türkiye.
JEL Kodları: F16, J23, L6

ABSTRACT

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Department of Economics

Eskişehir Anadolu University Graduate School of Social Sciences, April 2017

Supervisor: Assoc. Prof. Dr. Yılmaz KILIÇASLAN

The aim of this thesis is to analyze the impact of exports on labor demand in Turkish manufacturing industry. Firm-level production and trade data of Turkish manufacturing industry for 2003-2013 is used in the analysis. GMM (Generalized Methods of Moments) and Random Effects models were used to explore the impact of exports on labor demand. The estimations were carried out for different technology oriented industries, firm sizes, and 2-digit NACE sub-industries to check if the labor demand dynamics change. The results showed that both manufacturing exports and imports have significant and positive impact on the labor demand of the firm. The impact, on the other hand, was found to differ not only in the firms operating in different technology oriented industries but also in different sub-industries of manufacturing and the firms in different sizes.

Keywords: Trade and Labor Market Interactions, Labor demand, Manufacturing Industry, Turkey.

JEL Codes: F16, J23, L6

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I am very grateful to Turkish Statistical Institute (TURKSTAT) for providing me the big data sets on labor, production and trade of Turkish Manufacturing Industry. My thanks also go to dedicated personnel of TURKSTAT's Data Research Centre, Mr. Sabit Cengiz Ceylan, Mr. Ferhat Irmak, Mr. Erdal Yıldırım and Mr. Eyüp Mehmet Dinç who provided me information when I need and helped me get my results out from TURKSTAT's Data Research Centre.

I am also grateful to Konya Food and Agriculture University's personnel and academicians, my colleagues and my friends.

Last but not the least, I want to express my deepest gratitude to my family, mother who spent her life for her children, my father who is always ready to give everything he has, and my dear brothers.

Usual disclaimer applies.

To my parents and my brothers,

23./06/2017

DECLARATION OF CONFORMITY TO ETHICAL DOCTRINES AND RULES

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Mustafa ÖZSARI

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CHAPTER 1
INDTRODUCTION

1.1. Motivation and Aims

There is a gap in the literature analyzing the impact of international trade on labor demand, particularly in Turkish Manufacturing Industry. Several researchers tried to show the impact of trade on labor using different data sets for different periods. However, there is not a common conclusion of the impact of international trade on labor demand. The purpose of this thesis is to determine the impacts of international trade (especially exports) on labor demand of the firms operate in Turkish Manufacturing Industry to fill the gap in the literature, especially for Turkish Manufacturing. Various models are used with sophisticated methods to perform proper analysis. To make detailed comments, firms are grouped according to their sizes, sub-sectors, and technology levels for different estimations. However, one shall remember that the findings of this thesis may be accurate but only valid for the time-period -analyzed "2003-2013", for Turkish Manufacturing.

1.2. Questions Addressed

Two main questions motivated this study: First question is "Does international trade have an impact on labor demand for Turkish Manufacturing?" and the second question is "If there is a significant impact of the trade, does it differ for the sub-industries of Turkish Manufacturing?".

In addition to the questions above, this research gives detailed picture about the structure of Turkish Manufacturing in descriptive findings section.

Moreover, to present a comprehensive information about Turkish Manufacturing for policy makers and researchers, technology, size and NACE-2 sub-industry based estimations are made for the models to show the labor demand dynamics for each sub-industry.

1.3. Organization of the Study

This thesis is organized as follows: Chapter Two examines the theoretical and empirical background of this study. This chapter gives detailed information about existing literature on trade and labor demand relations.

Following second chapter, Chapter Three firstly presents the data set and the variables used in the estimations and gives a brief information about data set. After that, it gives some descriptive findings from TURKSTAT 2017 data (internet sourced) and panel data set for Turkish Manufacturing.

Chapter Four gives detailed information about the methodology. After the methodology, Chapter 4 gives analysis results and in Chapter 4, detailed estimations are interpreted for Turkish Manufacturing.

Following Chapter Four, Chapter Five gives concluding remarks and policy recommendations.

CHAPTER 2
THEORETICAL AND EMPIRICAL BACKGROUND

2.1. Theoretical Background

When optimizing the production mix, firms do not have much options in the short-run to adjust their production process according to their short-run decisions, and they properly change the amount of labor they employ. In practice, considering the changes in capital stock, this is less costly and the most feasible action for the firms in the short-run. Theoretically, since the plant size is fixed in the short-run for the competitive firms, they must change their variable inputs (labor and materials) to adjust their production (Pindyck & Rubinfeld, 1992: 249). A rational firm will change the number of workers it hires according to its profit-maximizing function *per se* a tool for optimization.

In the long-run firms' employment levels is depend on to the price of labor, capital, technology and labor productivity. Hence, the prices of labor and capital are the main determinants of labor demand in the long-run, followed by technology and labor productivity. Cost of labor to the firm is composed of gross wages including net payments to the workers, income tax cuts, social security expenses, transportation costs of the labor, lunch and the other expenses related to the labor. Therefore, cost of labor varies across countries (according to minimum wages and payroll taxes) and cities (according to cost of living). On the other hand, labor productivity is an outcome of available technology, ability to use available technology, quantity and quality of labor, utilization and quantity and quality of other factors of production. So, labor productivity also varies across countries, industries, sub-sectors and different technology levels. Labor productivity can be simply calculated by dividing total output to the quantity of labor it hired for each period. When other factors remain constant, the changes in output must be subject to the changes in labor productivity, so to the technology.

International trade provides many benefits to economic actors both on the import and export sides. Starting from the households, it is not only the wide range of products and lower prices they are enjoying, but they are also able to find new job opportunities through international trade. For the employers, it gives an

opportunity to make extra profit by exporting and an opportunity to increase its technology and productivity by importing and exporting. Lall (2004) concluded that exports can create jobs and increase technology transition process. Imports also lead firms' technology to increase through spillover and imitation. Hall and Jones (1999:98) briefly explained the technological and innovative benefits of trade:

> *"Trade with other countries yields benefits from specialization and facilitates the adoption of ideas and technologies from those countries"*

Especially in developing countries, trade enhances technology diffusion from advanced countries (Meschi *et al.* 2015). This technology diffusion mostly comes from imports and it is more important for developing economies than advanced economies due to their spending on research and development activities (Keller, 2004). Moreover, exports bring benefit to the firms by decreasing their costs, increasing labor productivity and their reliance on more skilled workers (Clerides *et al.* 1998).

According to the comparative advantage theory, exports cause firms' labor demand to increase. According to the theory, if a country exports a good X, it has comparative advantage in producing that good which implies a lower opportunity cost in production. Therefore, that country specializes more in producing that good because specialization will increase the total output of good X. That will bring an increase in the means of production for good X which results in a higher demand for labor in a related industry (McConnell et al. 2016: 148). This situation is also valid for the firms. If a firm is exporting a good or a service to abroad, it means, that firm has comparative advantage in producing that good or service. The more the firm export its good or service abroad, the more it will be specialized for producing that good or supplying that service, which comes with a higher labor demand for that firm. Following statement gives the importance of exports from another perspective from the book of Arthur Lewis "Theory of Economic Growth" first published in 1955:

> *"…a new employer cannot rely on the demand which his employment directly generates; he must also expect to be able to capture some of demand now enjoyed by other people. If this is home demand, he must believe that he is in a position to take other people's customers away, by offering a new good, or a more convenient or attractive service, or a lower*

price based on some new technique of production; he must be an innovator. Alternatively, he must be able to export, and so to capture foreign demand." (Lewis, 1955: 275)

So, far the variables of the analysis are explained hypothetically: labor cost (LC) and output (Q) exports (X) and imports (M). Total output is an indication of worker productivity and it affects labor demand, and there are technology and competitiveness benefits from international trade cause productivity to rise. *Ergo,* one should expect an employment generation impact of trade, both for imports and exports.

Determinants of demand for labor are stated as "the demand for product, productivity, number of employees, wages, technology and the prices of other resources". Since the demand for the product, the number of employees and prices of other resources are external factors, only the changes in productivity can shift labor demand at the firm level. Productivity is mainly depending on how skilled is the employed labor (as ability and knowledge) and how advanced is the available technology of the firm (Keller, 2004 & 2009). Furthermore, returns to skills (skill premia) are subject to the relative supply of skills, the degree of skill bias in technology, and international trade (Acemoglu, 2003). Additionally, in developing countries, a firm's available technology increases through international trade because, with international trade, a firm can import technology that is not available in the home country (Kilicaslan, 2005: 20).

This thesis will try to analyze the impact of international trade on labor demand in Turkish Manufacturing Industry. To see if labor demand dynamics changes with respect to sub-industries, size, and NACE-2, the further analysis are conducted. Further estimations are made because it is important for policymakers to know in which sub-industry Turkish Manufacturing is specialized and achieving international competitiveness or is there any proof of a successful export oriented industrialization (EOI). It is also important to know if there is a reallocation of labor across industries or any labor-saving technological impact of trade for some industries.

2.2. Empirical Background

The summary of the empirical literature on trade impacts on labor demand is given in Table 1. Based on the information given in Table 1, while some of the empirical studies are supporting the traditional international trade theory (i.e. Heckscher-Ohlin & Stolper-Samuelson theorems) with their results, some are conflicting with it. Previous studies present three different conclusions for the impact of trade openness, imports and exports on labor demand: positive, negative and no impact.

Fu & Balasubramanyam (2005), and Mitra & Shin (2012) found that when the share of exports (export/output ratio) increase in total sales, it shifts labor demand positively with their analysis for China and Korea, respectively. Milner & Wright (1998), Meschi *et al.* (2016), and Njikam (2016) found that trade liberalization has a positive impact on labor demand for Mauritius, Turkey and Cameroon. Additionally, Meshci *et al.* (2016), Wilkinson (1999), Ghose (2000), and Hong (1980) showed that exports affecting labor demand, positively. Bernard *et al.* (1995) also found that employment creation potential of exporting firms is higher than non-exporting firms. Athukorala & Menon (1996) found a positive effect of export-oriented FDI on Malaysian employment. Tombazos (1999) and Tomiura (2003) found positive impact of imports on employment for Australia and Japan.

On the other side, Greenaway *et al.* (1999), and Manda & Sen (2004) found that exports have negative impact on labor demand for UK and Kenya in their analysis. Revenga (1997), Greenaway *et al.* (1999), and Marquez & Pages (1998) found that trade liberalization has a negative impact on manufacturing employment for Mexico, UK and Latin America & Caribbean Countries.

Some studies provide conflicting results on the effect of exports on employment. Conte & Vivarelli (2007) found that skill-enhancing technological imports affect demand for white-collar workers positively, but blue-collars negatively. Konings & Vandenbussche (1995), and Bernard & Wagner (1997) found no impact of trade on employment.

Studies for Turkey mostly focused on female labor participation. Ozler (2000) and Çağatay & Berik (1990) found that exports increase the female share in employment.

Table 1. *Empirical Studies About Trade and Labor Demand Relations*

Author	Scope	Method	Result
Greenaway *et al.*	UK	GMM	An increase in the volume of imports and exports causes labor demand to decrease.
Konings & Vandenbussche	UK	GMM	An increase in foreign competition does not cause any changes in labor demand.
Fu & Balasubramanyam	China	GMM	An increase in exports/output ratio has a positive effect on employment.
Meschi *et al.*	Turkey	GMM-SYS	Exports and trade openness has a positive impact on labor demand.
Conte & Vivarelli	Developing Countries	GMM-SYS	Skill-enhancing technological import affects the demand for white-collar workers, positively and blue-collars negatively.
Milner & Wright	Mauritius	GMM	Trade liberalization has a positive effect on employment.
Bernard *et al.*	US	Cross-section	Exporting firms create more employment than non-exporting firms.
Revenga	Mexico	Regression	Trade liberalization has a negative impact on Mexico's manufacturing employment.
Başlevent & Onaran	Turkey	Probit	Turkey's exports have a positive impact on female labor force participation rate.
Ozler	Turkey	Logit	An increase in export/output share tend to increase the female share in employment.
Manda & Sen	Kenya	Panel regression	Exports have a negative impact on Kenya's manufacturing during 1990's.
Mitra & Shin	Korea	Panel regression	An increase in the export/output share increases the labor demand elasticity.
Njikam	Cameroon	OLS, FE, GMM-SYS	Trade liberalization shifted the demand for unskilled labor in Cameroon manufacturing.
Bernard & Wagner	Germany	Cross-section	Entering international trade has no effect on employment growth.
Athukorala & Menon	Malaysia	Descriptive statistics	Export – oriented FDI enhanced the employment in Malaysia.
Çağatay & Berik	Turkey	Regression	Exports increase the women employment share in the industry
Wilkinson	US	Regression	Export promotion increases the exports and this raises the labor demand.
Ghose	World	Descriptive statistics	In developing countries, trade has a positive impact on demand for skilled and unskilled labor.
Hong	Korea	Descriptive statistics	Korea's manufacturing exports have a positive impact on labor demand in Korea's manufacturing.
Marquez &Pages	Latin America & Caribbean Countries	Regression	Trade openness has a significant and negative impact on employment both for manufacturing and aggregate level.
Tombazos	Australia	Regression	Australian imports stimulate labor demand.
Tomiura	Japan	Regression	Imports have a positive impact on labor demand

Source: Author

CHAPTER 3
DATA AND DESCRIPTIVE FINDINGS

3.1. Data

This section gives some detailed information about the data and the variables used in the estimations. Analysis of this thesis are carried out by using firm level data which represents all Turkish Manufacturing with the weighted means. Since we need both trade and production variables, the micro-level manufacturing data set and the foreign trade data set of TURKSTAT (Turkish Statistical Institution) are merged in the data-preparation process. Furthermore, the nominal variables are transformed into their real values by using 4-digit industry level deflators. The final data set contains numerous variables for all manufacturing firms from year 2003 to 2013. Due to the confidentiality and data security standards, TURKSTAT only allows researchers to access the database in Ankara TURKSTAT Data Research Centre with signing a protocol. In addition to that, researchers should use the Data Research Centre's computers and they are not allowed to connect to the internet or to insert any portable memory devices. Due to the previous reasons, all the data-based analyses are made in TURKSTAT, Ankara and the results sent by e-mail after controlled by TURKSTAT's industry and foreign trade data departments.

Table 2 shows all the variables used in the estimations with their definitions.

Table 2. *Definitions of variables used in the estimations*

Variable	Definition
L	Number of labor the firm employed
Q	Total output of the firm
X	Total exports of the firm
D	Total domestic sales of the firm (Q-X)
M	Total imports of the firm
DP	Domestic production of the firm (Q-M)
INTX	Intensity of exports to output
XDUM	Dummy variable for imports (1, if M>0; 0, otherwise)
LC	Labor cost of the firm (per labor)

Source: *Author*

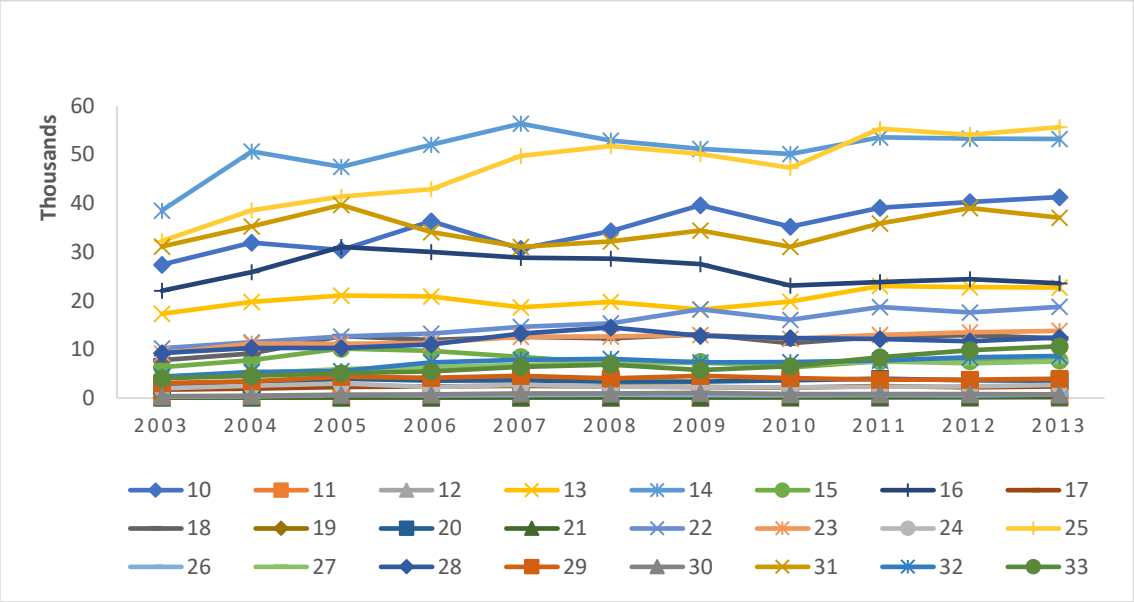
3.2. Descriptive Findings

This section gives some descriptive findings from panel the data set and with aggregate data downloaded from TURKSTAT web site. One should know that panel data statistics are calculated from given weighted means of the data set and it represents exactly Turkish Manufacturing Industry, just like the aggregate data.

Figure 1 shows the rise in the number of firms between 2003 and 2013 in Turkish Manufacturing by NACE-2 industry codes. Total number of firms increased in every year with one exception: in 2010, total number of firms decreased from 320,815 to 299,928. The number of firms increased from 234,633 to 340,438 in Turkish Manufacturing since 2003 to 2013. Obviously, some increments happened in the number of firms of some industries, some remained almost unchanged.

Figure 1 also draws a picture of the structure of Turkish Manufacturing Industry. Top 10 Industries with the most firms are NACE-25 (Manufacture of Fabricated Metal Products, Except Machinery and Equipment), NACE-14 (Manufacture of Wearing Apparel), NACE-10 (Manufacture of Food Products), NACE-31 (Manufacture of Furniture), NACE-16 (Manufacture of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials), NACE-13 (Manufacture of Textiles), NACE-22 (Manufacture of Rubber and Plastic Products), NACE-23 (Manufacture of Other Non-Metallic Mineral Products), NACE-28 (Manufacture of Machinery and Equipment N.E.C.) and NACE-18 (Printing and Reproduction of Recorded Media), respectively. These industries are classified as low and medium technology level industries in the estimations. While the number of firms increased in most of these industries since 2003 to 2013, not much changed in NACE-21 (Manufacture of Basic Pharmaceutical Products and Pharmaceutical Preparations) and NACE-26 (Manufacture of Computer, Electronic and Optical Products) which are classified as high technology level industries. Most tremendous increase in number of firms happened in NACE-25 industry. Since 2003 to 2013, the total number of firms are increased from 32,251 to 55,635.

