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Article

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Does exporting create employment? Evidence from Turkish manufacturing

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ABSTRACT

The aim of this study is to analyze the impact of exporting on labor demand in Turkish manufacturing industry. By using Generalized Methods of Moments (GMM) with the firm-level production and trade data of Turkish manufacturing industry, this paper is exploring the employment impact of international trade. The analysis is based on firm level data obtained from Turkish Statistical Institute (TURKSTAT) and covers the period from 2003 to 2013. The estimations were carried out for different technology-oriented industries and 2-digit NACE sub-industries to see how 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 Turkish manufacturing. © 2022 The Authors. Published by Elsevier B.V. on behalf of Central Bank of The Republic of Turkey. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

When optimizing the production mix, firms do not have many 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 competitive firms, they must change their variable inputs (labor and materials) to adjust their production (Pindyck and Rubinfeld, 1992). A rational firm will change the number of workers; thus, it hires according to its profit-maximizing function *per se* a tool for optimization.

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In the long-run, however, firms' employment levels depend on the price of labor, capital, technology and labor productivity. Hence, price 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. Therefore, labor productivity also varies across countries, industries, sub-industries and different technology levels. Labor productivity can simply be calculated by dividing total output to the quantity of labor 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.

Two main questions motivated this study: First question is

“Does exporting have an impact on labor demand in Turkish manufacturing industry?” and the second is “If there is a significant impact of the exports on employment, does it differ for the sub-industries of Turkish manufacturing?”. Although the main motivation of this paper to explore export-labor demand nexus, we also examined the relation between imports and labor demand in Turkish manufacturing.

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 paper is to determine the impact of both exports and imports on labor demand of the firms operating in Turkish manufacturing to contribute in filling the gap in the literature. The analysis is based on firm level data obtained from Turkish Statistical Institute (TURKSTAT) and covers the period from 2003 to 2013. To make detailed inferences, Generalized Methods of Moments (GMM) were conducted for different technology and sub-industry levels.

This paper is organized as follows: Section 2 examines the theoretical and empirical background of the topic of this study. This section gives detailed information about existing literature on trade and labor demand relations. Following Section 2, Section 3 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 the panel data set for Turkish Manufacturing. Section 4 introduces the methodology used in this paper. The results of estimations are interpreted in Section 5. Finally, Section 6 concludes and recommends some policy proposals.

2. Literature background

International trade provides many benefits to economic actors both on 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) 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., 2016). This technology diffusion mostly comes from imports, and it is more important for developing economies than advanced economies due to their low spending on research and development activities (Keller, 2004). Imported technologies, which generally cause a decrease in employment in traditional (low-tech) manufacturing industries, have generally a labor-saving characteristic (Meschi et al., 2016). 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 the demand of firms for labor to increase. This theory argues that if a country exports 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 uses of means of production for

good X which results in a higher demand for labor in a related industry (McConnell et al., 2016). 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 exports its good or service to 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, 1970).

Determinants of the 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 mainly depends on how skilled the employed labor (ability and knowledge) is and how advanced is the available technology of the firm (Keller, 2004 & 2010). Furthermore, returns to skills (skill premia) are subject to 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 a firm can import technology that is not available in the home country with international trade (Kılıçaslan, 2005).

All in all, international trade allows firms to invest in new technologies that leads to an increase in their productivity and decrease in their reliance on manpower which causes their demand for unskilled labor to decrease. However, these firms are now relied on more skilled labor to operate these new technologies. These two effects are the short-run impacts of international trade on labor demand for firms. In the long run, with the effect of specialization, growing firms will have new production lines which will increase their employment. Therefore, theoretical background suggests that international trade could cause a decrease in labor demand in the short run if the production is depended on unskilled labor (which is the case for low-tech industries in least developed and developing countries). In high-tech industries and in the long run, the expected impact of trade on employment is to be positive.

The summary of the empirical literature on the impact of trade on labor demand is given in Table 1. Based on the information given in the table, 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 impact of trade openness, imports and exports on labor demand: positive, negative and no impact.

