Journal of Economic Cooperation and Development, **33**, 1 (2012), 79-94

The Impact of Foreign Trade on the Labor Market: Evidence from Turkish Economy

Enes E. Uslu[1] and Ozgur Polat[2]

This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between 1994 and 2010. Data are seasonally adjusted by TRAMO/SEATS method before data evaluation, since the data used are quarterly. The results showed that production had positive impact on labor whereas it had negative impact on wages. Furthermore it was shown that imports and exports have a significant and positive impact on labor. Thus the results of the study point out that foreign trade positively affect the economy. Sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis, are also discussed in detailed.

Introduction

Importance of trade in the world economy has been increasing during the past decades, which can be seen at the figures of the world trade. The ratio of world exports of goods and services to GDP increased from 13.5% to 32% per cent between 1970 and 2005 (Jansen and Lee, 2007)

The impact of trade on labor market gained importance in the literature due to the structural changes in production brought by the increase in trade. The classical international trade theory based on Heckscher-Ohlin approach suggests that goods with different factor endowment intensity will be subject to trade due to the fact that countries have different factor

[1] Department of Econometrics, Ataturk University, Erzurum/Turkey
[2] Department of Economics, Dicle University, Diyarbakır/Turkey

A preliminary version of this article was presented Istanbul Conference of Economics and Finance (ICEF – 2011) at Istanbul, Turkey, 20-21 of May 2011. We would like to thank referees of Journal of Economic Cooperation and Development and participants at ICEF 2011 for their helpful comments.

endowment and technology capacity. Relatively labor abundant countries in factor endowment specialize, and thus, export labor intensive goods and import capital intensive goods from relatively capital abundant countries in factor endowment. Thus, employment in industries manufacturing labor-intensive goods will increase in countries exporting labor-intensive goods and employment in industries manufacturing capital-intensive goods will decrease in result of importing capital-intensive goods, and vice versa. Since developing countries have labor-intensive production structure and developed countries have capital-intensive production structure, these theories explain the impact of trade between developed and developing countries on employment structure in these countries.

Most of the studies analyzing impact of trade on employment focused on manufacturing industries of various countries, because of lack availability of data in other sectors for empirical researches (Jansen and Lee, 2007). In most countries, surveys applied to manufacturing sector by national statistical offices are more detailed and has more frequency by comparison with other sectors.

Milner and Wright (1998) investigated labor market effects of trade liberalization in Mauritius. The short and long run responses of employment and wages were examined by conducting a specific factor trade model for importable and exportable sectors for a period covering both the pre- and post-liberalization regimes. Empirical tests showed that trade liberalization had sector specific impacts on employment. The results showed that employment and wages were increased in the long run, but wages were pressured downward in the very short run. Decrease in output caused reduction in employment and wages in the importable sector.

Erlat (2000) used an accounting-identity based approach which decomposed employment change into impact of trade, domestic consumption and productivity change. The results of this decomposition method indicated that trade had a more significant role to play in employment change in the post-1980 period in Turkey, but export-based employment were not dominant in employment changes

Polat and Uslu (2010) found that exports and imports had positive and significant impact on employment in the short run, but not in the long-run, between 1988 and 2007 by conducting Autoregressive Distributed Lag approach with quarterly data of manufacturing industry. In another study, Polat and Uslu (2011) used a dynamic panel data model with an annual panel of data of 95 manufacturing industries in Turkey between 1992 and 2001. They found that export penetration and real exports of current year had positive impact on employment after one year, while import penetration had a negative impact on employment after two years. Polat et al. (2011) estimated employment impact of foreign trade using with panel data analysis with annual data of 22 manufacturing industries of Turkish economy according to two digit level of NACE Rev. 1.1 classification for the period of 2003-2008. Results of this study showed that while production has positive and wages have negative and significant impact on employment, foreign trade has no significant impact on employment for the period of analyzed. An extensive literature review about the relationship between trade and employment can be found in studies of Lee (2005) and Hoekman and Winters (2005).

This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 manufacturing industries in Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between 1994 and 2010. Data used in this study are more current with longer and much more frequency when compared with previous studies. Besides, the random coefficient panel data analysis used in this study enables to obtain sector specific estimations for trade variables. In the following section, data and the model used in this study are briefly summarized. Econometric approach is introduced in the third section. In the fourth section, results of the analysis are presented and sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis, are also discussed in detail. In the fifth section, the results of the study are evaluated.