Figure 1. *Number of Firms in Turkish Manufacturing, by NACE-2, 2003-2013*

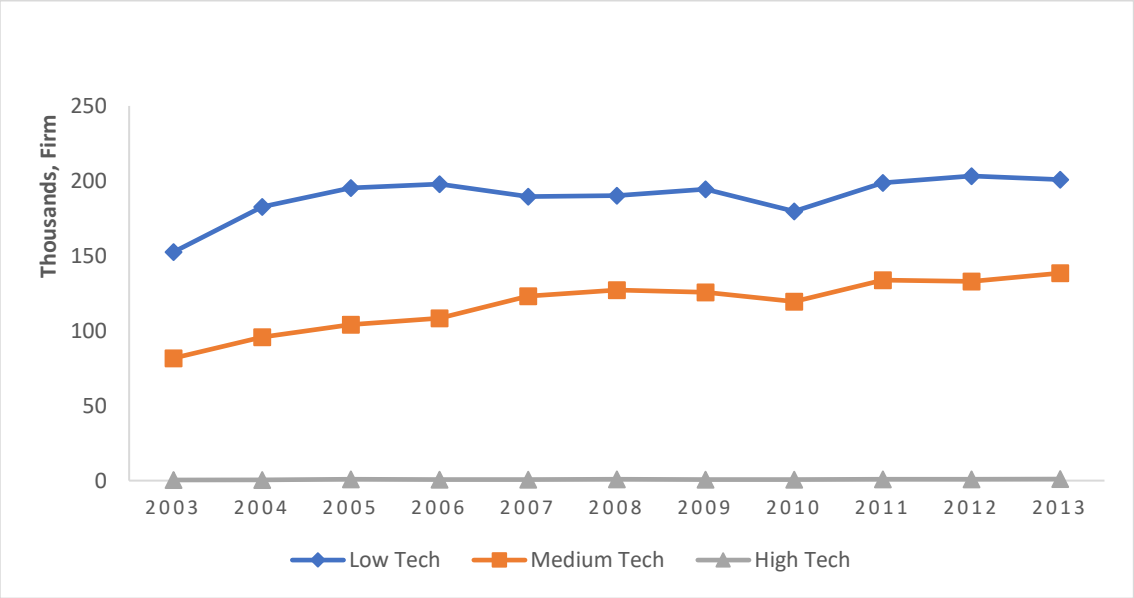


Source: *TURKSTAT 2017*

Legend: Manufacture of food products (10), Manufacture of beverages (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; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 2 shows the number of firms in Turkish Manufacturing according to their technology level. Figure 2 is important to see because it shows the structural problem of Turkish Manufacturing Industry. Since 2003 to 2013, number of firms increased in both low and medium tech but not in high tech. One should know that these technology classifications are made according to what kind of product these firms produce, not the level of technology they use as machinery and equipment. For more information about technology classification, see *Appendix A*.

Figure 2. *Number of Firms in Turkish Manufacturing, by Technology, 2003-2013*

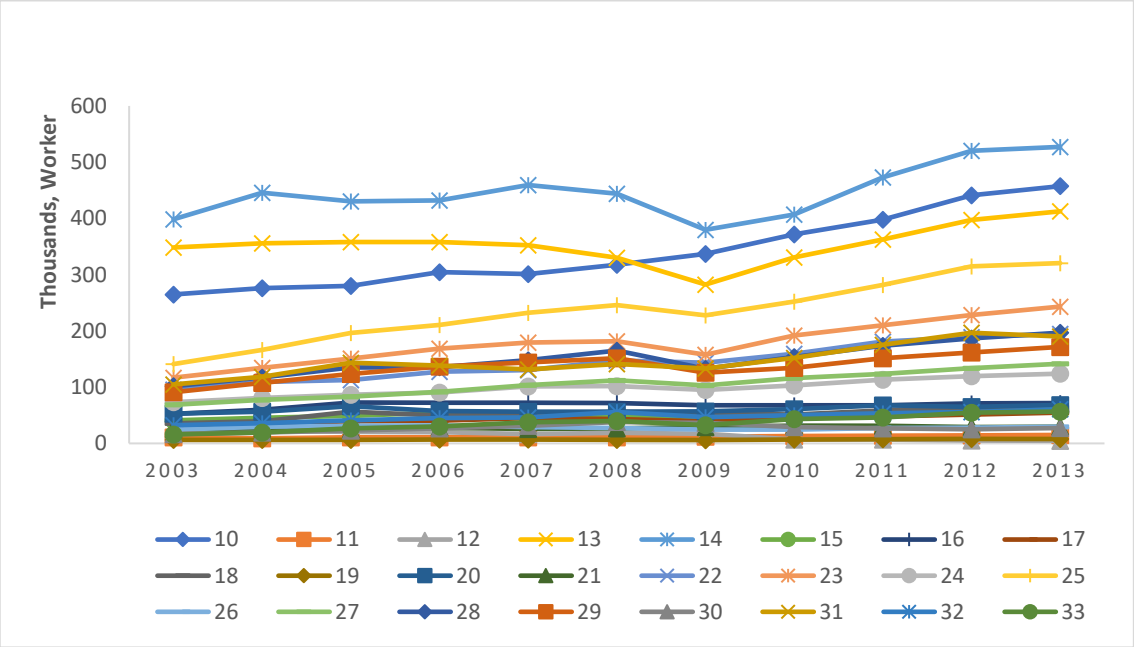


Source: *TURKSTAT 2017*

Figure 3 shows the increment in number of labor employed in Turkish Manufacturing from 2003 to 2013. There were 2,172,190 people employed in Turkish Manufacturing in 2003 and that number increased every year until 2013, except 2009 and reached 3,530,977. One can see the breakdown in the trendlines for almost all industries in 2009, except NACE-10 (Manufacture of Food Products). Figure 3 shows that the number of people working in food production has increased tremendously even in times of crisis. Is this because people need food and they would not stop consuming even in the crisis times? Moslow says food is the first thing humans look for to satisfy and it is the last thing to give up (Moslow, 1943). Can this behavior of Turkish Food Manufacturing firms be explained by the theory of Moslow's Hierarchy of Needs? This should be another research question.

In all industries, there is a shift in the total number of employment since 2003 to 2013 except for one: NACE-12 (Manufacture of Tobacco Products). In 2003, 22,181 workers were employed in the manufacture of tobacco products industry and that number diminished to 4,668 in 2013. The most dramatic decrease happened in 2010, more than ten thousand workers lost their jobs in that year.

Figure 3. *Number of Labor in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *TURKSTAT 2017*

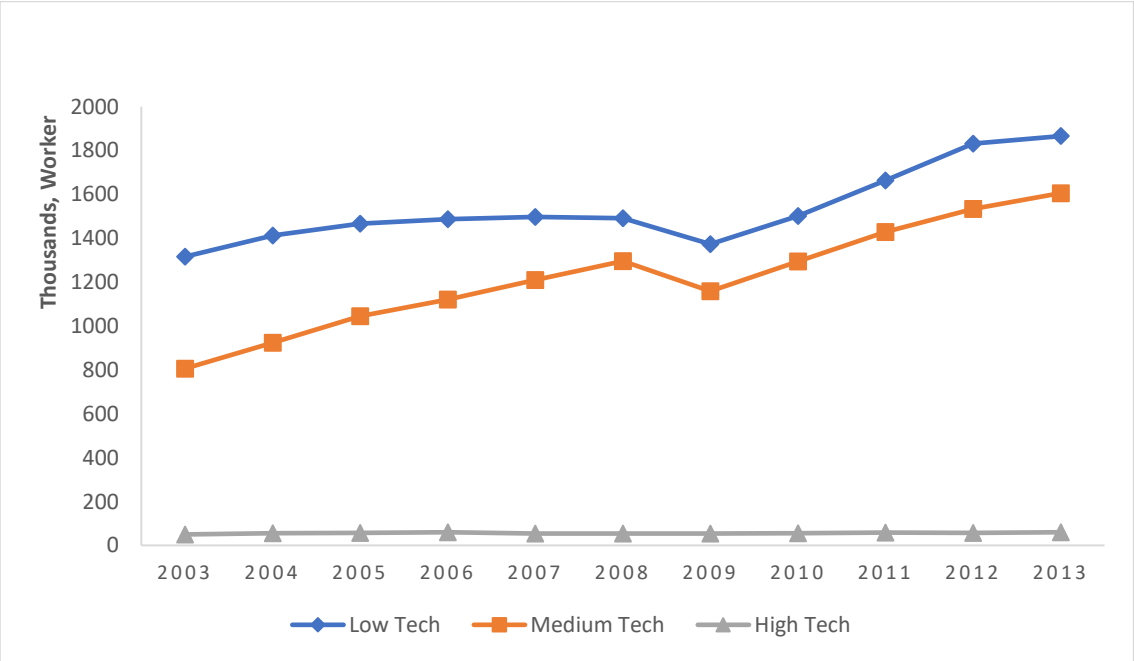
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 4 shows the number of labor employed in Turkish Manufacturing by technology. The decline in 2009 can be seen more clearly in figure 4. It also shows the structure of labor market of Turkish Manufacturing Industry. While only 2% of the workforce is working in high-tech production by 2013, 53% of the workforce in Turkish Manufacturing Industry is working in low-tech production and 45% is in medium-tech production. The growth in industrial production in Turkey stopped in 2008 and there was a decline in production in 2009. Simultaneously, Turkish Manufacturing Firms (as aggregate) decrease their employment. This is a splendid

example of how Turkish Manufacturing firms used their labor input as a tool for adjusting their short-term production levels as mentioned in Part 1.1.

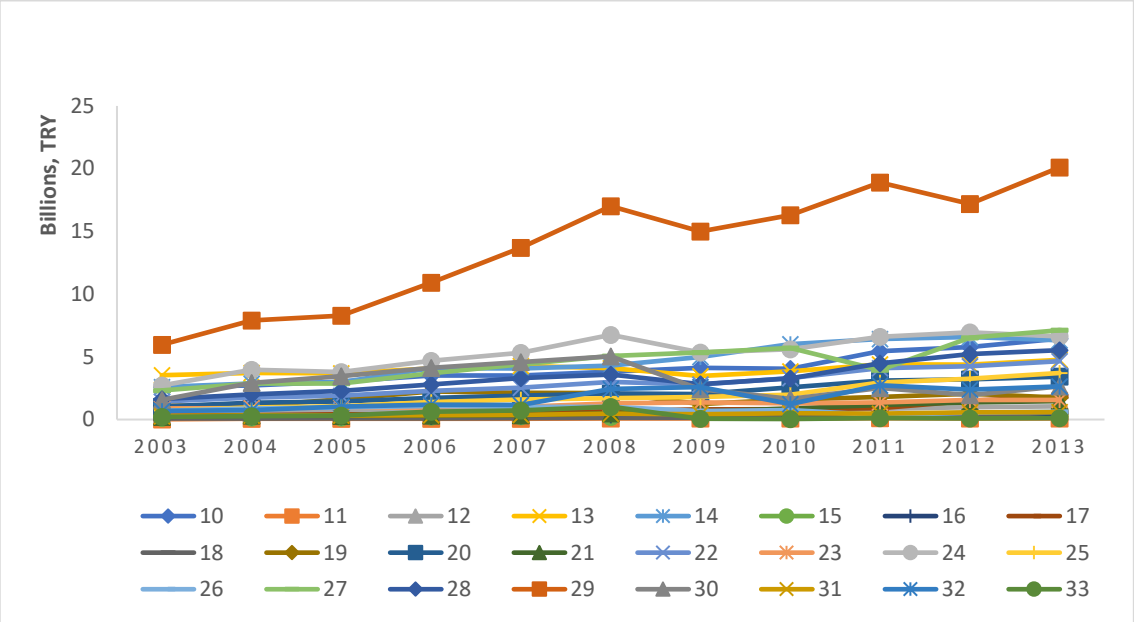
Figure 5 shows the changes in total (real) exports during 2003-2013 period by their NACE-2 industrial classification. There is an increase in total exports of almost all industries, however the increment in the total exports of NACE-29 industry (Manufacture of Motor Vehicles, Trailers, and Semi-Trailers) is extraordinary. The total exports of NACE-29 industry is increased more than three times of its value from 2003 to 2013. Evaluating figure 5 alone may lead to misconceptions. As can be seen in figure 8, it is understood that the export made by the automotive industry is dependent on imports. The main reason for this is that the automotive industry, which has an export volume close to 20 billion TRY, also has imports close to 20 billion TRY. This situation shows another structural problem of Turkish Manufacturing: import dependent exports. This shows that intermediates used in the automotive industry, especially those with high added value, are imported from outside.

Figure 4. *Number of Labor in Turkish Manufacturing, by Technology, 2003-2013*



Source: *TURKSTAT 2017*

Figure 5. *Total Exports of Turkish Manufacturing, by NACE-2, 2003-2013*



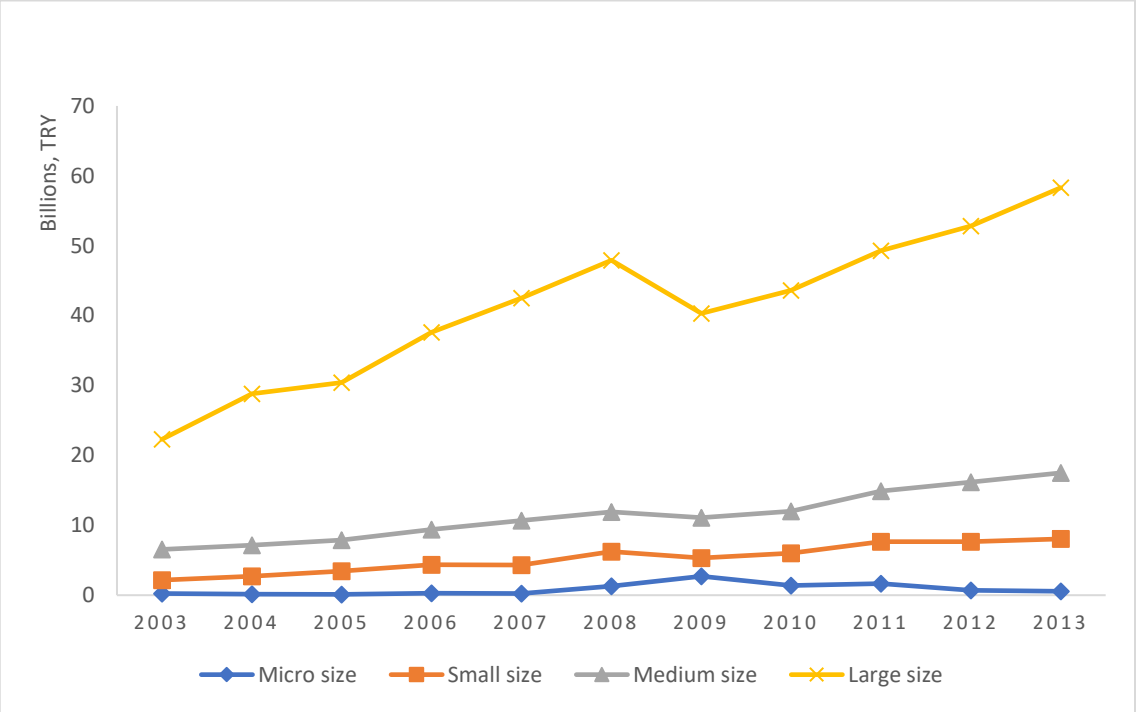
Source: *Author's calculations from panel data (Deflator, 2003=100)*

Legend: Manufacture of food products (10), Manufacture of beverages (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; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 6 shows that increment in the total exports is mainly caused from large-sized (Working labor>=250) firms and Figure 7 shows most the increase in exports are caused from medium-tech firms.

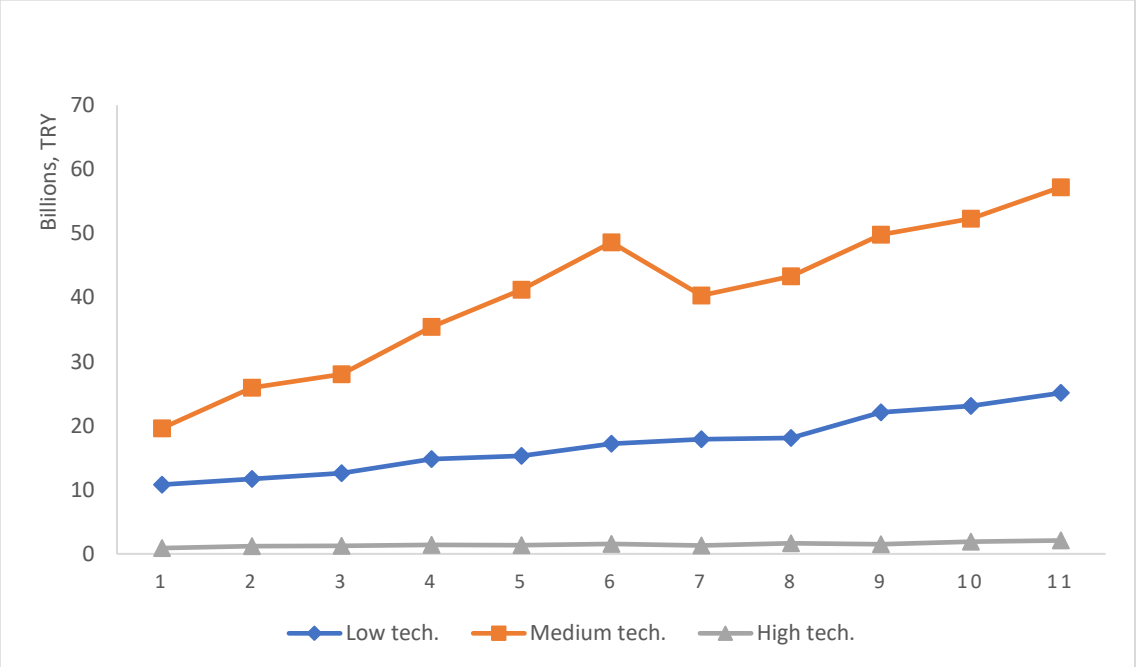
As a sum up for Figure 5, 6 and 7, total exports of Turkish Manufacturing are mainly carried-out by large-sized firms and the most exported goods of Turkish Manufacturing are primarily the medium-tech production. Moreover, NACE-29 (Manufacture of Motor Vehicles, Trailers, and Semi-Trailers) is the leading industry in total exports with its exceptional performance during the period between 2003 and 2013. This is an important indicator showing the development of Turkish Motor Vehicles, Trailers, and Semi-Trailers Industry between 2003-2013 period.

Figure 6. *Total Exports in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

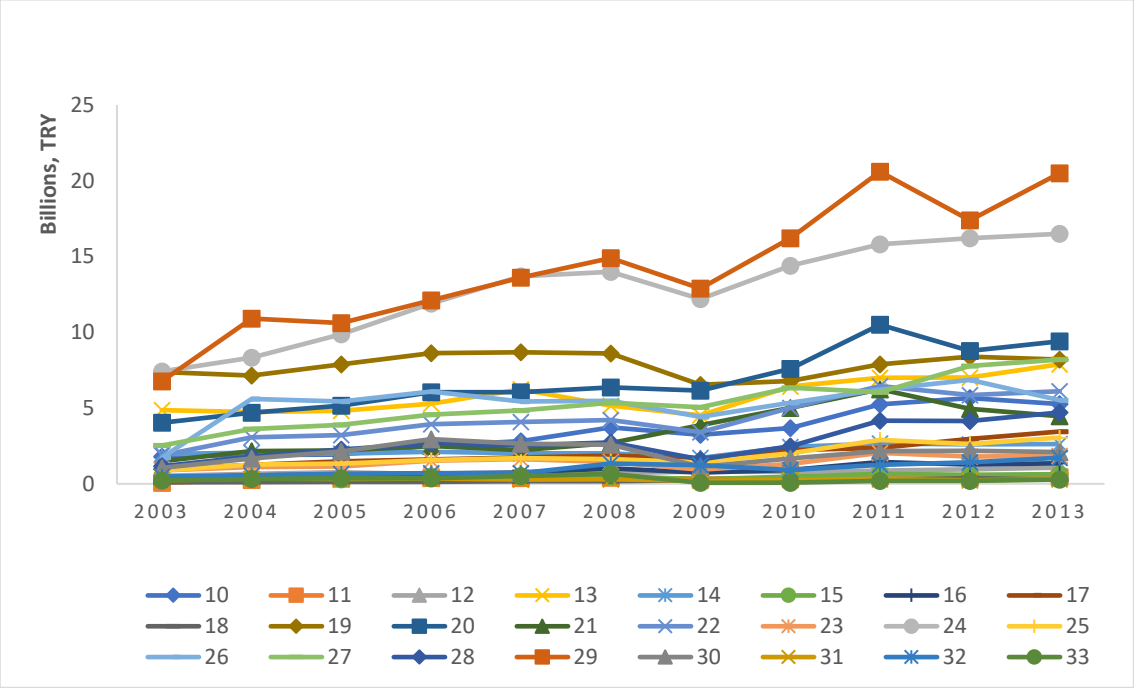
Figure 7. *Total Exports in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 8 shows total imports of Turkish Manufacturing by NACE-2 sub-industries. Accordingly, two sub-industries, NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers) and NACE-24 (Manufacture of basic metal) has the most intense increment in total imports during 2003-2013 period. Moreover, Figure 9 and Figure 10 show that the most of Turkish Manufacturing Industry's imports made by large-sized firms and medium-tech firms.