Fu and Balasubramanyam (2005), and Mitra and Shin (2012) found that when the share of exports (export/output ratio) increase in total sales, it shifts labor demand positively in their analysis for China and Korea. Milner and 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, Meschi 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-

Table 1
Summary of empirical studies about trade and labor demand relations.

Author	Scope	Method	Result
Hong (1980)	Korea	Descriptive statistics	Exports have a positive impact on labor demand in Korea's manufacturing.
Çağatay and Berik (1990)	Turkey	Regression	Exports increase the women employment share in the industry.
Bernard et al. (1995)	US	Cross-section	Exporting firms create more employment than non-exporting firms.
Athukorala and Menon (1996)	Malaysia	Descriptive statistics	Export-oriented FDI enhanced the employment in Malaysia.
Marquez & Pages (1998)	Latin America & Caribbean Countries	Regression	Trade openness has a significant and negative impact on employment both for manufacturing and aggregate level.
Milner and Wright (1998)	Mauritius	GMM	Trade liberalization has a positive effect on employment.
Greenaway et al. (1999)	UK	GMM	An increase in the volume of imports and exports causes labor demand to decrease.
Wilkinson (1999)	US	Regression	Export promotion increases the exports and this raises the labor demand.
Ozler (2000)	Turkey	Logit	An increase in export/output share tend to increase the female share in employment.
Tomiura (2003)	Japan	Regression	Imports have a positive impact on labor demand
Başlevent and Onaran (2004)	Turkey	Probit	Turkey's exports have a positive impact on female labor force participation rate.
Manda and Sen (2004)	Kenya	Panel regression	Exports have a negative impact on Kenya's manufacturing during 1990's.
Fu and Balasubramanyam (2005)	China	GMM	An increase in exports/output ratio has a positive effect on employment.
Fajnzylber and Maloney (2005).	Chile, Columbia & Mexico	GMM	Trade openness leads to a decrease in labor demand in Chile and Columbia.
Conte and Vivarelli (2007)	Developing Countries	GMM-SYS	Skill-enhancing technological import affects the demand for white-collar workers, positively and blue-collars negatively.
Mitra and Shin (2012)	Korea	Panel regression	An increase in the export/output share increases the labor demand elasticity.
Aydiner-Avsar and Onaran (2010)	Turkey	Panel regression	Trade has low/no significant impact on labor for Turkish manufacturing between 1973 and 2001.
Yu and Yun (2010)	China	GMM-SYS	Export causes the demand for labor to increase in high-tech and decrease in low-tech industries.
Meschi et al. (2016)	Turkey	GMM-SYS	Exports and trade openness has a positive impact on labor demand.
Kiyota (2016)	China, Indonesia, Japan and Korea	Input-output	Manufacturing exports create jobs not only in manufacturing but also in other sectors.
Njikam (2016)	Cameroon	OLS, FE, GMM-SYS	Trade liberalization shifted the demand for unskilled labor in Cameroon manufacturing.
Feenstra et al. (2019)	United States	OLS, 2SLS	Exports create jobs for U.S. manufacturing between 1991 and 2011.
Sasahara (2019)	United States, China, Japan	Input-output	Exports increase employment level in U.S., China and Japan.
Idris et al. (2021)	20 countries	GMM	High-tech exports decrease employment.

exporting firms. Athukorala and 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. Kiyota (2016) found positive impact of exports on employment in Korea, China, Indonesia and Japan. Feenstra et al. (2019) found positive impact of exports on labor demand in U.S. manufacturing. Sasahara (2019) found that exports increase the employment level for China, U.S. and Japan.

On the other hand, Greenaway et al. (1999), and Manda and 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. Fajnzylber and Maloney (2005) found that trade openness leads to a decrease in labor demand in Chile and Colombia. Idris et al. (2021) found negative relationship between high-tech exports and employment in 20 high-tech exporting countries.