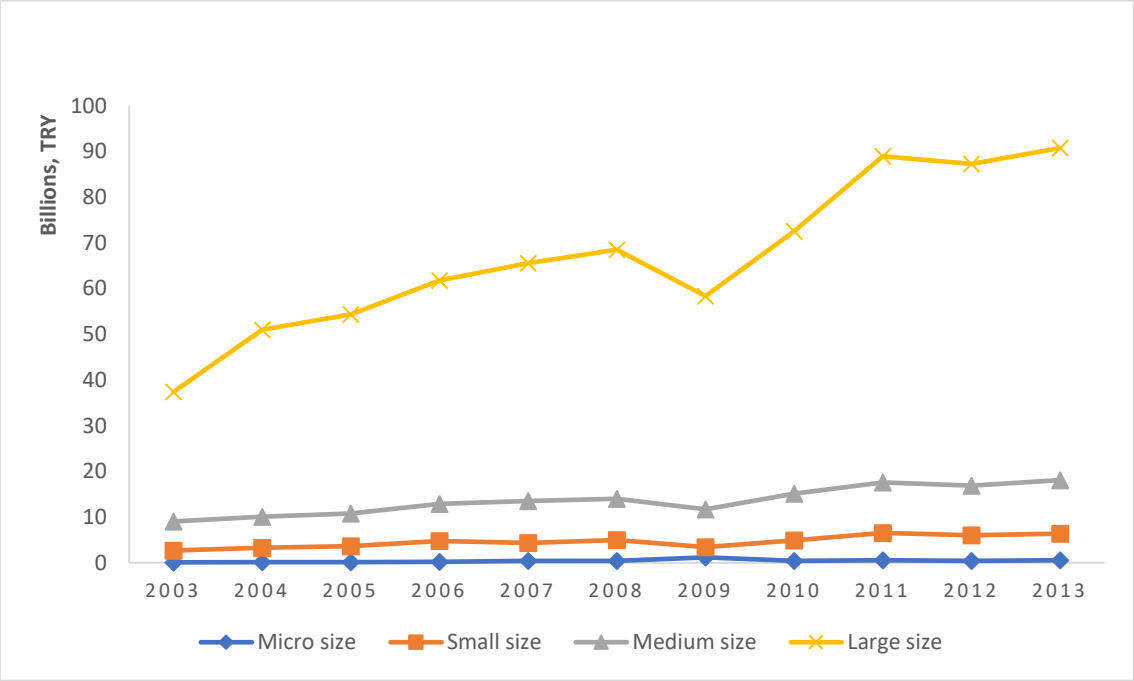
Figure 8. *Total Imports of Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

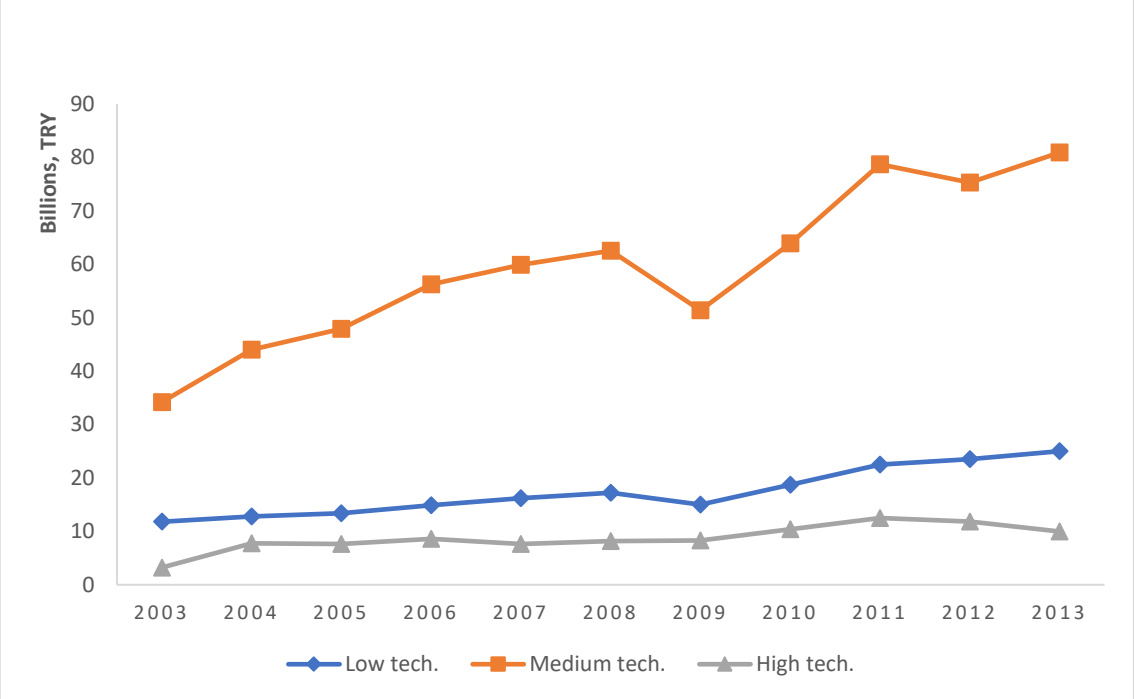
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 9. *Total Imports in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

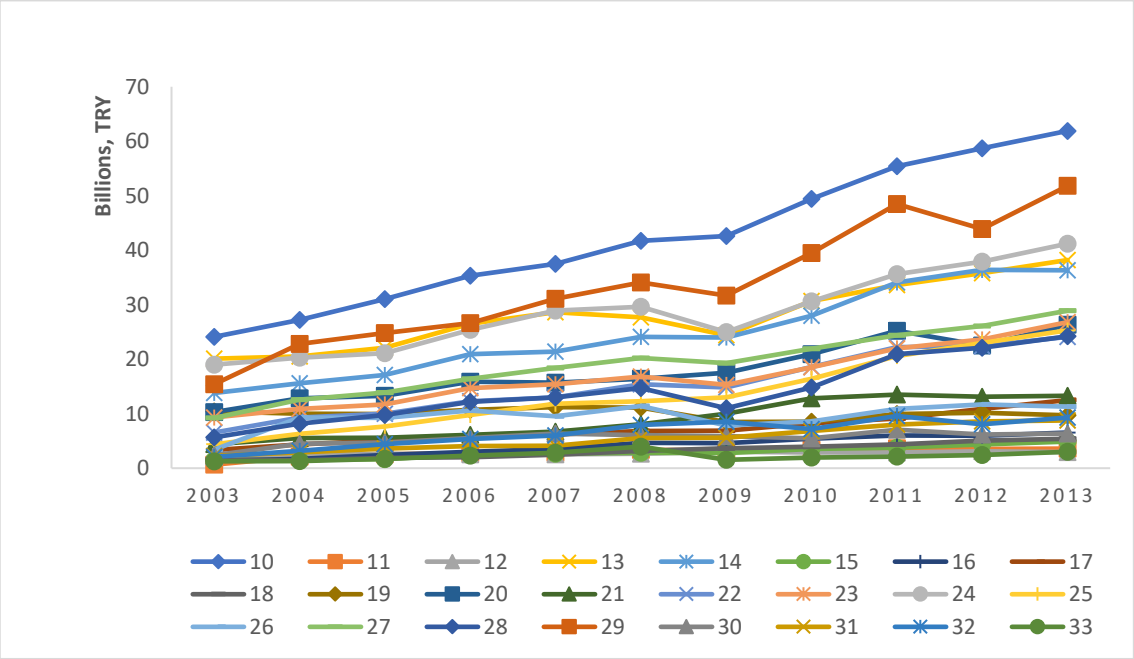
Figure 10. *Total Imports in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 11 shows five industries are leading according to their total (real) outputs in Turkish Manufacturing; NACE-10 (Manufacture of Food Products), NACE-29 (Manufacture of Motor Vehicles, Trailers, and Semi-Trailers), NACE-24 (Manufacture of Basic Metals), NACE-13(Manufacture of Textiles) and NACE-14 (Manufacture of Wearing Apparel). Figure 12 shows the tremendous increase in large-sized firms while micro, small and medium-sized firms achieved a slight increment in their total output between 2003 and 2013. Figure 13 shows the growth of total output of Turkish Manufacturing is mostly achieved by the industries of low and medium-tech products.

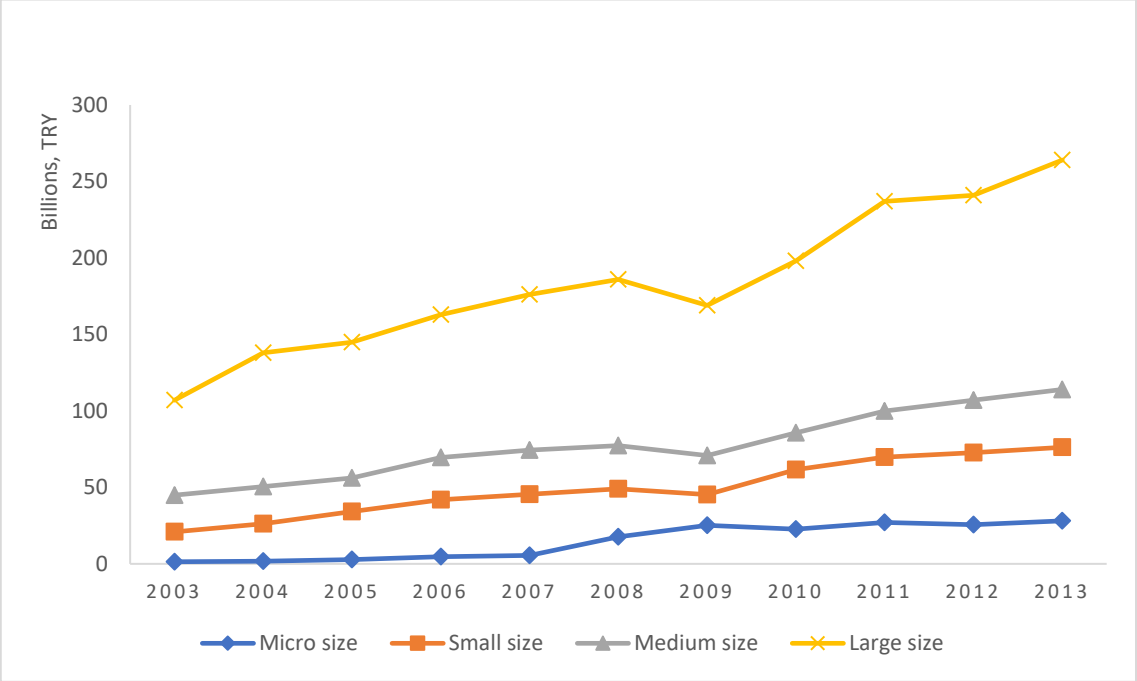
Figure 11. *Total Output in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

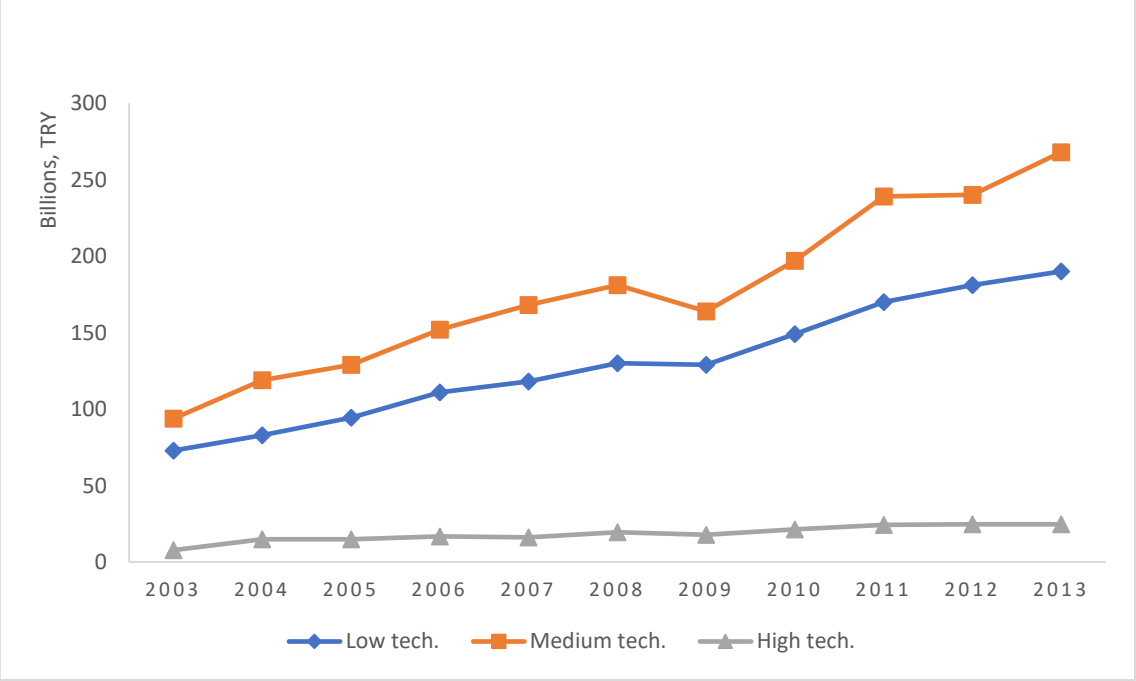
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 12. *Total Output in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 13. *Total Output in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Table 3 shows the increase in real output of Turkish Manufacturing Industry together with the rise in the share of manufacturing/total output. Total Manufacturing output is increased from 17.4 bn. TRY to 29.4 bn. TRY since 2003 to 2013. The share of the sector, which was 22.7% in 2003, increased to 24% in 2013. Numbers show the growth of Turkish Manufacturing with an average of 5.8% annually from 2003 to 2013. One can see the impacts of global financial crisis in years 2008 and 2009. The growth of total output is stopped in 2008 and the total output of the Turkish industry has declined to a significant amount of 7.3%.

Table 3. Production, Sector Share and Growth of Turkish Manufacturing, 2002-2003

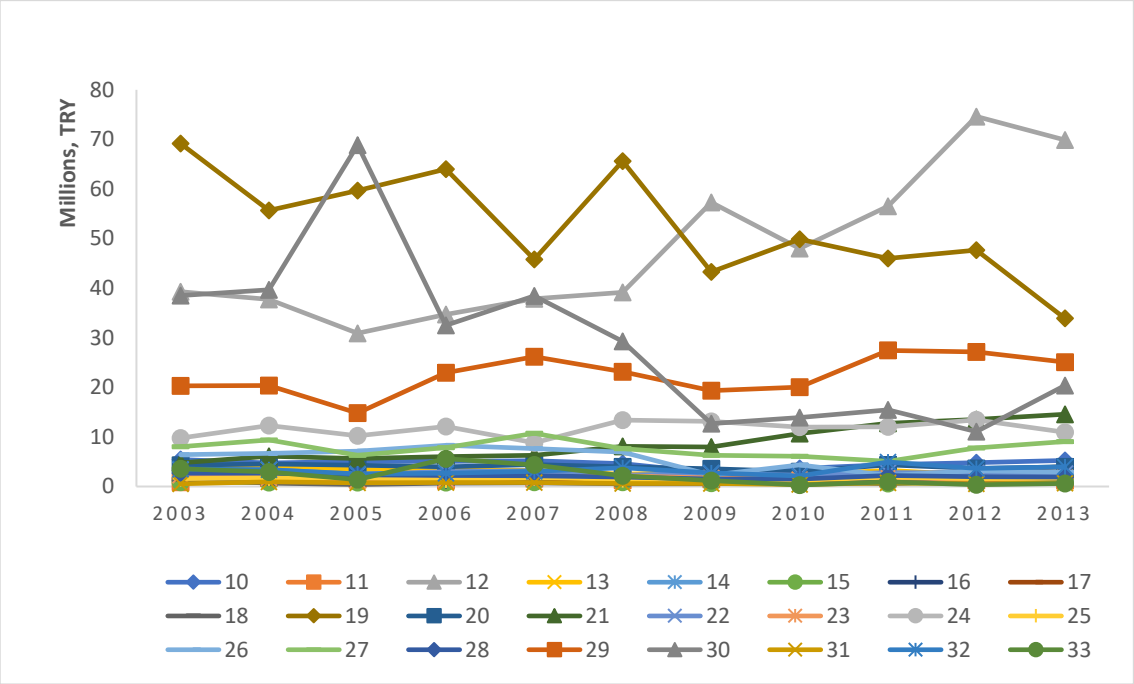
Year	Value	Sector Share, %	Growth Rate, %
2003	17 362 208 667	22,7	8,3
2004	19 392 073 207	23,2	11,7
2005	20 984 291 310	23,2	8,2
2006	22 760 496 133	23,5	8,5
2007	24 042 143 921	23,7	5,6
2008	24 015 322 574	23,6	-0,1
2009	22 273 917 290	23,0	-7,3
2010	25 355 340 007	23,9	13,8
2011	27 890 450 086	24,2	10,0
2012	28 370 054 075	24,1	1,7
2013	29 426 602 005	24,0	3,7

Source: *TURKSTAT 2017, (1998 Prices, TRY)*

Figure 16 shows the mean exports of Turkish manufacturing by the technologic level of the products. High-tech products are leading the figures because technology increases the value of goods, *ergo* high-tech products are highest value-added products.

Figure 14 shows the average exports of the Turkish Manufacturing according to the NACE-2 sub-industries. By the end of 2013, NACE-12 (Manufacture of tobacco products), NACE-19 (Manufacture of coke and refined petroleum products) and NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers) are the top three industries by mean exporting. Figure 15 shows that the highest mean exports are belong to large-sized firms. According to Figure 16, high-tech producing firms have the highest mean exports followed by medium-tech firms, by their nature. Figure 16 *per se* shows the importance of producing high-value-added products.

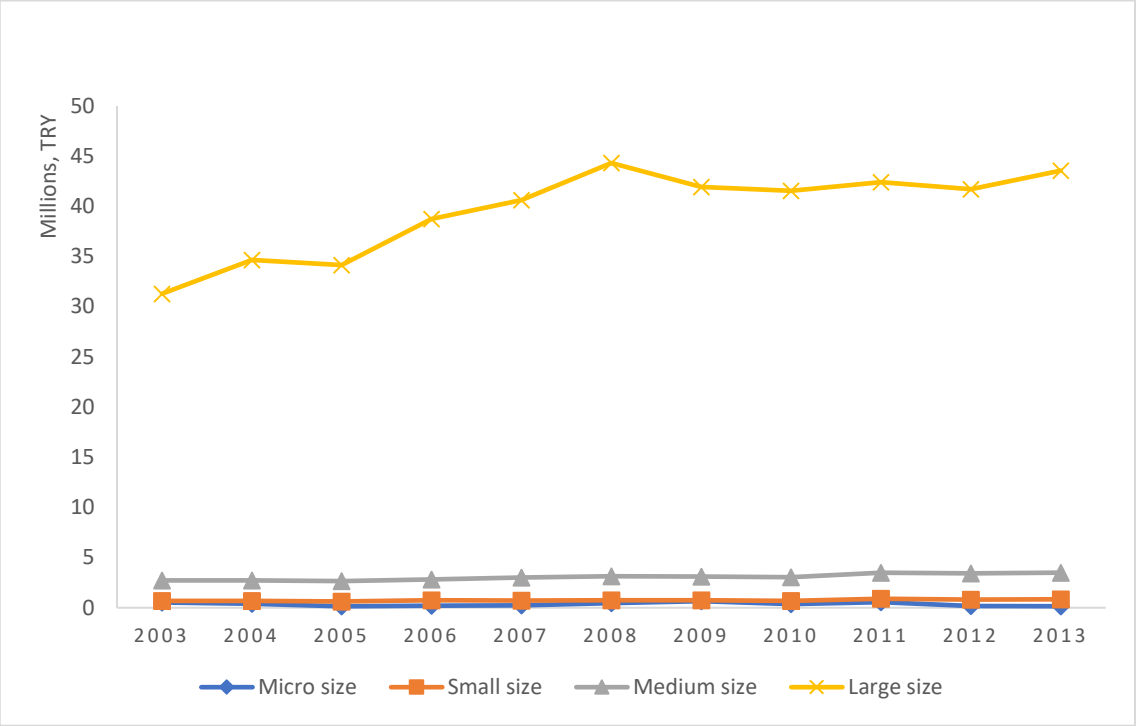
Figure 14. *Mean Exports in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

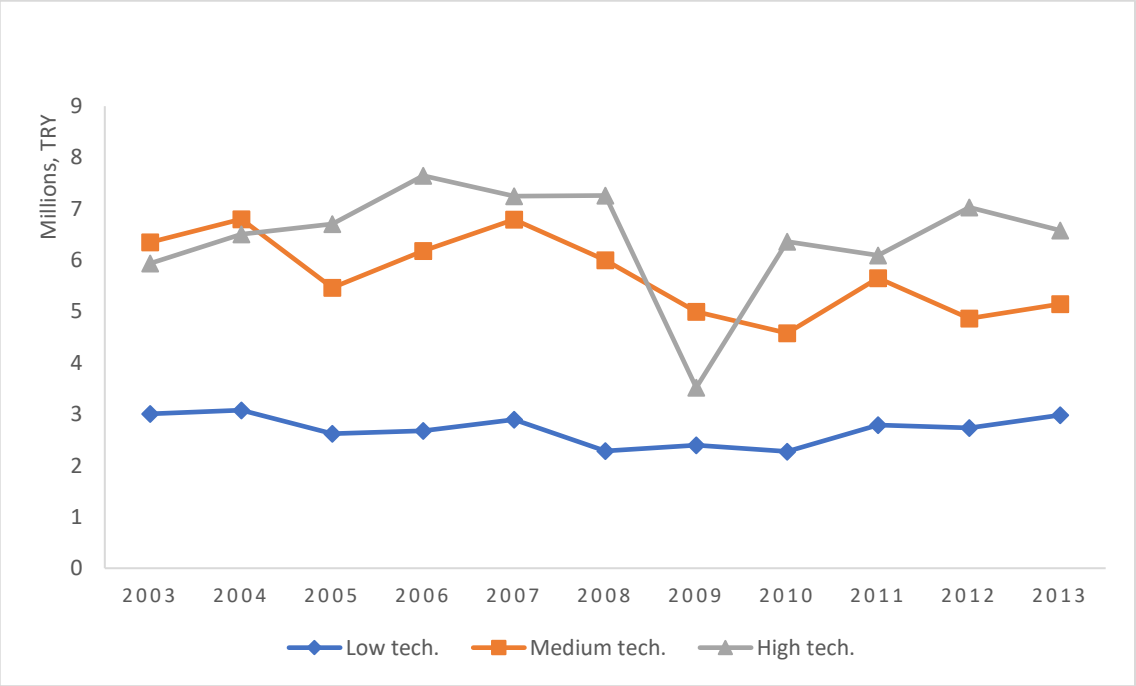
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 15. *Mean Exports in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

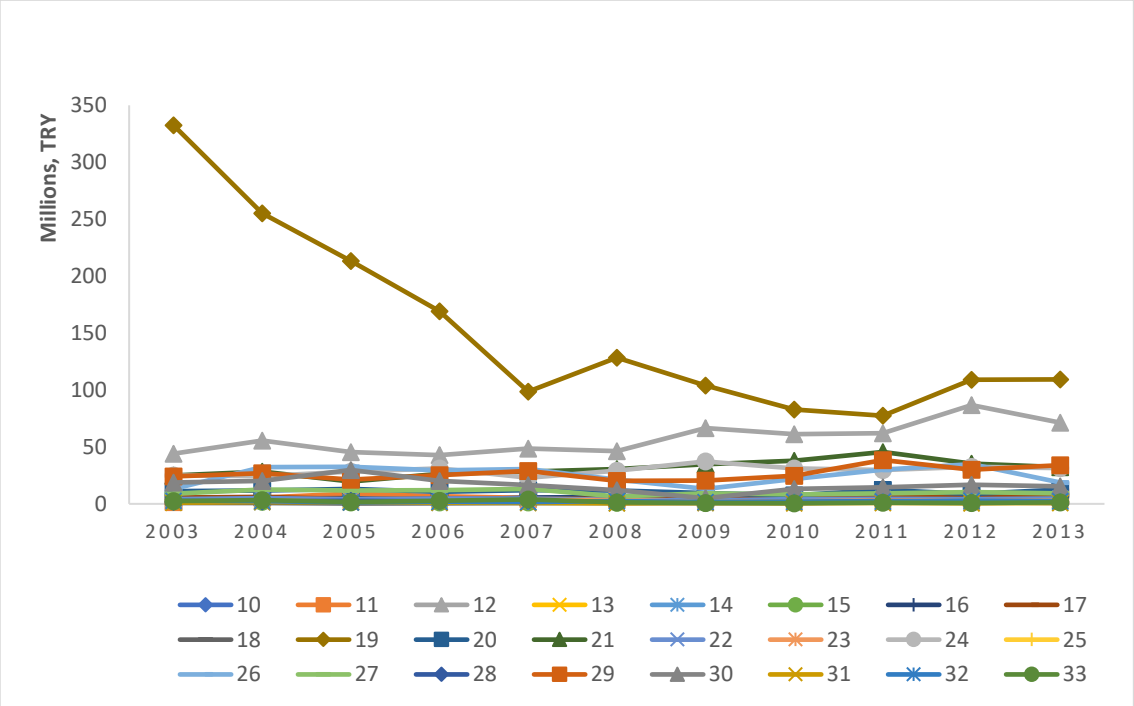
Figure 16. *Mean Exports in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 17 shows mean imports of Turkish Manufacturing by NACE-2 sub-industries. According to the Figure 17, NACE-19 (Manufacture of coke and refined petroleum products) and NACE-12 (Manufacture of tobacco products) have the highest mean imports in Turkish Manufacturing for 2003- 2013 period. Figure 18 shows that highest mean imports are made by large-sized firms and Figure 19 shows that the highest mean imports are made by high-tech producing firms. Those results are similar with the results for mean exports.

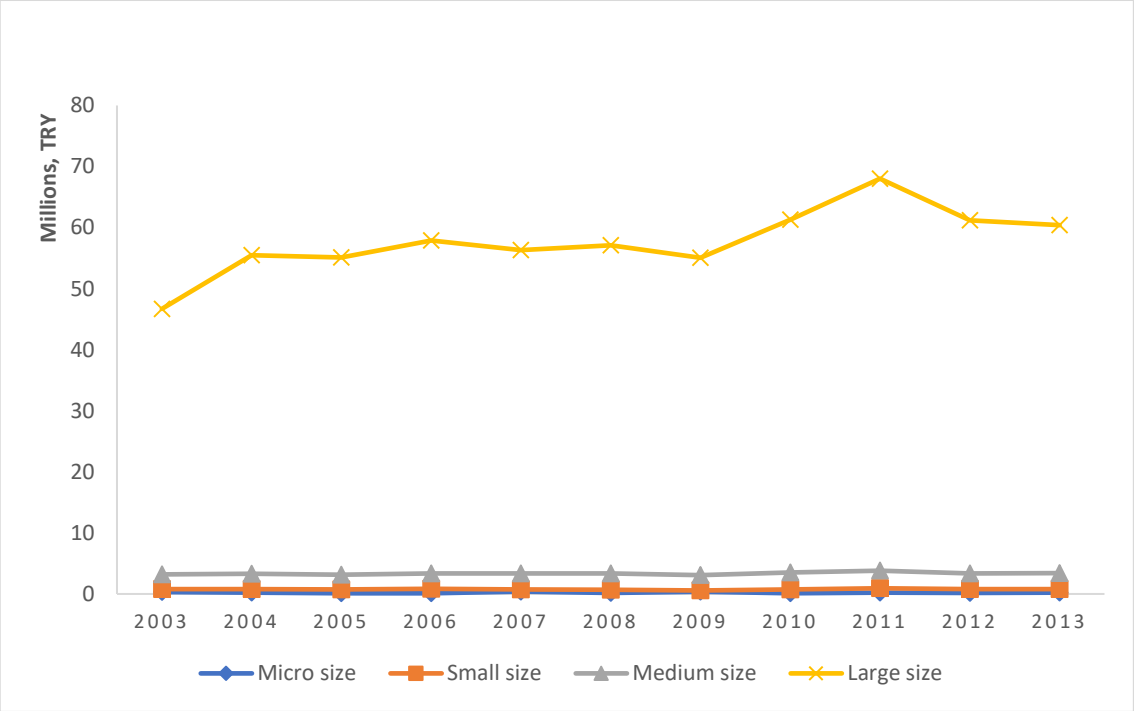
Figure 17. *Mean Imports in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

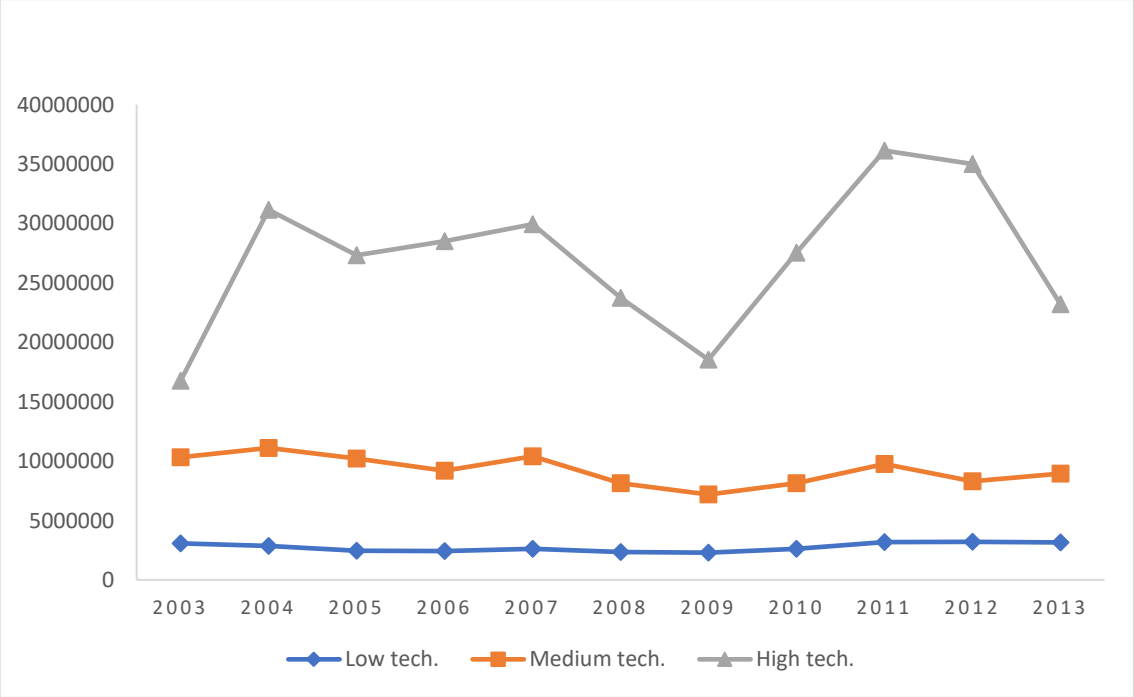
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 18. *Mean Imports in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

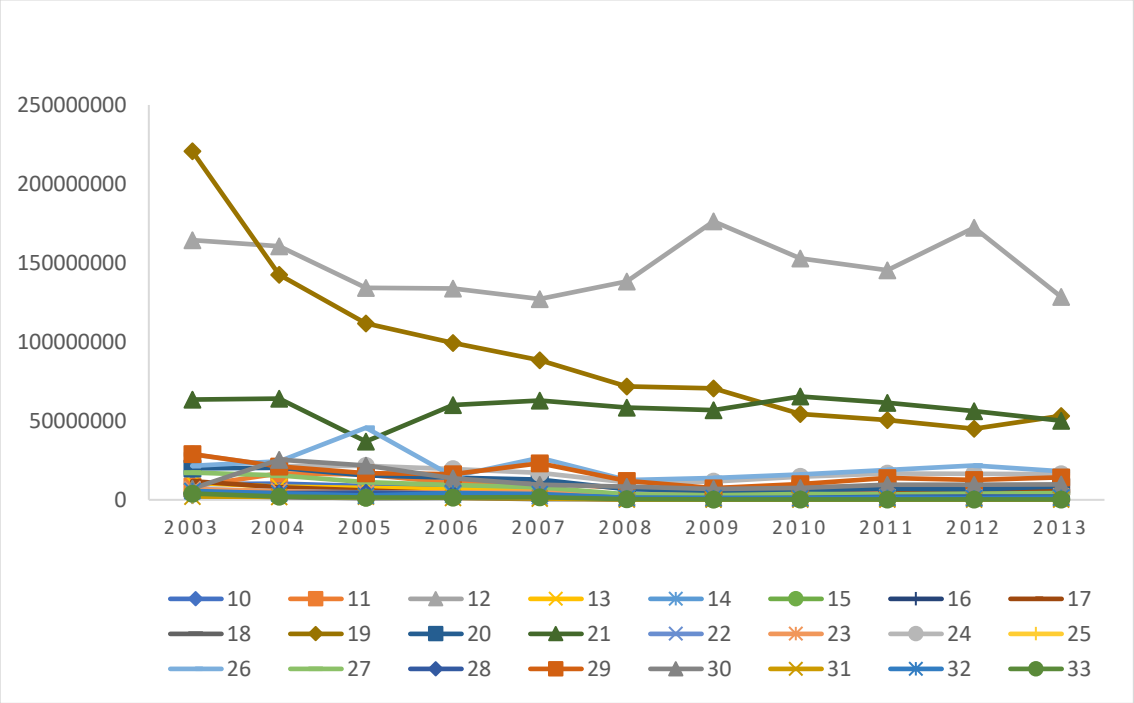
Figure 19. *Mean Imports in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 20 shows mean output in Turkish Manufacturing by NACE-2 sub-industries. Accordingly, NACE-12 (Manufacture of tobacco products), NACE-19 (Manufacture of coke and refined petroleum products) and NACE-21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations) sub-industries have the highest values with their mean outputs. Moreover, Figure 21 and Figure 22 show that large-sized and high-tech producing firms have the highest mean output values.

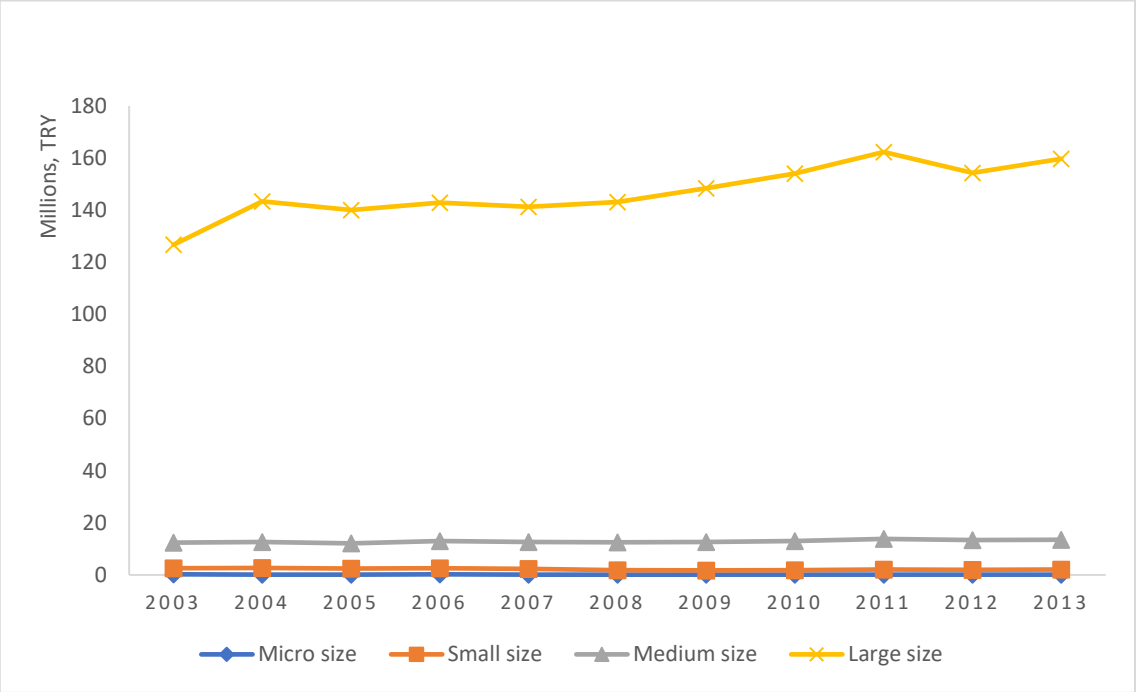
Figure 20. *Mean Output in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