Finally, some studies provide conflicting results on the effect of exports on employment. Conte and Vivarelli (2007) found that skill-enhancing technological imports affect demand for white-collar workers positively, but blue-collars negatively. Yu and Yun (2010) found that exports increase labor demand for high-tech industries and decrease labor demand for low-tech industries of China. Konings and Vandenbussche (1995), Bernard and Wagner (1997) and Aydiner-Avsar and Onaran (2010) found no impact of trade on employment.

Empirical studies for Turkey mostly focused on female labor participation. Ozler (2000) and Çağatay and Berik (1990) found that

exports increase the female share in employment. Başlevent and Onaran (2004) found that exports positively affects the women participation in labor force.

This study analyzes the impact of international trade on labor demand in the Turkish manufacturing industry. Estimations are conducted for both all firms and different samples with respect to technological intensity, and sub-industries (NACE Rev.2) to see if labor demand dynamics changes in different industries of manufacturing. To know which sub-industries of Turkish manufacturing generate/destroy employment with exporting and/or importing is quite important for policy making. It is also important to know if there is reallocation of labor across industries or any labor-saving technological impact of trade for some industries. Our study fills the gap in empirical literature in Turkish case with a different focus by examining the impact of exports on employment via labor demand for in manufacturing industry with a rich dataset at the firm-level. This study also contributes the existing literature by providing a deeper understanding with sub-industry level analysis.

3. The data and descriptive findings

In this paper, we use a firm level rich data set representing all Turkish manufacturing firms. The data used in this work includes two main databases at firm-level of the Turkish manufacturing industry for the period 2003–2013 obtained from the Turkish Statistical Institute (TURKSTAT): Annual Industry and Service Statistics (TURKSTAT, 2015a) and Foreign Trade Statistics (TURKSTAT, 2015b). We converted all databases of different years into a

common data format and check the consistency issues. The classification of enterprises by type of activity was determined by NACE Rev. 2 for all sectors. We transformed all nominal variables into real variables by using 4-digit industry level deflators with 2003 as the base year. All data-based analyses were conducted at the Data Research Center of TURKSTAT in Ankara, Turkey.

Fig. 1 shows the percentage change in the employment in Turkish manufacturing between the years 2004–2013 by exporting. The negative effects of the financial crisis in the years 2008 and 2009 on employment are seen for both exporting and non-exporting firms. Although they were equally affected by the crisis, exporting firms overcame the impact of the crisis faster than non-exporting firms and increased their employment by an average of 5% every year. Fig. 1 also shows that the labor growth of exporting firms is higher than that of non-exporting firms, except for the year 2005. While employment growth in non-exporting firms turned out negative in 2008, exporting firms continued to increase their employment every year except for 2009. This finding proves that exporting firms face the negative impact of the financial crisis on employment later and recovered from these effects sooner than the non-exporting firms. This indeed is consistent with the findings of Kurz and Senses (2016) that exporting firms labor demand is less volatile.

Fig. 2 shows the percentage increase in the employed labor in Turkish manufacturing between the years 2004–2013 by importing. The negative effects of the financial crisis in the years 2008 and 2009 on employment are seen for both importing and non-importing firms. However, the effect is obviously less for

importing firms. Just as exporting firms recovered from the effects of the crisis faster than non-exporting firms, importer firms also recovered from the effects of the crisis faster than non-importers and increased their employment by an average 7% every year. The figure implies that the labor growth of importing firms is higher than that of non-importing firms, except for the year 2005. While employment in non-importing firms decreased almost every year after 2008, employment growth was negative only in the year 2009 for importing firms. Similar to the case of exporting firms, importing firms faced the effects of the financial crisis later and recovered from these effects sooner than non-importing firms.