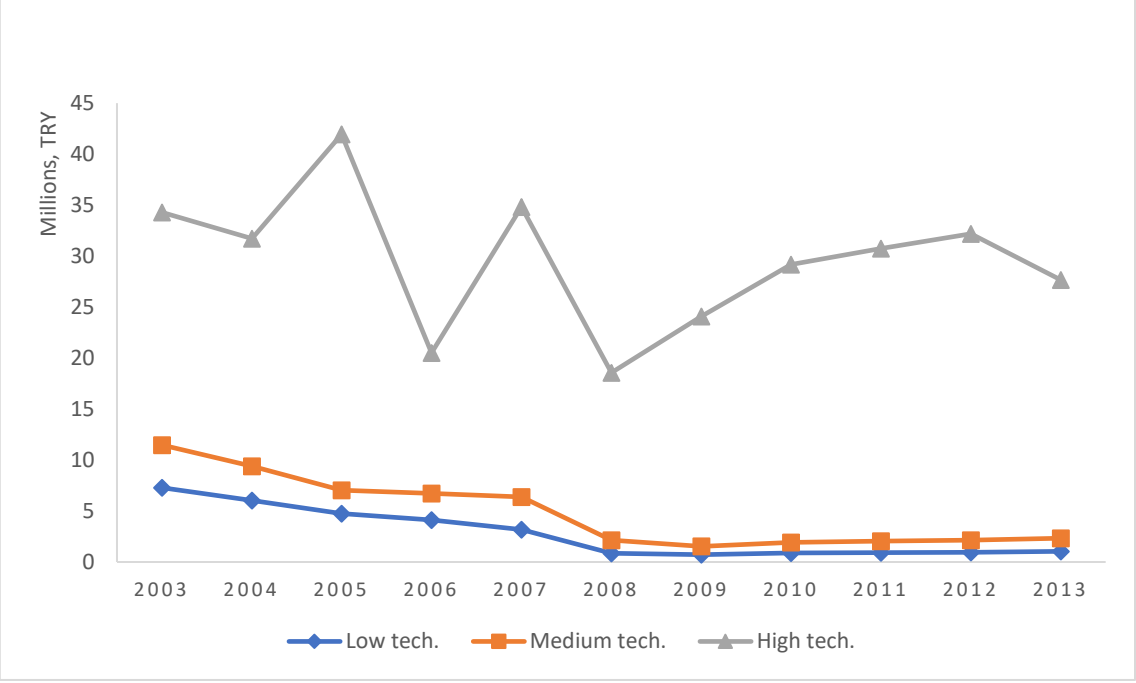
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 21. *Mean Output in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

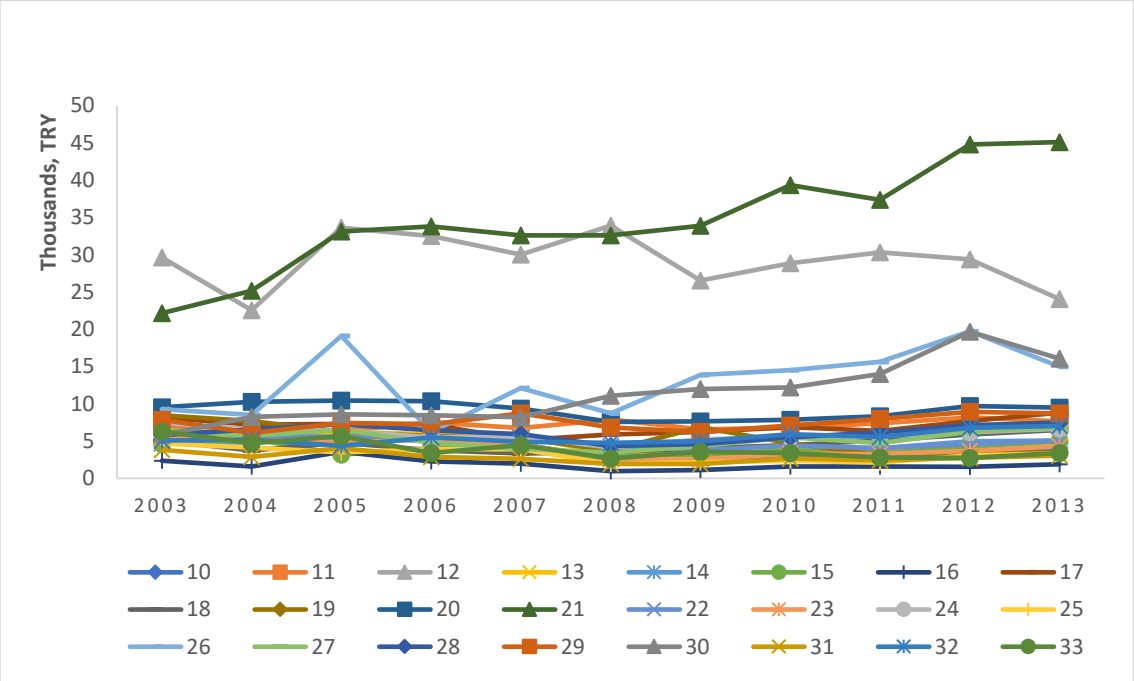
Figure 22. *Mean Output in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

Figure 23 shows average per labor cost in Turkish Manufacturing by NACE-2 sub-industries. According to the Figure 23, NACE-21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations) industry has the most expensive labor in Turkish Manufacturing followed by NACE-12 (Manufacture of tobacco products), NACE-30 (Manufacture of other transport equipment) and NACE-26 (Manufacture of computer, electronic and optical products). Figure 24 and Figure 25 show that large-sized and high-tech producing firms per labor cost is highest in Turkish Manufacturing.

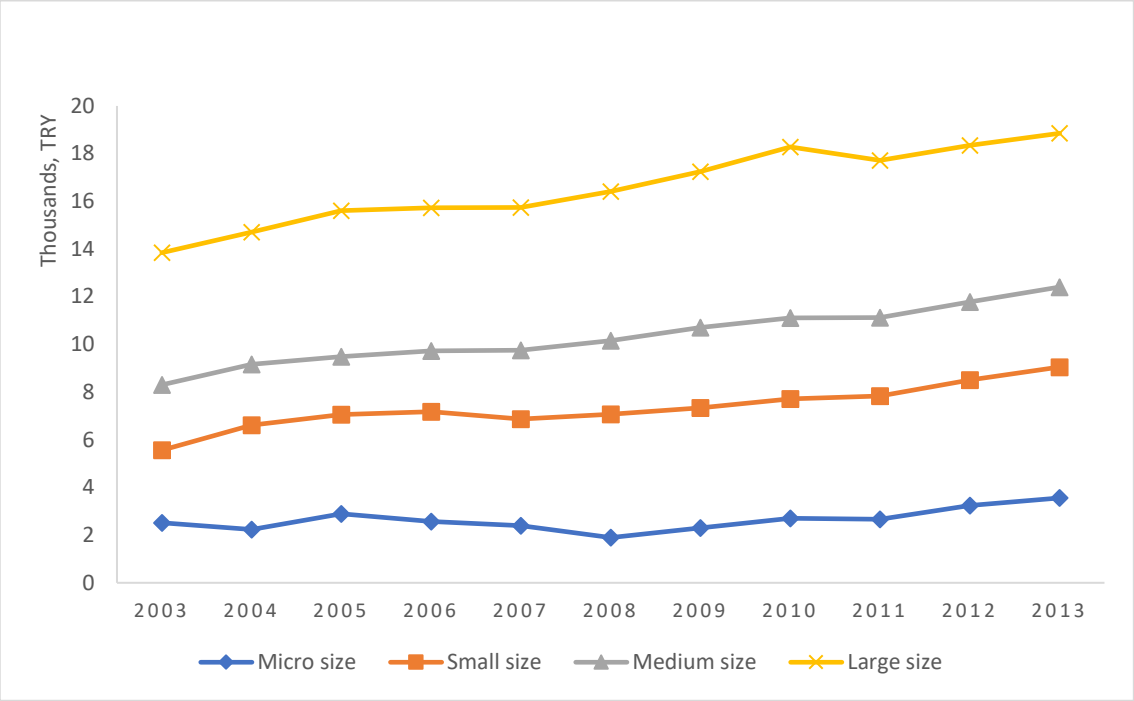
Figure 23. *Average Per Labor Cost in Turkish Manufacturing, by NACE-2, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

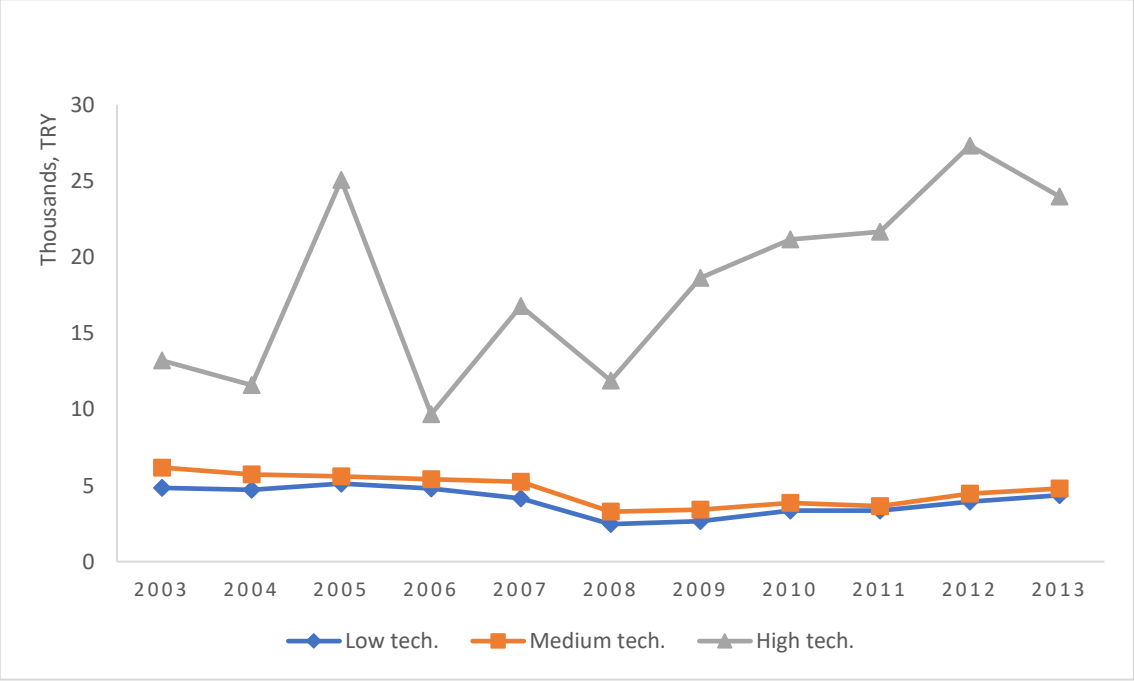
Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14), Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (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 and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (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 (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

Figure 24. *Average Per Labor Cost in Turkish Manufacturing, by Firm Size, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

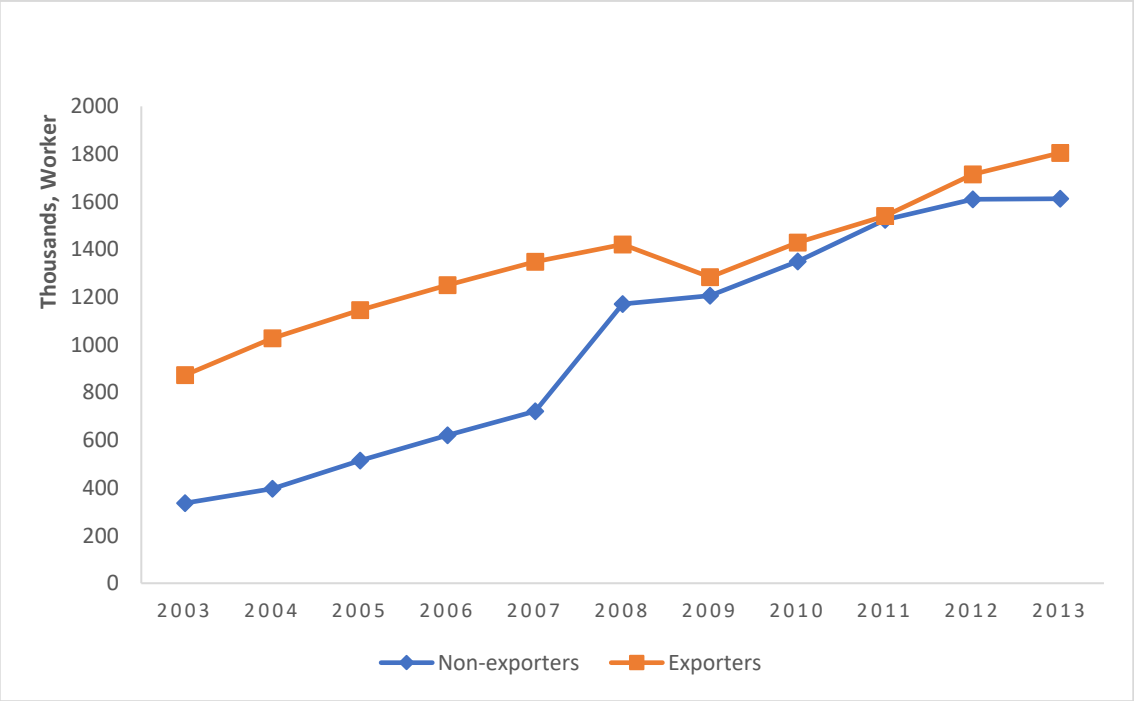
Figure 25. *Average Per Labor Cost in Turkish Manufacturing, by Technology, 2003-2013*



Source: *Author's calculations from panel data (Deflator, 2003=100)*

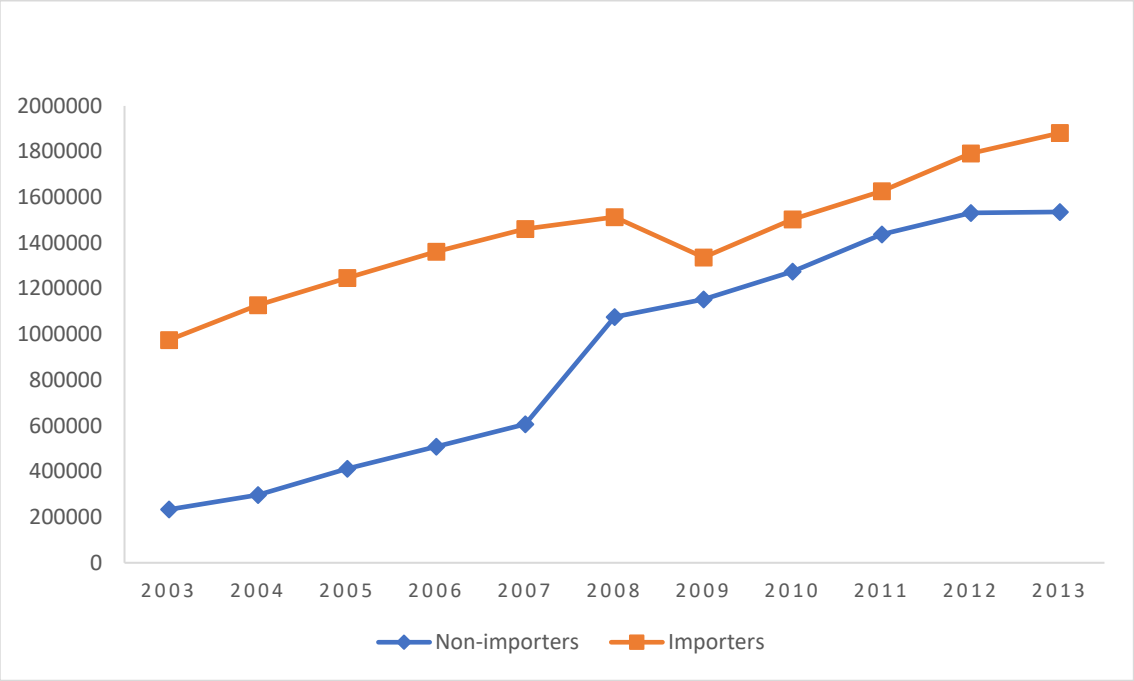
Figure 26 shows labor demand for Turkish Manufacturing according to the firms' exporting status. Figure 26 shows that exporting firms are employing more workers than non-exporting firms. Figure 27 shows labor demand for Turkish Manufacturing according to the firms' importing status. Accordingly, importing firms are employing more workers than non-importing firms. These findings are supporting the cross-section findings of Bernard *et al.* (1995) for US. However, the number of employees itself, does not represent the whole picture of the impact of trade on labor demand for Turkish Manufacturing. So, the Figure 28 and Figure 29 are derived from the rate of labor growth for both exporting and non-exporting firms. The results very constructive to make more accurate comments. For both importing and exporting firms, labor growth is higher than non-importers and non-exporters. Moreover, non-importing and non-exporting firms did not achieve a labor growth since 2008. These figures show that the post-crisis recovery processes for 2008 financial crisis of firms are faster for exporting and importing firms.

Figure 26. *Labor demand by exporting, 2003-2013*



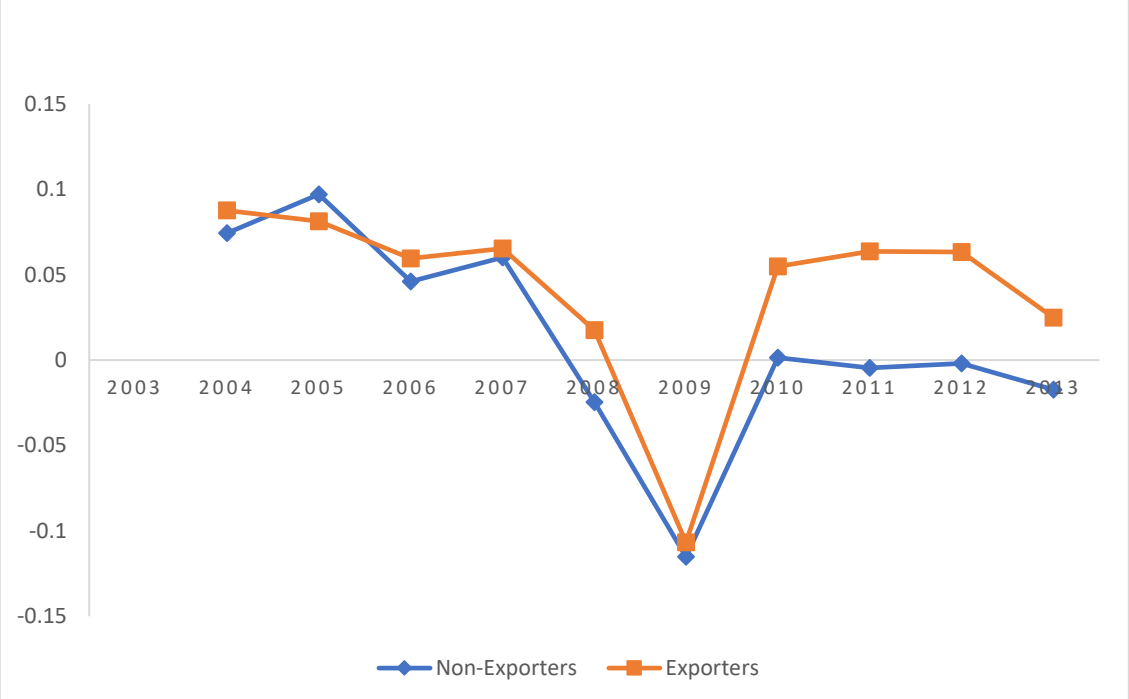
Source: *Author's calculations from panel data*

Figure 27. *Labor demand by importing, 2003-2013*



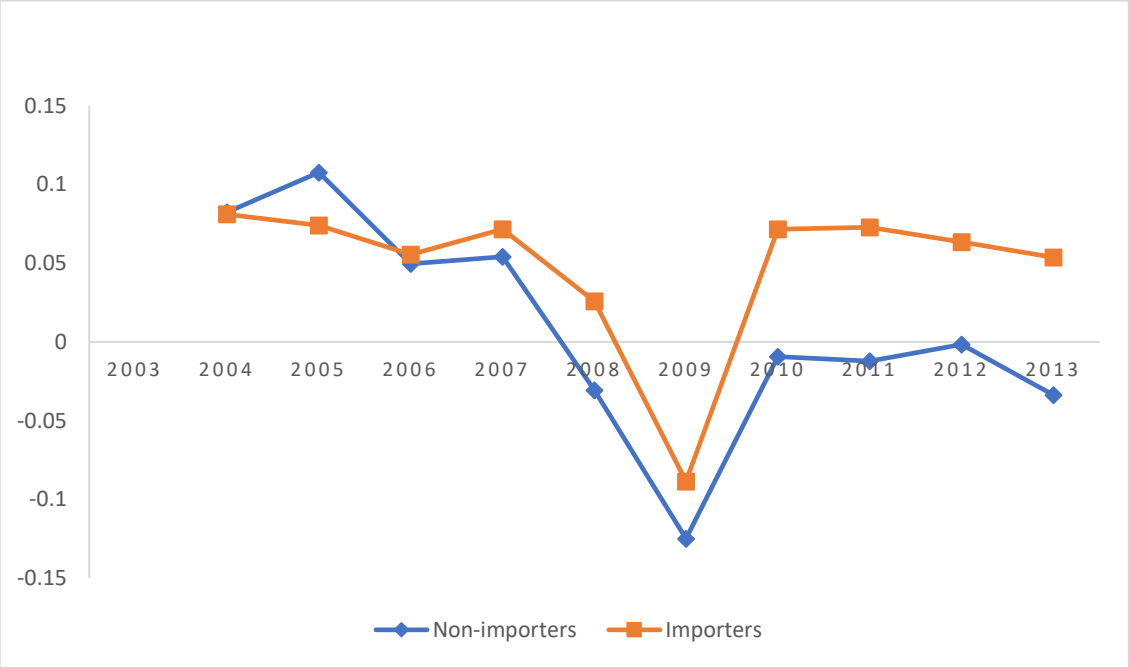
Source: *Author's calculations from panel data*

Figure 28. *Labor growth by exporting, 2003-2013*



Source: *Author's calculations from panel data*

Figure 29. *Labor growth by importing, 2003-2013*



Source: *Author's calculations from panel data*

To sum up, descriptive findings show that most of the labor force working and most of the production of Turkish Manufacturing are belong to the low-tech and medium-tech production. A large part of the production of Turkish Manufacturing is belong to automotive (medium-tech) and food (low-tech) industry. Automotive industry is also Turkish Manufacturing's top exporting industry. However, automotive industry's imports are almost equal to its exports which shows a structural problem of Turkish Automotive Industry: import-based production. Because most of the exports of the automotive industry are based on imports, there is almost no net foreign currency inflow from the automotive industry to Turkish economy. Total imports of manufacturing of basic metal industry is moving along the line with the automotive industry. The imports of manufacture of chemicals and chemical products is the third highest import figure in Turkish Manufacture.

Assessing the trading impact on labor demand, exporting and importing firms tend to employ more labor than non-exporters and non-importers. Labor demand growth of exporting and importing firms are also higher than non-exporting and non-importing firms. These figures partly prove the employment generation impact

of foreign trade in Turkish Manufacturing. However, these are only descriptive findings, they should be supported with the econometric analysis results. Following section gives the methodology and econometric results of the estimations.

CHAPTER 4
METHODOLOGY AND ECONOMETRIC FINDINGS

4.1. Methodology

This section gives detailed information about the models used in the analysis. A trade augmented labor demand function created from a Cobb – Douglas production function following Greenaway *et al.* (1999), Milner & Wright (1998) and Fu & Balasubramanyam (2005):

$$Q_{it} = A^{\gamma} K_{it}^{\alpha} L_{it}^{\beta} \tag{1}$$

Where Q represents the real output, K capital stock and L labor for the firm *i* and time *t*. Additionally, α and β are the factor share coefficients and γ changes the efficiency of production. Following equation is obtained by solving equation 1 according to the profit – maximization condition:

$$Q_{it} = A^{\gamma} (\frac{\alpha N_{it}}{\beta} . \frac{w_i}{c})^{\alpha} L_{it}^{\beta} \tag{2}$$

Where w is the marginal revenue product of labor equals the wage and c is the marginal revenue product of capital equals its user cost. Rearranging the equation after taking the natural logarithm, following function is obtained:

$$lnL_{it} = \phi_0 + \phi_1 \ln(w_i/c) + \phi_2 lnQ_{it} + \varepsilon_{it} \tag{3}$$

Where $\phi_0 = -(\gamma lnA + \alpha ln\alpha - \alpha ln\beta)/(\alpha + \beta)$; $\phi_1 = -\alpha/(\alpha + \beta)$; $\phi_2 = 1/(\alpha + \beta)$ and ε_{it} is the error term. Assuming there is a correlation between technology adoption and exports resulting from the competitiveness of the international markets, the technology term of A in the production function should vary with time in the following:

$$A_{it} = e^{\delta_0 T_i} X_{it}^{\delta_1} M_{it}^{\delta_2}; \;\; \delta_0, \delta_1, \delta_2 > 0 \tag{4}$$

Where T represents time trend, M import and X export penetration. Following equation is obtained by yielding both exports and imports into equation 4:

$$lnL_{it} = \phi_0 + \phi_1 \ln(w_i/c) + \phi_2 lnQ_{it} + \delta_1 X_{it} + \delta_2 M_{it} + \mu_0 T + \varepsilon_{it} \quad (5)$$

In the analyses, export to output ratio (export intensity) "X/Q" is used as export penetration following Greenaway *et al.* (1999). In addition to that, for the import penetration two different variables are used in the estimations: natural logarithm of the imports "ln(M)" and a dummy variable "MDUM" which take the value of "1" if the import of the firm is bigger than zero (M>0) and "0", otherwise. Following equations gives the first two models used in estimations:

$$L_{it} = \gamma Q_{it} + \delta_1 INTX_{it} + \delta_2 MDUM_{it} + \omega LC_{it} + \varepsilon_{it} \quad (6)$$

$$L_{it} = \gamma Q_{it} + \delta_1 INTX_{it} + \delta_2 M_{it} + \omega LC_{it} + \varepsilon_{it} \quad (7)$$

Where L is number of labor the firm *i* hired in year *t*, Q is total sales, INTX is intensity of the exports in total sales, M is total imports, MDUM is dummy variable for imports and LC is the labor cost of the firm including wage, seniority, accrued premium and payment in lieu of notice.

In addition to models 6 and 7, a model is estimated to prevent a possible collinearity between Q and M. A domestic production "DP" variable is derived by subtracting imports from total sales. By using DP instead of Q for the equation 9, following equation is acquired:

$$L_{it} = \gamma DP_{it} + \delta_1 INTX_{it} + \delta_2 M_{it} + \omega LC_{it} + \varepsilon_{it} \quad (8)$$

Again, to prevent a possible collinearity between imports and exports, an "only export augmented" model is also used in the estimations. By excluding the imports (M) from equation 5, following expression is obtained:

$$L_{it} = \gamma Q_{it} + \delta_1 INTX_{it} + \omega LC_{it} + \varepsilon_{it} \quad (9)$$

Further, there is an extension to the Greenaway-Milner-Wright MODEL Ay Fu and Balasubramanyam (2005) by decomposing output into exports and imports. Following expression is obtained by dividing total output (Q) into its two components; exports (X) and domestic sales (D) for equation 3:

$$lnN_{it} = \phi_0 + \phi_1 \ln(w_i/c) + \phi_2 lnD_{it} + \phi_3 lnX_{it} + \mu_0 T + \varepsilon_{it} \quad (10)$$

Where D is domestic sales and X is exports. Yet again by yielding X and D into equation 10 together with removing INTX, last model is obtained for the estimations:

$$L_{it} = \gamma_1 D_{it} + \gamma_2 X_{it} + \omega LC_{it} + \varepsilon_{it} \quad (11)$$

For the analysis, Random Effects model is used with and without year dummies, separately. Since the estimation results are sensitive to the econometric methodology to some extent, the results are robust. However, Random Effects MODEL could contain endogeneity problem. To eliminate the endogeneity problem GMM (Generalized Methods of Moments) is also used in the estimations.

To test the reliability of the GMM results, Sargan and Arellano-Bond tests are applied. The null-hypothesis of Sargan suggests validation of overidentifying restrictions and the null-hypothesis of AR test suggests the residuals are serially uncorrelated. Failure of rejection of the null-hypothesis of Sargan test implies that the instruments are valid. Rejection of AR(1) null-hypothesis implies a dynamic specification is needed and failure of rejection of AR(2) implies that the GMM estimator is consistent.

Table 4 gives the summary of the GMM models used in the estimations. According to the Table 4, a total of 8 different explanatory variables are used in the estimations which are lnQ, lnQD, lnDP, lnQX, INTX, MDUM, lnM and lnLC. lnQ is natural logarithm of total output (total sales), lnQD is natural logarithm of domestic sales (total sales – exports), lnDP is natural logarithm of domestic production (total sales – imports), lnQX is natural logarithm of total exports, INTX is intensity of exports in total sales (exports/total output), MDUM is a dummy variable stands for importing firms (1 for

importing, 0 otherwise) and lnLC is natural logarithm of labor costs. It is expected to get positive and significant results for lagged dependent variable (L_{it-1}), output (Q_{it}, QD_{it}, DP_{it} QX_{it}) and international trade variables ($INTX_{it}$, M_{it}, $MDUM_{it}$) and labor cost variable (LC_{it}) is expected to be negative and significant.

Table 4. *Estimated GMM Models*

MODEL	EQUATION
MODEL A	$L_{it} = \rho L_{it-1} + \gamma Q_{it} + \delta_1 INTX_{it} + \delta_2 MDUM_{it} + \omega LC_{it} + \varepsilon_{it}$
MODEL B	$L_{it} = \rho L_{it-1} + \gamma Q_{it} + \delta_1 INTX_{it} + \delta_2 M_{it} + \omega LC_{it} + \varepsilon_{it}$
MODEL C	$L_{it} = \rho L_{it-1} + \gamma DP_{it} + \delta_1 INTX_{it} + \delta_2 M_{it} + \omega LC_{it} + \varepsilon_{it}$
MODEL D	$L_{it} = \rho L_{it-1} + \gamma Q_{it} + \delta_1 INTX_{it} + \omega LC_{it} + \varepsilon_{it}$
MODEL E	$L_{it} = \rho L_{it-1} + \gamma_1 QD_{it} + \gamma_2 QX_{it} + \omega LC_{it} + \varepsilon_{it}$

Source: *Author*

4.2. Econometric Findings

This section gives GMM and Random Effects analysis results to show the impact of international trade on labor demand for Turkish Manufacturing. A total of five different econometric models are estimated.

Table 5 shows the GMM results for the five models (A, B, C, D, and E) is used in the estimations. According to the table 5, the signs and significance of the variables are as expected. The output variables are significant and positive for all models. Lagged dependent variable is significant and positive and labor cost variable is significant and negative for all models. There is no proof of an omitted variable bias in the models. One should remember that including dependent variable lnL (labor demand), all the variables are in their natural logarithms except for INTX and MDUM which are exports to output intensity and import dummy, respectively.

According to the model A, output variable lnQ is positive and significant. The coefficient of this variable is 0.372, which means a 1 percent increase in total output will increase labor demand as 0.372 percent (because both variables are in their natural logarithms). For Model A, INTX (intensity of exports in total sales) is also significant and positive as expected. Coefficient of INTX is 0.0180 which means 1 unit increase in INTX leads labor demand to increase 1.80 percent. In addition to that, dummy variable for imports (MDUM) is also positive and significant. It means

importing firms are likely to employ more employees than the firms do not import. lnLC (labor cost) variable is negative and statistically significant and the coefficient is -0.244. This means if lnLC (labor cost) increase 1 percent, it will lead labor demand to decrease 2.44 percent.

In model B, lnM (natural logarithm of imports) is used instead of MDUM. Which gives opportunity to interpret the marginal effects of imports to labor demand for Turkish Manufacturing. According to the results of Model B, lnM is statistically significant and positive, and the coefficient is 0.0097. Which means, if the imports increase 1 percent, it will lead total labor employed to increase 0.01 percent. Rest of the variables for Model B are significant and positive like Model A. It may be significant according to the analysis but 0.01 percent increase in labor demand for a 1 percent increase in imports does not seem to be a significant impact. There must be a problem and that problem may be caused from the assumption of total sales (lnQ) includes imports in it. This is an important problem because if one variable includes another in it, one cannot interpret the real impact of these (at least one of them) variables. To eliminate this problem, Model C is conducted.

For Model C, a different output variable is used: lnDP (domestic production (lnQ – lnM)). This variable is used to indicate the real impact of the imports to labor demand because the main variable lnQ includes imports. With removing imports from total output, it is expected that the estimates should present a more real impact of imports on labor demand for Turkish Manufacturing. Figure 5 shows that the only difference between Model B and Model C is the difference between two lnM variables. According to the results of Model C, the coefficient of lnM is 0.317 and statistically significant. This means that a 1 percent increase in total imports leads labor demand to increase 0.32 percent.

Model D and Model E are import excluded models. The only difference between Model D and Model A is that Model D does not have an import variable. Just like Model A, lnQ has a statistically significantly positive impact on labor demand for Model D and the coefficient is 0.374. Which means a 1 percent increase in total output leads a 0.37 percent increase in the labor demand in Turkish Manufacturing. INTX variable is also positive and statistically significant. The coefficient is 0.0181 which means 1 unit increase in INTX variable leads labor demand to increase 1.81

percent in Turkish Manufacturing. For Model D, lnLC variable is negative and statistically significant as expected. The coefficient is -0.245 which means a 1 percent increase in labor costs leads total employment in Turkish Manufacturing to decrease 0.25 percent.

Model E represents a different approach estimating labor demand. Following Fu & Balasubramanyam (2005).

AR tests suggests that GMM estimator is consistent for Model A, B, C and D. Sargan tests failed to reject that the instruments are valid for all models, however for the big data sets this is usual.

Table 5. *Labor Demand Estimation Results for GMM*

VARIABLES	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E
ln_Q	0.372***	0.307***		0.374***	
	(0.00217)	(0.00347)		(0.00217)	
ln_QD					0.184***
					(0.00264)
ln_QX					0.0250***
					(0.000978)
ln_DP			0.307***		
			(0.00347)		
INT_X	0.0180***	0.0146***	0.0146***	0.0181***	
	(0.000957)	(0.000892)	(0.000892)	(0.000957)	
MDUM	0.0255***				
	(0.00296)				
ln_M		0.00973***	0.317***		
		(0.000897)	(0.00336)		
ln_LC	-0.244***	-0.220***	-0.220***	-0.245***	-0.199***
	(0.00360)	(0.00468)	(0.00468)	(0.00360)	(0.00495)
L.1.ln_L	0.0225	0.389***	0.389***	0.0202	0.372***
	(0.0142)	(0.0150)	(0.0150)	(0.0143)	(0.0164)
L.2.ln_L	-0.0328***	0.000659	0.000659	-0.0331***	0.00923**
	(0.00288)	(0.00400)	(0.00400)	(0.00288)	(0.00424)
Constant	-	-	-	-	-
Observations	102142	53837	53837	102142	51288
Number of firm	23929	12330	12330	23929	14701
Hansen	0.0000	0.0000	0.0000	0.0000	0.0000
AR(1)	0.0000	0.0000	0.0000	0.0000	0.0000
AR(2)	0.3191	0.7051	0.7051	0.4012	0.0017

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Table 6 shows the robust Random Effects results. The significance and direction of the results found for the GMM estimations are also valid for Random Effects estimations. However, marginal effects are changed for Random Effects in the estimations.

Table 6. *Labor Demand Estimation Results for Random Effects*

VARIABLES	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E
ln_Q	0.548***	0.514***		0.556***	
	(0.00368)	(0.00731)		(0.00355)	
ln_QD					0.378***
					(0.00426)
ln_QX					0.0594***
					(0.00125)
ln_DP			0.514***		
			(0.00731)		
INT_X	0.0107**	0.00940**	0.00940**	0.0112**	
	(0.00459)	(0.00431)	(0.00431)	(0.00467)	
MDUM	0.0828***				
	(0.00377)				
ln_M		0.0121***	0.526***		
		(0.00133)	(0.00652)		
ln_LC	-0.167***	-0.221***	-0.221***	-0.159***	-0.161***
	(0.00569)	(0.00932)	(0.00932)	(0.00524)	(0.00875)
Years	*included*	*included*	*included*	*included*	*included*
Constant	-3.230***	-2.082***	-2.082***	-3.409***	-1.033***
	(0.0458)	(0.107)	(0.107)	(0.0400)	(0.0820)
Observations	275906	111885	111885	275906	109225
Number of firm	84598	24674	24674	84598	25291

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Following tables (Table 7, 8, 9, 10, 11, 12 and 13) gives the results for more detailed analysis for Turkish Manufacturing and its sub-industries for Model A. Same detailed analysis results for other models can be found in the appendices.

Table 7 gives the GMM estimation results for Model A according to the level of technology orientation. According to the Table 7, variable lnQ is positive and statistically significant for all technology classifications. However, INTX is only positive for low-tech and medium-tech. Negative sign of exports for high-tech

industry can be explained by the inadequacy of the number of observations, but this result is not significant. It is not possible to say the same things for the import variable, because MDUM is positive and significant for all estimations. Labor cost variable lnLC is significant and negative for all technology classifications, as expected.

Table 7. *Model A: GMM Labor Demand Estimations for Technology Level*

VARIABLES	GMM Low Tech	GMM Medium Tech	GMM High Tech
ln_Q	0.369***	0.376***	0.322***
	(0.00312)	(0.00312)	(0.0167)
INT_X	0.0392***	0.0178***	-0.153
	(0.00737)	(0.000981)	(0.107)
MDUM	0.0302***	0.0207***	0.0705*
	(0.00398)	(0.00451)	(0.0409)
ln_LC	-0.249***	-0.254***	-0.269***
	(0.00514)	(0.00504)	(0.0225)
L.1.ln_L	0.0201	0.159***	0.0164
	(0.0226)	(0.0162)	(0.1000)
L.2.ln_L	-0.0377***	-0.0208***	-0.0179
	(0.00415)	(0.00413)	(0.0233)
Constant	-	-	-
Observations	53182	47333	1627
Number of firm	12589	11291	405
Hansen	0.0000	0.0000	0.0127
AR(1)	0.0001	0.0000	0.8667
AR(2)	0.7753	0.6892	0.4078

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Table 8 gives the GMM estimation results for Model A according to the firm sizes. According to the Table 8, INTX has a positive and significant impact on labor demand for only medium-sized firms. For the micro-sized, small-sized and large-sized firms, the impact is insignificant. On the other hand, ln_M has a statistically significant and positive impact on labor demand for small-sized, medium-sized and large-sized firms.

Table 8. *Model B: GMM Labor Demand Estimations for Firm Size*

VARIABLES	Micro Size	Small Size	Medium Size	Large Size
ln_Q	0.834***	0.227***	0.299***	0.318***
	(0.0835)	(0.00549)	(0.00553)	(0.0130)
INT_X	-0.0193	0.00462	0.0164***	-0.0477
	(0.0297)	(0.00817)	(0.000999)	(0.0292)
ln_M	-0.00716	0.00914***	0.0107***	0.0197***
	(0.0473)	(0.00143)	(0.00137)	(0.00363)
ln_LC	-0.519***	-0.279***	-0.219***	-0.284***
	(0.131)	(0.00709)	(0.00721)	(0.0130)
L.1.ln_L	1.070***	0.675***	0.642***	0.693***
	(0.178)	(0.0289)	(0.0183)	(0.0269)
L.2.ln_L	0.314*	-0.0217***	-0.00580	0.0159
	(0.169)	(0.00808)	(0.00619)	(0.0102)
Constant		-	-	-
Observations	215	18941	25854	8827
Number of firm	172	6531	6876	1868

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

According to Table 9, the impact of exports and imports are positive and statistically significant for NACE-10 (Manufacture of Food Products), NACE-12 (Manufacture of tobacco products) and NACE-13 (Manufacture of textiles) sub-industries. The coefficient of INTX is highest for Manufacture of Tobacco Products in these five sub-industries with 0.183. Which means a 1 unit increase in INTX leads a 18.3 percent increase in labor demand for Turkish Food Production Industry. In addition to that, a 1 unit increase in INTX leads a 10.8 percent increase in Turkish Textile Industry. Importing also leads the firms in Turkish Manufacture of Food Product, Manufacture of Textiles and Manufacture of Wearing Apparel industries.