4. Methodology

Following Greenaway et al. (1999), Milner and Wright (1998) and Fu and Balasubramanyam (2005), a trade augmented labor demand function may be obtained from a Cobb–Douglas production function as follows:

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

where Q represents the real output, K is capital stock and L is labor for the firm i and time t . α and β are the factor share coefficients and γ denotes the changes in the efficiency of production. By solving equation (1) according to the profit-maximization condition,² the marginal product of labor equals the wage (w) and the marginal product of capital equals its user cost (c):

$$Q_{it} = A^\gamma \left(\frac{\alpha L_{it}}{\beta} \cdot \frac{w_{it}}{c} \right)^\alpha L_{it}^\beta \tag{2}$$

By rearranging the equation after taking the natural logarithm, we get the following labor demand function in econometric specification:

$$\ln L_{it} = \varphi_0 + \varphi_1 \ln(w_{it} / c) + \varphi_2 \ln Q_{it} + \varepsilon_{it} \tag{3}$$

where $\varphi_0 = -(\gamma \ln A + \alpha \ln \alpha - \alpha \ln \beta) / (\alpha + \beta)$; $\varphi_1 = -\alpha / (\alpha + \beta)$; $\varphi_2 = 1 / (\alpha + \beta)$ and ε_{it} is the error term.

Assuming there is a relation between technology adoption and exports and imports resulting from the competitiveness of the international markets, the technology term of A in the production function should vary with time as follows:

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

where T represents time trend, X and M denote exports and imports, respectively. By inserting both exports and imports in equation (4) into equation (3), following equation is obtained:

$$\ln L_{it} = \varphi_0^{new} + \varphi_1 \ln(w_{it} / c) + \varphi_2 \ln Q_{it} + \delta_1 \ln X_{it} + \delta_2 \ln M_{it}$$

² $K_{it} = \frac{\alpha L_{it}}{\beta} \cdot \frac{w_{it}}{c}$ in Equation (2) can easily be derived from the profit-maximization problem of a firm.

$$\max_{K_{it}, L_{it}} \pi_{it} = p A^\gamma K_{it}^\alpha L_{it}^\beta - w_{it} L_{it} - c K_{it}$$

$$\frac{\partial \pi_{it}}{\partial K_{it}} = p A^\gamma \alpha K_{it}^{\alpha-1} L_{it}^\beta - c = 0$$

$$\frac{\partial \pi_{it}}{\partial L_{it}} = p A^\gamma \beta K_{it}^\alpha L_{it}^{\beta-1} - w_{it} = 0$$

Dividing the first-order conditions above gives us $\frac{\alpha L_{it}}{\beta K_{it}} = \frac{c}{w_{it}}$. So, we can express as: $K_{it} = \frac{\alpha L_{it}}{\beta} \cdot \frac{w_{it}}{c}$

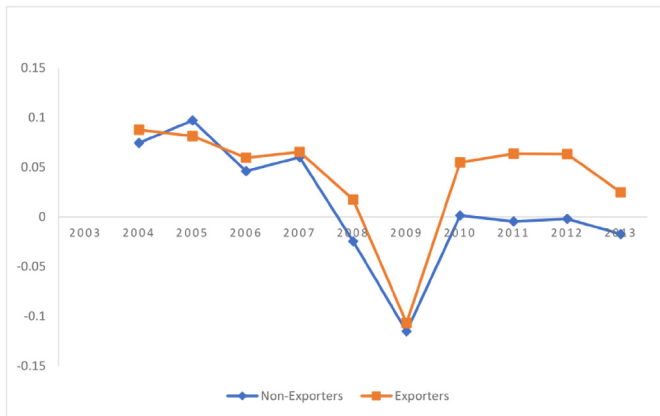


Fig. 1. Employment growth in exporter and non-exporter firms. Source: TurkStat (2015a&2015b)

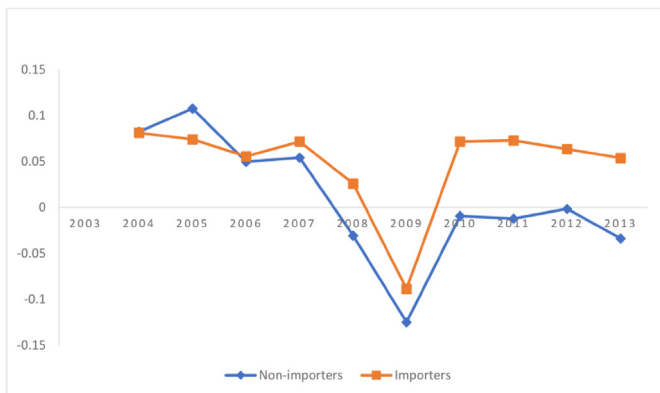


Fig. 2. Employment growth in importer and non-importer firms. Source: TurkStat (2015a&2015b)