Table 9. *Model A: GMM Labor Demand Estimations for NACE-2 (10-14)*

VARIABLES	NACE 10	NACE 11	NACE 12	NACE 13	NACE 14
L.1.ln_L	0.284***	0.355***	0.147	0.502***	0.495***
	(0.0261)	(0.0896)	(0.109)	(0.0389)	(0.0357)
L.2.ln_L	0.0494***	-0.00436	0.0272	-0.0572***	-0.0755***
	(0.00894)	(0.0363)	(0.0450)	(0.00915)	(0.00877)
ln_Q	0.318***	0.249***	0.175***	0.396***	0.385***
	(0.00776)	(0.0317)	(0.0659)	(0.00688)	(0.00606)
INT_X	0.163***	-0.260***	0.183***	0.108***	-0.0165
	(0.0373)	(0.0892)	(0.0701)	(0.0252)	(0.0174)
MDUM	0.0186**	-0.0101	-0.165	0.0301***	0.0212**
	(0.00855)	(0.0379)	(0.145)	(0.00844)	(0.00914)
ln_LC	-0.254***	-0.150***	-0.643***	-0.295***	-0.400***
	(0.0110)	(0.0347)	(0.0661)	(0.0116)	(0.00976)
Constant					
Observations	10512	540	102	12427	15593
Number of firm	2458	154	20	2762	3731

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Legend: Manufacture of food products (10), Manufacture of beverages (11), Manufacture of tobacco products (12), Manufacture of textiles (13), Manufacture of wearing apparel (14).

Table 10 shows GMM labor demand estimations for Turkish Manufacturing's NACE-15 (Manufacture of leather and related products), NACE-16 (Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials), NACE-17 (Manufacture of paper and paper products), NACE-18 (Printing and reproduction of recorded media), and NACE-19 (Manufacture of coke and refined petroleum products) sub-industries. According to Table 10, INTX is positive and statistically significant for only Turkish Paper and Paper Production Industry. However, MDUM is statistically significant for NACE-15 and NACE-17 sub-industries. Importing leads higher labor demand for the firms operate in NACE-15 and NACE-17 sub-industries.

Table 10. *Model A: GMM Labor Demand Estimations for NACE-2 (15-19)*

VARIABLES	NACE 15	NACE 16	NACE 17	NACE 18	NACE 19
L.1.ln_L	-0.00255	0.0554	0.0429	0.259**	0.189
	(0.0771)	(0.0843)	(0.0651)	(0.113)	(0.121)
L.2.ln_L	-0.107***	-0.0177	-0.0678***	-0.0428	-0.104**
	(0.0225)	(0.0244)	(0.0162)	(0.0279)	(0.0450)
ln_Q	0.368***	0.348***	0.394***	0.420***	0.313***
	(0.0154)	(0.0181)	(0.0153)	(0.0200)	(0.0384)
INT_X	0.0323	0.0179	0.208***	-0.258	-0.281
	(0.0619)	(0.121)	(0.0298)	(0.178)	(0.254)
MDUM	0.0628***	0.00376	0.0486***	0.0277	-0.0629
	(0.0200)	(0.0222)	(0.0157)	(0.0176)	(0.0700)
ln_LC	-0.157***	-0.280***	-0.0657***	-0.270***	-0.0852
	(0.0271)	(0.0270)	(0.0116)	(0.0246)	(0.0541)
Constant					
Observations	2339	1443	2451	1521	272
Number of firm	628	398	599	423	91

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Legend: Manufacture of leather and related products (15), Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (16), Manufacture of paper and paper products (17), Printing and reproduction of recorded media (18), Manufacture of coke and refined petroleum products (19).

Table 11 shows GMM labor demand estimations for Turkish Manufacturing's NACE-20 (Manufacture of chemicals and chemical products), NACE-21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations), NACE-22 (Manufacture of other non-metallic mineral products), NACE-23 (Manufacture of other non-metallic mineral products) and NACE-24 (Manufacture of basic metal) sub-industries. Accordingly, the impact of exports on labor demand is significant and positive only for Manufacture of Other Non-Metallic Mineral Products Industry. The coefficient of INTX variable for NACE-22 sub-industry is 0.106. Which means a 1 unit increase in INTX will lead labor demand for NACE-22 industry firms to increase 10.6 percent. INTX variable is not statistically significant for any other industry showed in Table 11. Also, MDUM is insignificant for all industries except NACE-23 and NACE-24.

Table 11. *Model A: GMM Labor Demand Estimations for NACE-2 (20-24)*

VARIABLES	NACE 20	NACE 21	NACE 22	NACE 23	NACE 24
L.1.ln_L	0.328***	0.173	0.116***	0.255***	0.310***
	(0.0809)	(0.121)	(0.0394)	(0.0334)	(0.0410)
L.2.ln_L	0.0494***	-0.0126	-0.0139	-0.00279	-0.0121
	(0.0163)	(0.0477)	(0.0112)	(0.00971)	(0.0149)
ln_Q	0.263***	0.358***	0.448***	0.406***	0.341***
	(0.0149)	(0.0346)	(0.00953)	(0.00913)	(0.0110)
INT_X	-0.0128	-0.254	0.106***	0.00558	-0.0254
	(0.0704)	(0.255)	(0.0389)	(0.0478)	(0.0460)
MDUM	0.0237	0.0194	0.0136	0.0209*	0.0270*
	(0.0210)	(0.0794)	(0.0102)	(0.0125)	(0.0145)
ln_LC	-0.251***	-0.302***	-0.216***	-0.315***	-0.195***
	(0.0189)	(0.0378)	(0.0129)	(0.0141)	(0.0162)
Constant					
Observations	2869	609	6348	7704	3741
Number of firm	667	135	1567	1776	882

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Legend: Manufacture of chemicals and chemical products (20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (21), Manufacture of rubber and plastic products (22), Manufacture of other non-metallic mineral products (23), Manufacture of basic metal (24).

Table 12 shows GMM labor demand estimations for Turkish Manufacturing's NACE-25 (Manufacture of fabricated metal products, except machinery and equipment), NACE-26 (Manufacture of computer, electronic and optical products), NACE-27 (Manufacture of electrical equipment), NACE-28 (Manufacture of machinery and equipment n.e.c), NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers) sub-industries. According to Table 12, INTX is positive and statistically significant for Manufacture of Motor Vehicles, Trailers and Semi-Trailers industry while it is negative and statistically significant for Metal Products Except Machinery and Equipment industry. A 1 unit increase in INTX leads labor demand for the firms in NACE-29 to increase 10.2 percent while a 1 point increase in INTX leads labor demand for the firms in NACE-25 to decrease 8.3 percent.

Table 12. *Model A: GMM Labor Demand Estimations for NACE-2 (25-29)*

VARIABLES	NACE 25	NACE 26	NACE 27	NACE 28	NACE 29
L.1.ln_L	0.0177	0.128*	0.372***	0.200***	0.196***
	(0.0400)	(0.0690)	(0.0484)	(0.0350)	(0.0355)
L.2.ln_L	0.00686	-0.0316	-0.0152	-0.0316***	-0.00781
	(0.00979)	(0.0263)	(0.0150)	(0.0105)	(0.0132)
ln_Q	0.407***	0.308***	0.368***	0.341***	0.447***
	(0.00745)	(0.0179)	(0.0117)	(0.00690)	(0.00959)
INT_X	-0.0827***	-0.135	0.00629	-0.0279	0.102**
	(0.00710)	(0.112)	(0.0456)	(0.0246)	(0.0403)
MDUM	0.0177*	0.0724	0.0376**	0.0106	0.0279**
	(0.0107)	(0.0468)	(0.0154)	(0.00920)	(0.0130)
ln_LC	-0.213***	-0.290***	-0.271***	-0.226***	-0.321***
	(0.0125)	(0.0244)	(0.0161)	(0.0110)	(0.0142)
Constant					
Observations	8377	1018	3679	7727	4125
Number of firm	2337	270	931	2005	995

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Legend: 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).

Table 12 shows GMM labor demand estimations for Turkish Manufacturing's NACE-30 (Manufacture of other transport equipment), NACE-31 (Manufacture of furniture), NACE-32 (Other manufacturing), NACE-33 (Repair and installation of machinery and equipment) sub-industries. INTX variable is positive and statistically significant for the firms in Turkish Manufacture of Other Transport Equipment Industry and the coefficient is 0.009. Which means a 1 unit increase in INTX leads firms' labor demand in NACE-30 industry to increase 0.9 percent. For the firms in NACE-32 industry, variable INTX is negative but not statistically significant. Table 13 also shows that importing has positive impact on labor demand only for the firms operates in NACE-30 industry.

Table 13. *Model A: GMM Labor Demand Estimations for NACE-2 (30-33)*

VARIABLES	NACE 30	NACE 31	NACE 32	NACE 33
L.1.ln_L	0.589***	0.138***	0.244***	0.418***
	(0.107)	(0.0503)	(0.0806)	(0.0719)
L.2.ln_L	-0.100**	-0.0518***	0.0644***	-0.0157
	(0.0396)	(0.0143)	(0.0221)	(0.0278)
ln_Q	0.169***	0.335***	0.265***	0.567***
	(0.0167)	(0.00991)	(0.0127)	(0.0183)
INT_X	0.00887***	0.0106	0.00886	-0.0662
	(0.00186)	(0.0462)	(0.00946)	(0.0706)
MDUM	0.118*	0.0131	0.0163	-0.00629
	(0.0622)	(0.0122)	(0.0207)	(0.0488)
ln_LC	-0.320***	-0.183***	-0.363***	-0.403***
	(0.0344)	(0.0184)	(0.0201)	(0.0308)
Constant				
Observations	900	4206	2048	1591
Number of firm	309	1119	554	637

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimations

Legend: Manufacture of other transport equipment (30), Manufacture of furniture (31) Other manufacturing (32), Repair and installation of machinery and equipment (33).

CHAPTER 5
CONCLUSION

5.1. Concluding Remarks

This section gives the brief review of this study and points out the important descriptive and econometric findings from the analysis. Giving similar results with different estimation methods shows the strength of the models used in this study. In a few words, imports and exports have positive impact on labor demand of Turkish Manufacturing.

This thesis analyzed the impact of international trade on labor for Turkish Manufacturing Industry. A firm-level panel data set for Turkish Manufacturing for 2003-2013 period is used for Random Effect and GMM analysis. A detailed picture of the structure of Turkish Manufacturing is presented with descriptive findings and empirical analysis of this thesis.

Descriptive findings give detailed information about the change Turkish Manufacturing Experienced during 2003-2013 period. While some industries have experienced huge growth in their labor inputs and production levels i.e." Manufacture of Motor Vehicles, Trailers, and Semi-Trailers, Manufacture of Textiles, Manufacture of Wearing Apparel and Manufacture of Food Products", some industries have experience relatively low growth rates. Figures show that these industries are also the major exporters of Turkish Manufacturing. However, analyzing the figures for exports and imports together gives opportunity to see a major structural problem in Turkish Manufacturing Industry: Turkish Automotive Industry's production is based on imports. This leads imports to increase while domestic sales and exports increase. One should know that, despite having Turkish Manufacturing's highest exports, there is no net foreign currency inflow to Turkish Economy from Turkish Automotive Industry. The reason behind that is the automotive industry import values are almost equal to its exports.

Moreover, while the share of high-tech products decreased during 2003-2013 period, medium-tech products' share increased. In addition, large-sized firms and medium-tech products have large shares total output and exports of Turkish Manufacturing Industry.

Empirical results showed that, international trade has a positive impact on demand for labor in Turkish Manufacturing both on exporting and importing sides. However, this impact varies according to NACE-2 industries, firm sizes and technological classification of products. While imports have a positive impact for all technological classifications, the impact of exports is only positive for medium-tech products. Additionally, exports have a positive impact only for medium-sized firms and imports for small, medium and large-sized firms.

Notably, exports to output share (INTX) have positive impact on labor demand for the firms operating in following sub-industries of Turkish Manufacturing: NACE-10 (Manufacture of food products), NACE-11 (Manufacture of beverages), NACE-12 (Manufacture of tobacco products), NACE-13 (Manufacture of textiles), NACE-17 (Manufacture of paper and paper products), NACE-22 (Manufacture of other non-metallic mineral products), NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers), and NACE-30 (Manufacture of other transport equipment).

In addition, importing firms' labor demand tend to be higher than non-importers for following sub-industries of Turkish Manufacturing: NACE-10 (Manufacture of food products), NACE-13 (Manufacture of Textiles), NACE-14 (Manufacture of Wearing Apparel), NACE-15 (Manufacture of leather and related products), NACE-17 (Manufacture of paper and paper products), NACE-23 (Manufacture of other non-metallic mineral products), NACE-24 (Manufacture of basic metal), NACE-25 (Manufacture of fabricated metal products, except machinery and equipment), NACE-27 (Manufacture of electrical equipment) and NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers).

For the future research, more specific estimations shall be made to analyze the impact of trade on Turkish Manufacturing. To reach deeper conclusions and point shot policy recommendations, size-based sub-industry estimations or region based sub-industry estimations might be useful. For example, this study showed a positive impact of exports on Turkish Food Production Industry. This study also showed that this positive impact concentrated in medium-sized firms. Although, we cannot conclude that all the firms in Turkish Food Production Industry will response higher labor demand to an increase in exports. This impact may be different for small-sized food production firms.

5.2. Policy Recommendations

Analysis of this study showed that there is a potential in Turkish Manufacturing Industry for future policy implications on trade to increase employment in Turkish Manufacturing. Following information would be helpful to make point shot policy implications for Turkish Manufacturing to increase labor demand:

To increase labor demand for some specific sub-industries in Turkish Manufacturing, there should be some export subsidies in following sub-industries of Turkish Manufacturing: NACE-10 (Manufacture of food products), NACE-11 (Manufacture of beverages), NACE-12 (Manufacture of tobacco products), NACE-13 (Manufacture of textiles), NACE-17 (Manufacture of paper and paper products), NACE-22 (Manufacture of other non-metallic mineral products), NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers), and NACE-30 (Manufacture of other transport equipment).

Not only export subsidies, but some import easiness shall be provided for the following industries to increase labor demand for specific industries through trade: NACE-10 (Manufacture of food products), NACE-13 (Manufacture of Textiles), NACE-14 (Manufacture of Wearing Apparel), NACE-15 (Manufacture of leather and related products), NACE-17 (Manufacture of paper and paper products), NACE-23 (Manufacture of other non-metallic mineral products), NACE-24 (Manufacture of basic metal), NACE-25 (Manufacture of fabricated metal products, except machinery and equipment), NACE-27 (Manufacture of electrical equipment) and NACE-29 (Manufacture of motor vehicles, trailers and semi-trailers).

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APPENDIX A: NACE-2 CLASSIFICATION OF MANUFACTURING INDUSTRIES

NACE-2 Classifications

NACE	Industry	Technology Level
NACE 10	Manufacture of Food Products	Low Tech
NACE 11	Manufacture of Beverages	Low Tech
NACE 12	Manufacture of Tobacco Products	Low Tech
NACE 13	Manufacture of Textiles	Low Tech
NACE 14	Manufacture of Wearing Apparel	Low Tech
NACE 15	Manufacture of Leather and Related Products	Low Tech
NACE 16	Manufacture of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials	Low Tech
NACE 17	Manufacture of Paper and Paper Products	Low Tech
NACE 18	Printing and Reproduction of Recorded Media	Low Tech
NACE 19	Manufacture of Coke and Refined Petroleum Products	Low Tech
NACE 20	Manufacture of Chemicals and Chemical Products	Medium Tech
NACE 21	Manufacture of Basic Pharmaceutical Products and Pharmaceutical Preparations	High Tech
NACE 22	Manufacture of Rubber and Plastic Products	Medium Tech
NACE 23	Manufacture of Other Non-Metallic Mineral Products	Medium Tech
NACE 24	Manufacture of Basic Metals	Medium Tech
NACE 25	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	Medium Tech
NACE 26	Manufacture of Computer, Electronic and Optical Products	High Tech
NACE 27	Manufacture of Electrical Equipment	Medium Tech
NACE 28	Manufacture of Machinery and Equipment N.E.C.	Medium Tech
NACE 29	Manufacture of Motor Vehicles, Trailers, and Semi-Trailers	Medium Tech
NACE 30	Manufacture of Other Transport Equipment	Medium Tech
NACE 31	Manufacture of Furniture	Low Tech
NACE 32	Other Manufacturing	Medium Tech
NACE 33	Repair and Installation of Machinery and Equipment	Medium Tech

Source: *European Commission*

APPENDIX B: ESTIMATION RESULTS FOR MODEL A

VARIABLES	GMM	Low Tech	Medium Tech	High Tech	Random Effects	Random Effects	Fixed Effects	Fixed Effects
l_out	0.372***	0.369***	0.376***	0.322***	0.548***	0.548***	0.477***	0.465***
	(0.00217)	(0.00312)	(0.00312)	(0.0167)	(0.00370)	(0.00368)	(0.00571)	(0.00584)
exp_output_ratio	0.0180***	0.0392***	0.0178***	-0.153	0.0107**	0.0107**	0.00882**	0.00845**
	(0.000957)	(0.00737)	(0.000981)	(0.107)	(0.00458)	(0.00459)	(0.00420)	(0.00409)
impdum	0.0255***	0.0302***	0.0207***	0.0705*	0.0827***	0.0828***	0.0708***	0.0726***
	(0.00296)	(0.00398)	(0.00451)	(0.0409)	(0.00378)	(0.00377)	(0.00374)	(0.00372)
ln_lc	-0.244***	-0.249***	-0.254***	-0.269***	-0.157***	-0.167***	-0.169***	-0.218***
	(0.00360)	(0.00514)	(0.00504)	(0.0225)	(0.00524)	(0.00569)	(0.00619)	(0.00735)
y2003						-0.0803***		
L.ln_l	0.0225	0.0201	0.159***	0.0164				
	(0.0142)	(0.0226)	(0.0162)	(0.1000)				
L2.ln_l	-0.0328***	-0.0377***	-0.0208***	-0.0179				
	(0.00288)	(0.00415)	(0.00413)	(0.0233)				
Years						included		included
Constant					-3.333***	-3.230***	-1.985***	-1.499***
					(0.0407)	(0.0458)	(0.0693)	(0.0832)
Observations	102142	53182	47333	1627	275906	275906	275906	275906
R-squared							0.400	0.408
Number of id	23929	12589	11291	405	84598	84598	84598	84598