$$+ \mu_0 T + \varepsilon_{it} \tag{5}$$

Finally, we can define a dynamic model by adding lagged value of labor into the equation above in order to consider the cost of labor adjustments due to firm’s attrition and delays in hiring/firing workers (Lachenmaier and Rottmann, 2011; Kılıçaslan and Töngür, 2019). Since our empirical approach employs a dynamic specification in a panel data context, to account for the significant lagged effects of the dependent variable that determine serial correlation in itself, the augmented labor demand equation for the estimation can be expressed as follows:

$$\ln L_{it} = \beta_0 + \beta_1 \ln L_{it-1} + \beta_1 \ln W_{it} + \beta_1 \ln Q_{it} + \beta_1 \ln X_{it} + \beta_1 \ln M_{it} + u_{it} \tag{6}$$

where the subscripts *i* and *t* refer firm and year, respectively. *L_{it}* represents the number of employees of the firm. Real wage (*W_{it}*) is the labor cost of the firm including wage, seniority, accrued premium and payment in lieu of notice. *Q_{it}* is the value of real output. Export variable (*X_{it}*) is proxied by export-output ratio (export intensity) following Fu and Balasubramanyam (2005). *M_{it}* is the real value of the volume of imports.³ The last term *u_{it}* is a stochastic, idiosyncratic error component.

We estimated equation (6) to investigate the impact of exports on employment generation/destruction in Turkish manufacturing. It is crucial to state that the assumption of strict exogeneity of the estimators is violated in a dynamic setting. The existence of firm specific effects in augmented labor demand equation above creates a correlation between the lagged dependent variable and the individual fixed effect. Using ordinary least squares (OLS) gives inconsistent and upward biased estimates for the coefficient of the lagged dependent variable (Hsiao, 1986; Baltagi, 1995), and fixed effects (FE) estimator leads to a downward bias for the estimated parameter (Nickell, 1981).

To consider the problems pointed out above, we use system GMM (GMM-SYS) estimation suggested by Blundell and Bond (1998) for two main reasons: On the one hand, GMM-SYS uses the lagged first-differences as instruments for equations in levels, in addition to the lagged levels as instruments for equations in the first differences, thus GMM-SYS uses all information available in the data (Bond, 2002). Moreover, GMM-SYS combines equations in levels with equations in first differences to gain asymptotic efficiency, and it has better asymptotic and finite sample properties compared to difference GMM (GMM-DIF) (Bond et al. 2001; Blundell et al. 2000). On the other hand, we adopt GMM-SYS approach to estimate dynamic labor demand equation in this study since the existence of strong persistent time series and short time dimension relative to cross-section units in our sample (i.e. large *N* and small *T*). Note that the empirical issues considered in all estimation specifications in this study are mainly based on Roodman (2006) and Roodman (2009).⁴

³ Since majority of the exports of Turkish manufacturing is import dependent, authors chose to use exports as a ratio (export/output) and imports as the real volume to avoid multicollinearity.

⁴ Main empirical issues considered in our estimations are as follows: First, all explanatory variables in our model are treated as endogenous in GMM-SYS specification to take potential endogeneity in the model into account. However, year effects are set to be exogenous and treated as typical instrumental variables. Secondly, all GMM estimations are conducted with two-step efficient GMM. Lastly, we collapse the GMM instruments by creating one instrument for each variable and lag distance (rather than one for each time period, variable, and lag distance) to avoid an over-identification problem. Thus, we prevent instrument proliferation.

5. Estimation results

In order to reveal the effect of exporting on the employment, the data of 25448 firms operating in the Turkish manufacturing industry between 2003 and 2013 were analyzed by using GMM model. For robustness check, estimations were made for two different models: with and without imports. Table 2 shows the GMM estimation results by technology classification. The technology classification is made according to the technological level of the products that the firms produce, not the firms’ technological advancement in production. A detailed description about the technological classification and two-digit NACE industries are given in the appendix.

Before the interpretation of the estimation results, some econometric issues should be discussed: First of all, we checked the persistence of employment time series. For all specifications, the significant value of the lagged coefficients of employment confirms the persistence of its time series, favoring the adoption of GMM-SYS. The dynamic specification is supported by Arellano–Bond test statistics for AR (1). Moreover, there is no evidence of a second-order serial correlation in the differenced residuals of the models in GMM-SYS. Although Sargan tests of over-identifying restrictions for most of the models present strong evidence against the null hypothesis that the over-identifying restrictions are valid, this is not surprising since the validity of inference on Sargan test diminishes if we use of heteroskedasticity-consistent standard errors and large samples (Baum et al., 2003; Blundell and Bond, 1998; Roodman, 2006, 2009). Therefore, we presume that there is no reliability Sargan test results in our estimations since we use robust standard errors and large samples.⁵

The results provide statistically significant coefficients for the standard variables in the labor demand model. The real wage coefficient shows significant and negative value indicating a negative relationship between labor demand and wages which is consistent with our expectation. The output of the firms has a positive effect on employment, i.e. the expansion of production requires higher

Table 2
Impact of exporting on employment, without imports, 2003–2013.

	All firms	Low	Medium	High
Labor _{t-1}	0.268*** (0.011)	0.237*** (0.018)	0.323*** (0.013)	0.259*** (0.072)
Wage _t	-0.211*** (0.004)	-0.216*** (0.007)	-0.212*** (0.006)	-0.229*** (0.021)
Output _t	0.321*** (0.003)	0.306*** (0.005)	0.334*** (0.004)	0.315*** (0.018)
Exports _t	0.013*** (0.001)	-0.006** (0.003)	0.016*** (0.001)	-0.124 (0.077)
Constant	0.014 (0.049)	0.441*** (0.080)	-0.420*** (0.063)	0.447* (0.270)
Observations	102142	51406	49109	1627
Number of firms	25448	12383	12660	405
Sargan test (p-value)	0.000	0.000	0.000	0.015
AR(1) test (p-value)	0.000	0.000	0.000	0.367
AR(2) test (p-value)	0.319	0.575	0.510	0.390

Notes: The dependent variable is labor demand. “All firms” denotes full sample. Low, Medium, and High denote different samples by technological intensity (Eurostat, 2022), respectively. All models include year dummies. Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

⁵ For the consistency check, we ran the same GMM regressions by using a random sub-sample that comprises very small parts (%10) of the whole sample. The null hypothesis of adequate instruments of Sargan tests was not rejected.

demand of labor.

According to Table 2, exports have a positive and significant impact on labor demand for Turkish manufacturing firms, in general. However, when analyzed by different technology oriented industries, the impact seems to be only valid for the medium-tech firms. For the low-tech firms, the impact of exports on labor demand is negative and significant. This result supports the previous findings of Yu and Yun (2010) and Conte and Vivarelli (2007). Low-tech firms depend more on labor than medium and high-tech firms on the production process and exporting low-tech firms tend to have less labor demand than non-exporting low-tech firms since they became more capital intensive by investing in new technologies. Exporting firms are always one step ahead of non-exporting firms on capital investments since they enjoy the benefits of foreign demand. Exporting does not seem to be significant in the estimations for high-tech firms. This result can be explained by the fact that the number of high-tech firms in the dataset is only 405 and the majority of the firms in this classification is mostly exporters.

The estimation results in Table 3 includes the imports as well. Tables 2 and 3 together proves the robustness of our findings. Adding another important trade variable to the equations, does not change the results. Imports have a positive impact on labor demand for the firms in all technology classifications.