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	GMM	NACE 10	NACE 11	NACE 12	NACE 13	NACE 14
L.ln_l	0.0225	0.284***	0.355***	0.147	0.502***	0.495***
	(0.0142)	(0.0261)	(0.0896)	(0.109)	(0.0389)	(0.0357)
L2.ln_l	-0.0328***	0.0494***	-0.00436	0.0272	-0.0572***	-0.0755***
	(0.00288)	(0.00894)	(0.0363)	(0.0450)	(0.00915)	(0.00877)
l_out	0.372***	0.318***	0.249***	0.175***	0.396***	0.385***
	(0.00217)	(0.00776)	(0.0317)	(0.0659)	(0.00688)	(0.00606)
exp_output_ratio	0.0180***	0.163***	-0.260***	0.183***	0.108***	-0.0165
	(0.000957)	(0.0373)	(0.0892)	(0.0701)	(0.0252)	(0.0174)
impdum	0.0255***	0.0186**	-0.0101	-0.165	0.0301***	0.0212**
	(0.00296)	(0.00855)	(0.0379)	(0.145)	(0.00844)	(0.00914)
ln_lc	-0.244***	-0.254***	-0.150***	-0.643***	-0.295***	-0.400***
	(0.00360)	(0.0110)	(0.0347)	(0.0661)	(0.0116)	(0.00976)
Observations	102142	10512	540	102	12427	15593
Number of id	23929	2458	154	20	2762	3731

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 15	NACE 16	NACE 17	NACE 18	NACE 19
L.ln_l	-0.00255	0.0554	0.0429	0.259**	0.189
	(0.0771)	(0.0843)	(0.0651)	(0.113)	(0.121)
L2.ln_l	-0.107***	-0.0177	-0.0678***	-0.0428	-0.104**
	(0.0225)	(0.0244)	(0.0162)	(0.0279)	(0.0450)
l_out	0.368***	0.348***	0.394***	0.420***	0.313***
	(0.0154)	(0.0181)	(0.0153)	(0.0200)	(0.0384)
exp_output_ratio	0.0323	0.0179	0.208***	-0.258	-0.281
	(0.0619)	(0.121)	(0.0298)	(0.178)	(0.254)
impdum	0.0628***	0.00376	0.0486***	0.0277	-0.0629
	(0.0200)	(0.0222)	(0.0157)	(0.0176)	(0.0700)
ln_lc	-0.157***	-0.280***	-0.0657***	-0.270***	-0.0852
	(0.0271)	(0.0270)	(0.0116)	(0.0246)	(0.0541)
Observations	2339	1443	2451	1521	272
Number of id	628	398	599	423	91

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 20	NACE 21	NACE 22	NACE 23	NACE 24
L.ln_l	0.328***	0.173	0.116***	0.255***	0.310***
	(0.0809)	(0.121)	(0.0394)	(0.0334)	(0.0410)
L2.ln_l	0.0494***	-0.0126	-0.0139	-0.00279	-0.0121
	(0.0163)	(0.0477)	(0.0112)	(0.00971)	(0.0149)
l_out	0.263***	0.358***	0.448***	0.406***	0.341***
	(0.0149)	(0.0346)	(0.00953)	(0.00913)	(0.0110)
exp_output_ratio	-0.0128	-0.254	0.106***	0.00558	-0.0254
	(0.0704)	(0.255)	(0.0389)	(0.0478)	(0.0460)
impdum	0.0237	0.0194	0.0136	0.0209*	0.0270*
	(0.0210)	(0.0794)	(0.0102)	(0.0125)	(0.0145)
ln_lc	-0.251***	-0.302***	-0.216***	-0.315***	-0.195***
	(0.0189)	(0.0378)	(0.0129)	(0.0141)	(0.0162)
Observations	2869	609	6348	7704	3741
Number of id	667	135	1567	1776	882

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 25	NACE 26	NACE 27	NACE 28	NACE 29
L.ln_l	0.0177	0.128*	0.372***	0.200***	0.196***
	(0.0400)	(0.0690)	(0.0484)	(0.0350)	(0.0355)
L2.ln_l	0.00686	-0.0316	-0.0152	-0.0316***	-0.00781
	(0.00979)	(0.0263)	(0.0150)	(0.0105)	(0.0132)
l_out	0.407***	0.308***	0.368***	0.341***	0.447***
	(0.00745)	(0.0179)	(0.0117)	(0.00690)	(0.00959)
exp_output_ratio	-0.0827***	-0.135	0.00629	-0.0279	0.102**
	(0.00710)	(0.112)	(0.0456)	(0.0246)	(0.0403)
impdum	0.0177*	0.0724	0.0376**	0.0106	0.0279**
	(0.0107)	(0.0468)	(0.0154)	(0.00920)	(0.0130)
ln_lc	-0.213***	-0.290***	-0.271***	-0.226***	-0.321***
	(0.0125)	(0.0244)	(0.0161)	(0.0110)	(0.0142)
Observations	8377	1018	3679	7727	4125
Number of id	2337	270	931	2005	995

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 30	NACE 31	NACE 32	NACE 33
L.ln_l	0.589***	0.138***	0.244***	0.418***
	(0.107)	(0.0503)	(0.0806)	(0.0719)
L2.ln_l	-0.100**	-0.0518***	0.0644***	-0.0157
	(0.0396)	(0.0143)	(0.0221)	(0.0278)
l_out	0.169***	0.335***	0.265***	0.567***
	(0.0167)	(0.00991)	(0.0127)	(0.0183)
exp_output_ratio	0.00887***	0.0106	0.00886	-0.0662
	(0.00186)	(0.0462)	(0.00946)	(0.0706)
impdum	0.118*	0.0131	0.0163	-0.00629
	(0.0622)	(0.0122)	(0.0207)	(0.0488)
ln_lc	-0.320***	-0.183***	-0.363***	-0.403***
	(0.0344)	(0.0184)	(0.0201)	(0.0308)
Observations	900	4206	2048	1591
Number of id	309	1119	554	637

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

APPENDIX C: ESTIMATION RESULTS FOR MODEL B

VARIABLES	GMM	Low Tech	Medium Tech	High Tech	Random Effects	Random Effects	Fixed Effects	Fixed Effects
dom_prod	0.307***	0.313***	0.302***	0.302***	0.525***	0.514***	0.486***	0.453***
	(0.00347)	(0.00527)	(0.00476)	(0.0222)	(0.00720)	(0.00731)	(0.00876)	(0.00903)
exp_output_ratio	0.0146***	0.0305***	0.0140***	-0.0493	0.00980**	0.00940**	0.00917**	0.00810**
	(0.000892)	(0.00766)	(0.000895)	(0.115)	(0.00444)	(0.00431)	(0.00426)	(0.00399)
l_m	0.317***	0.321***	0.313***	0.334***	0.536***	0.526***	0.499***	0.468***
	(0.00336)	(0.00513)	(0.00460)	(0.0196)	(0.00640)	(0.00652)	(0.00808)	(0.00840)
ln_lc	-0.220***	-0.225***	-0.217***	-0.249***	-0.171***	-0.221***	-0.159***	-0.244***
	(0.00468)	(0.00704)	(0.00635)	(0.0264)	(0.00756)	(0.00932)	(0.00832)	(0.0112)
o.y2013						0		
						(0)		
L.ln_l	0.389***	0.398***	0.430***	0.120				
	(0.0150)	(0.0258)	(0.0169)	(0.0972)				
L2.ln_l	0.000659	-0.0112*	0.0133**	0.00238				
	(0.00400)	(0.00588)	(0.00565)	(0.0256)				
Years						included		included
Constant					-2.760***	-2.082***	-2.154***	-1.015***
					(0.0842)	(0.107)	(0.107)	(0.140)
Observations	53837	26703	25759	1375	111885	111885	111885	111885
R-squared							0.381	0.401
Number of id	12330	6251	5955	334	24674	24674	24674	24674

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	GMM	NACE 10	NACE 11	NACE 12	NACE 13	NACE 14
L.ln_l	0.389***	0.497***	0.466***	0.209*	0.642***	0.485***
	(0.0150)	(0.0352)	(0.138)	(0.108)	(0.0389)	(0.0489)
L2.ln_l	0.000659	0.0860***	-0.0790	0.0999	-0.0652***	-0.0397***
	(0.00400)	(0.0154)	(0.0526)	(0.105)	(0.0116)	(0.0118)
l_out	0.307***	0.301***	0.214***	0.109	0.329***	0.303***
	(0.00347)	(0.0166)	(0.0447)	(0.0874)	(0.0105)	(0.00967)
exp_output_ratio	0.0146***	0.0830	-0.336***	0.165*	0.0320	-0.000546
	(0.000892)	(0.0546)	(0.0914)	(0.0847)	(0.0279)	(0.0176)
l_m	0.00973***	0.00243	0.0235***	-0.00283	0.00980***	0.00738***
	(0.000897)	(0.00364)	(0.00907)	(0.0157)	(0.00243)	(0.00245)
ln_lc	-0.220***	-0.289***	-0.158***	-0.416***	-0.251***	-0.334***
	(0.00468)	(0.0192)	(0.0523)	(0.0868)	(0.0147)	(0.0133)
Observations	53837	3799	261	86	7995	7518
Number of id	12330	888	67	16	1789	1788

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 15	NACE 16	NACE 17	NACE 18	NACE 19
L.ln_l	0.157**	0.154*	0.151***	-0.0173	0.471***
	(0.0791)	(0.0897)	(0.0573)	(0.0962)	(0.118)
L2.ln_l	-0.0521**	0.0583*	-0.0293	0.0915**	-0.0396
	(0.0259)	(0.0325)	(0.0196)	(0.0409)	(0.0547)
l_out	0.314***	0.384***	0.397***	0.299***	0.216***
	(0.0211)	(0.0270)	(0.0194)	(0.0299)	(0.0460)
exp_output_ratio	0.0328	-0.0494	0.201***	-0.416**	-0.179
	(0.0728)	(0.126)	(0.0266)	(0.176)	(0.280)
l_m	0.0110*	0.000637	0.0196***	0.00227	-0.0146
	(0.00623)	(0.00747)	(0.00490)	(0.00564)	(0.0166)
ln_lc	-0.0675*	-0.298***	-0.0454***	-0.0839**	-0.237***
	(0.0354)	(0.0366)	(0.0104)	(0.0336)	(0.0542)
Observations	1389	744	1581	555	183
Number of id	363	187	371	186	53

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 20	NACE 21	NACE 22	NACE 23	NACE 24
L.ln_l	0.302***	0.232*	0.338***	0.312***	0.541***
	(0.0574)	(0.124)	(0.0399)	(0.0481)	(0.0441)
L2.ln_l	0.102***	0.0184	0.0187	0.0123	0.0165
	(0.0176)	(0.0540)	(0.0144)	(0.0173)	(0.0188)
l_out	0.255***	0.329***	0.393***	0.377***	0.277***
	(0.0181)	(0.0451)	(0.0146)	(0.0187)	(0.0167)
exp_output_ratio	0.00645	0.280	0.119**	-0.0179	0.0538
	(0.0633)	(0.418)	(0.0466)	(0.0672)	(0.0470)
l_m	0.0207***	0.0525***	0.00739**	0.0139***	0.00201
	(0.00621)	(0.0199)	(0.00324)	(0.00434)	(0.00379)
ln_lc	-0.228***	-0.358***	-0.254***	-0.259***	-0.174***
	(0.0190)	(0.0448)	(0.0164)	(0.0228)	(0.0201)
Observations	2217	539	3935	2483	2212
Number of id	490	114	982	586	504

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 25	NACE 26	NACE 27	NACE 28	NACE 29
L.ln_l	0.440***	0.145**	0.488***	0.427***	0.162***
	(0.0438)	(0.0694)	(0.0462)	(0.0356)	(0.0363)
L2.ln_l	0.00227	-0.0170	-0.0144	0.00613	0.0427***
	(0.0139)	(0.0261)	(0.0194)	(0.0134)	(0.0150)
l_out	0.343***	0.273***	0.304***	0.291***	0.401***
	(0.0117)	(0.0230)	(0.0160)	(0.00958)	(0.0135)
exp_output_ratio	-0.0905***	-0.112	0.0220	-0.0454	0.151***
	(0.00612)	(0.104)	(0.0508)	(0.0294)	(0.0423)
l_m	0.00552**	0.0208**	0.00299	0.0139***	0.0122***
	(0.00281)	(0.00950)	(0.00469)	(0.00290)	(0.00371)
ln_lc	-0.212***	-0.223***	-0.185***	-0.188***	-0.268***
	(0.0155)	(0.0268)	(0.0179)	(0.0137)	(0.0170)
Observations	4095	836	2386	4860	2585
Number of id	1072	220	587	1245	606

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	NACE 30	NACE 31	NACE 32	NACE 33
L.ln_l	0.191	0.459***	0.176**	0.302**
	(0.122)	(0.0719)	(0.0890)	(0.123)
L2.ln_l	-0.137***	-0.0764***	0.1000***	-0.0417
	(0.0417)	(0.0268)	(0.0246)	(0.0479)
l_out	0.0982***	0.380***	0.245***	0.207***
	(0.0177)	(0.0230)	(0.0178)	(0.0295)
exp_output_ratio	0.00479***	0.0516	0.0125	-0.0675
	(0.00134)	(0.0720)	(0.00914)	(0.0425)
l_m	0.0577***	0.0116**	0.0177***	-0.00706
	(0.00992)	(0.00516)	(0.00629)	(0.00939)
ln_lc	-0.104***	-0.190***	-0.325***	-0.0845**
	(0.0370)	(0.0299)	(0.0246)	(0.0385)
Observations	407	1402	1373	396
Number of id	120	367	368	162

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	GMM	Micro Size	Small Size	Medium Size	Large Size
L.ln_l	0.389***	1.070***	0.675***	0.642***	0.693***
	(0.0150)	(0.178)	(0.0289)	(0.0183)	(0.0269)
L2.ln_l	0.000659	0.314*	-0.0217***	-0.00580	0.0159
	(0.00400)	(0.169)	(0.00808)	(0.00619)	(0.0102)
l_out	0.307***	0.834***	0.227***	0.299***	0.318***
	(0.00347)	(0.0835)	(0.00549)	(0.00553)	(0.0130)
exp_output_ratio	0.0146***	-0.0193	0.00462	0.0164***	-0.0477
	(0.000892)	(0.0297)	(0.00817)	(0.000999)	(0.0292)
l_m	0.00973***	-0.00716	0.00914***	0.0107***	0.0197***
	(0.000897)	(0.0473)	(0.00143)	(0.00137)	(0.00363)
ln_lc	-0.220***	-0.519***	-0.279***	-0.219***	-0.284***
	(0.00468)	(0.131)	(0.00709)	(0.00721)	(0.0130)
Observations	53837	215	18941	25854	8827
Number of id	12330	172	6531	6876	1868

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX D: ESTIMATION RESULTS FOR MODEL C

VARIABLES	GMM	Low Tech	Medium Tech	High Tech	Random Effects	Random Effects	Fixed Effects	Fixed Effects
dom_prod	0.307***	0.313***	0.302***	0.302***	0.525***	0.514***	0.486***	0.453***
	(0.00347)	(0.00527)	(0.00476)	(0.0222)	(0.00720)	(0.00731)	(0.00876)	(0.00903)
exp_output_ratio	0.0146***	0.0305***	0.0140***	-0.0493	0.00980**	0.00940**	0.00917**	0.00810**
	(0.000892)	(0.00766)	(0.000895)	(0.115)	(0.00444)	(0.00431)	(0.00426)	(0.00399)
l_m	0.317***	0.321***	0.313***	0.334***	0.536***	0.526***	0.499***	0.468***
	(0.00336)	(0.00513)	(0.00460)	(0.0196)	(0.00640)	(0.00652)	(0.00808)	(0.00840)
ln_lc	-0.220***	-0.225***	-0.217***	-0.249***	-0.171***	-0.221***	-0.159***	-0.244***
	(0.00468)	(0.00704)	(0.00635)	(0.0264)	(0.00756)	(0.00932)	(0.00832)	(0.0112)
L.ln_l	0.389***	0.398***	0.430***	0.120				
	(0.0150)	(0.0258)	(0.0169)	(0.0972)				
L2.ln_l	0.000659	-0.0112*	0.0133**	0.00238				
	(0.00400)	(0.00588)	(0.00565)	(0.0256)				
Years						included		included
Constant					-2.760***	-2.082***	-2.154***	-1.015***
					(0.0842)	(0.107)	(0.107)	(0.140)
Observations	53837	26703	25759	1375	111885	111885	111885	111885
R-squared							0.381	0.401
Number of id	12330	6251	5955	334	24674	24674	24674	24674

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX E: ESTIMATION RESULTS FOR MODEL D

VARIABLES	GMM	Low Tech	Medium Tech	High Tech	Random Effects	Random Effects	Fixed Effects	Fixed Effects
l_out	0.374***	0.371***	0.377***	0.324***	0.556***	0.556***	0.483***	0.471***
	(0.00217)	(0.00311)	(0.00310)	(0.0166)	(0.00355)	(0.00354)	(0.00566)	(0.00581)
exp_output_ratio	0.0181***	0.0414***	0.0178***	-0.166	0.0112**	0.0112**	0.00916**	0.00879**
	(0.000957)	(0.00737)	(0.000980)	(0.107)	(0.00467)	(0.00469)	(0.00424)	(0.00413)
ln_lc	-0.245***	-0.251***	-0.254***	-0.271***	-0.159***	-0.167***	-0.170***	-0.219***
	(0.00360)	(0.00514)	(0.00504)	(0.0225)	(0.00524)	(0.00570)	(0.00620)	(0.00737)
L.ln_l	0.0202	0.0218	0.157***	0.0205				
	(0.0143)	(0.0227)	(0.0162)	(0.0998)				
L2.ln_l	-0.0331***	-0.0383***	-0.0209***	-0.0185				
	(0.00288)	(0.00416)	(0.00413)	(0.0233)				
Years						Included		included
Constant					-3.409***	-3.322***	-2.018***	-1.540***
					(0.0400)	(0.0448)	(0.0694)	(0.0833)
Observations	102142	53182	47333	1627	275906	275906	275906	275906
R-squared							0.398	0.406
Number of id	23929	12589	11291	405	84598	84598	84598	84598

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX F: ESTIMATION RESULTS FOR MODEL E

VARIABLES	GMM	Low Tech	Medium Tech	High Tech	Random Effects	Random Effects	Fixed Effects	Fixed Effects
l_d	0.184***	0.141***	0.235***	0.289***	0.384***	0.378***	0.327***	0.301***
	(0.00264)	(0.00374)	(0.00385)	(0.0165)	(0.00425)	(0.00426)	(0.00522)	(0.00522)
l_x	0.0250***	0.0246***	0.0253***	0.0154***	0.0614***	0.0594***	0.0536***	0.0481***
	(0.000978)	(0.00146)	(0.00134)	(0.00594)	(0.00126)	(0.00125)	(0.00134)	(0.00131)
ln_lc	-0.199***	-0.202***	-0.206***	-0.205***	-0.109***	-0.161***	-0.0948***	-0.202***
	(0.00495)	(0.00783)	(0.00644)	(0.0229)	(0.00712)	(0.00875)	(0.00792)	(0.0111)
						(0)		
L.ln_l	0.372***	0.364***	0.402***	0.127				
	(0.0164)	(0.0299)	(0.0180)	(0.0794)				
L2.ln_l	0.00923**	-0.000152	0.0213***	-0.00194				
	(0.00424)	(0.00657)	(0.00566)	(0.0250)				
Years						Included		included
Constant					-1.682***	-1.033***	-0.689***	0.603***
					(0.0653)	(0.0820)	(0.0821)	(0.109)
Observations	51288	23664	26580	1044	109225	109225	109225	109225
R-squared							0.288	0.319
Number of id	12480	6072	6344	263	25291	25291	25291	25291

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1