Table 4 shows the GMM estimation results by 2-digit NACE Rev.2 industry classification. The results show positive and significant impact of exports on labor demand for manufactures of food products (10), textiles (13), wearing apparel (14), paper and paper products (17), rubber and plastic products (22), electrical equipment (27), motor vehicles, trailers, and semi-trailers (29), and other transport equipment (30). On the other hand, exporting has a significant negative impact on labor demand for manufactures of beverages (11), tobacco products (12), fabricated metal products, except machinery and equipment (25). Estimations show the importance and need for the deeper and detailed analysis made for the sub-industries. Although the analysis for low-tech industries (in Table 2, Table 3) show that exports had negative effects on employment, industry level estimations (in Table 4) revealed that exports have positive effects on employment for food products (10), textiles (13), wearing apparel (14), paper and paper products (17) sub-industries. Likewise, the impact of exports on employment is negative for the firms operating in fabricated metal products,

Table 3
Impact of exporting on employment, with imports, 2003–2013.

	All firms	Low	Medium	High
Labor _{t-1}	0.366*** (0.012)	0.311*** (0.021)	0.423*** (0.014)	0.251*** (0.070)
Wage _t	-0.206*** (0.005)	-0.201*** (0.007)	-0.212*** (0.006)	-0.210*** (0.022)
Output _t	0.303*** (0.004)	0.296*** (0.006)	0.311*** (0.005)	0.276*** (0.021)
Exports _t	0.012*** (0.001)	-0.007*** (0.003)	0.015*** (0.001)	-0.042 (0.084)
Imports _t	0.010*** (0.001)	0.011*** (0.002)	0.010*** (0.001)	0.020** (0.009)
Constant	-0.264*** (0.058)	0.060 (0.096)	-0.584*** (0.075)	0.580** (0.280)
Observations	102142	51406	49109	1627
Number of firms	25448	12383	12660	405
Sargan test (p-value)	0.000	0.000	0.000	0.013
AR(1) test (p-value)	0.000	0.000	0.000	0.867
AR(2) test (p-value)	0.401	0.775	0.689	0.408

Notes: The dependent variable is labor demand. "All firms" denotes full sample. Low, Medium, and High denote different samples by technological intensity (Eurostat, 2022), respectively. All models include year dummies. Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

except for machinery and equipment (25) industry a medium-tech industry. This proves that although the technology classification is the same, the dynamics of labor demand the firms in different sub-industries might be different.

Sub-industry level analysis proved that analysis made at aggregate levels might present deceiving results. Considering the results of the analysis given in Tables 2 and 3, one can easily think that exports incentives should be given to only medium-technology companies to create employment. However, industry level analysis proves that some low-tech sub-industries (NACE 10, 13, 14 and 17) could also generate employment with some export incentives as well. Likewise, one can assume that an export incentive program would only create new jobs for medium-tech industries in Turkish manufacturing, but Table 4 shows that it is not the case for NACE-25 sub-industry.

6. Conclusion and discussion

The purpose of this paper is to investigate the employment generation/destruction impacts of exporting in Turkish manufacturing. To achieve a better understanding of the impact, we executed separate estimations for each technology classification and 2-digit NACE sub-industries. The results proved the necessity of the different technology and industry level estimations. According to the estimation results for all firms in the sample, exports have a significant impact on employment generation in Turkish manufacturing. The estimations for different technology intensive industries showed that the effect of exports on employment is negative for low-tech firms and positive for medium-tech firms. Likewise, sub-industry level estimations showed the impact differs for the firms operating in different industries of manufacturing. The impact of exports on employment turned to be positive for food products (10), textiles (13), wearing apparel (14), paper and paper products (17). These industries are in fact classified as low-tech industries. On the other hand, the impact was negative for fabricated metal products, except machinery and equipment (25) sub-industry which classified as medium-tech.

As the low-tech firms exports more, they employ more labor substituting production technologies. The negative relation between labor demand and exports in low-tech firms may be attributed to this channel. As automation increases, people working in fields such as packaging will be laid off first, and given their current skill set, it is unlikely that they will be able to switch industries and find jobs in mid-tech or high-tech fields. This situation brings up a very important issue: creating new employment areas for people who will lose their jobs due to automation and technological advancement. To be able to create appropriate jobs, there is clearly a need for new studies to explore the labor structure of the firms operating in different sub-industries, especially where the impact of exports is negative on employment.

Unlike low-tech firms, medium-tech firms tend to employ more workers as they export more. This implies that there will be a need for skilled workers in these industries. There is a threat to the blue-collar workers employed in the medium-tech industries as well. There is also a debate for the blue-collar workers in medium and high-tech industries who are assumed to lose their jobs in the future, and the need for creation of new employment opportunities and social security infrastructure for these people.

This study demonstrates how labor demand dynamics can differ both in different technology oriented industries and sub-industries in the Turkish manufacturing industry. In fact, the results of this study showed that an export incentive to be applied to create employment may result in a reduction of the employment level in

Table 4
Impact of exporting on employment by sub-industries (NACE Rev.2), 2003–2013.

NACE	Technology	Labor _{t-1}	Wage _t	Output _t	Exports _t	Imports _t	Obs.	Firms
10	Low-tech	0.675***	-0.322***	0.280***	0.095**	0.009	10512	2458
11	Low-tech	0.466***	-0.197***	0.198***	-0.322***	-0.031	540	154
12	Low-tech	-0.013	-0.531***	0.080	-0.112***	-0.102	102	20
13	Low-tech	0.364***	-0.273***	0.365***	0.057***	0.021*	12427	2762
14	Low-tech	0.171***	-0.310***	0.284***	0.007*	0.020**	15593	3731
15	Low-tech	0.149**	-0.169***	0.314***	0.072	0.053**	2339	628
16	Low-tech	0.371***	-0.384***	0.344***	-0.062	-0.048	1443	398
17	Low-tech	0.267***	-0.037***	0.356***	0.146***	0.022	2451	599
18	Low-tech	0.204***	-0.048*	0.263***	-0.184	0.028*	1521	423
19	Medium-tech	0.544***	-0.278***	0.309***	0.265	-0.217**	272	91
20	Medium-tech	0.512***	-0.235***	0.261***	0.016	-0.009	2869	667
21	High-tech	0.232***	-0.182***	0.332***	-0.088	0.086	609	135
22	Medium-tech	0.320***	-0.239***	0.376***	0.070**	0.010	6348	1567
23	Medium-tech	0.300***	-0.258***	0.386***	0.038	0.024	7704	1776
24	Medium-tech	0.422***	-0.176***	0.335***	-0.020	0.021	3741	882
25	Medium-tech	0.319***	-0.219***	0.347***	-0.089***	0.012	8377	2337
26	High-tech	0.262***	-0.268***	0.308***	-0.132	0.055	1018	270
27	Medium-tech	0.390***	-0.204***	0.321***	0.047**	0.022	3679	931
28	Medium-tech	0.323***	-0.171***	0.291***	0.015	0.019**	7727	2005
29	Medium-tech	0.233***	-0.267***	0.395***	0.084**	0.037***	4125	995
30	Medium-tech	-0.109	-0.190***	0.219***	0.012***	-0.007	900	309
31	Low-tech	0.296***	-0.192***	0.337***	0.028	0.016	4206	1119
32	Low-tech	0.415***	-0.335***	0.252***	-0.028***	0.038	2048	554
33	Medium-tech	-0.064	-0.108***	0.263***	-0.020	0.046	1591	637

Notes: The dependent variable is labor demand. All models include intercept and year dummies. ***p < 0.01, **p < 0.05, *p < 0.1.

some sub-industries. This clearly shows that there is a need for in-depth analysis for both Turkey and other countries implementing export-oriented employment policies. Obviously, implementing sector-specific policies will lead to more effective results.

Declaration of competing interest

No potential conflict of interest was reported by the authors.

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APPENDIX

Table A
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	Medium-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	Low-tech
NACE 33	Repair and Installation of Machinery and Equipment	Medium-tech

Source: Eurostat (2022).

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