Data and Model

In order to analyze the long-term and provide more degree of freedom, index numbers of manufacturing industry for employment, wage, production, import and export series are considered in this study and obtained from TURKSTAT database, which is the one of distinguished aspect of this study. Indices of different periods and classifications of every variable are unified by authors to get a single series of every variable. Dataset of variables are based on two-digit ISIC Rev. 3 and NACE Rev. 1.1 classification and cover 17 sectors in manufacturing industry of Turkey for the quarterly period of 1994:4-2010:1. Since the data are quarterly, all series are seasonally and calendar adjusted by TRAMO/SEATS[3] with automatic model identification.

The impact of trade on employment was investigated by using the model derived from Cobb-Douglas production function following Milner and Wright (1998) and Greenaway et al. (1999). Base equation with the random coefficients model specification of sectors estimated in this study can be written as follows:

$$\ln L_{i,t} = \alpha + \sum_{k=1}^{p} \gamma_{k,i} \ln L_{i,t-k} + \sum_{k=0}^{q} \beta_{k,i} \ln W_{i,t-k} + \sum_{k=0}^{r} \theta_{k,i} \ln Q_{i,t-k} + \delta_{1,i} D(1999)_{i,t} + \delta_{2,i} D(2001)_{i,t} + \delta_{3,i} D(2008)_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where $\ln L_{i,t}$ is the logarithm of employment index in i'th sector and t'th time period; $\ln W_{i,t}$, is the logarithm of wage index in i'th sector and t'th time period; $\ln Q_{i,t}$, is the logarithm of production index in i'th sector and t'th time period; $D(1999)$, $D(2001)$, $D(2008)$ are dummy variables that represent depressions in Turkish economy; p, q and r are the number of lags; γ, β, θ, δ are cross-sectional (sector) specific coefficients.

Impact of trade on labor market can be analyzed by extending this model with import index (*M*) and export index (*X*) variables as below:

$$\ln L_{i,t} = \alpha + \sum_{k=1}^{p} \gamma_{k,i} \ln L_{i,t-k} + \sum_{k=0}^{q} \beta_{k,i} \ln W_{i,t-k} + \sum_{k=0}^{r} \theta_{k,i} \ln Q_{i,t-k} + \sum_{k=0}^{s} \phi_{k,i} \ln M_{i,t-k} + \sum_{k=0}^{m} \varphi_{k,i} \ln X_{i,t-k} + \delta_{1,i} D(1999)_{i,t} + \delta_{2,i} D(2001)_{i,t} + \delta_{3,i} D(2008)_{i,t} + \varepsilon_{i,t} \qquad (2)$$

[3] See Gómez and Maravall (1997) for TRAMO/SEATS

Econometric Approach

In order to estimate model (1) and (2), Swamy (1970) proposed following estimation procedure:

$$Y_i = \beta_i X_i + u_i \qquad (3)$$

where; there are T observations on each of the N individual units. $i = 1,...,n$, and β_i is the coefficient vector $(kx1)$ for i'th cross-sectional unit. Here;

$$\beta_i = \beta + v_i \qquad E(v_i) = 0 \qquad E(v_i v_i^{'}) = \Sigma$$

are assumed. Given that

$$Y_i = \beta_i X_i + u_i = X_i(\beta + v_i) + u_i = \beta X_i + (X_i v_i + u_i) = \beta X_i + \omega_i \qquad (4)$$

where $E(\omega_i) = 0$ and

$$E(\omega_i \omega_i^{'}) = E\{(X_i v_i + u_i)(X_i v_i + u_i)^{'}\} = E(u_i u_i^{'}) + X_i E(v_i v_i^{'}) X_i^{'} = \sigma_i^2 I + X_i \Sigma X_i^{'} = \Pi_i \qquad (5)$$

Then the GLS estimator of $\hat{\beta}$ is

$$\hat{\beta} = \left(\sum_i X_i^{'} \Pi_i^{-1} X_i \right)^{-1} \sum_i X_i^{'} \Pi_i^{-1} Y_i = \sum_{i=1}^{n} W_i b_i \qquad (6)$$

where

$$W_i = \left\{ \sum_{i=1}^{n} (\Sigma + V_i)^{-1} \right\}^{-1} (\Sigma + V_i)^{-1} \qquad (7)$$

Feasible best linear predictor of β_i is given by

$$\hat{\beta}_i = \hat{\beta} + \hat{\Sigma} X_i^{'} \left(X_i \hat{\Sigma} X_i^{'} + \hat{\sigma}_i^2 I \right)^{-1} \left(Y_i - X_i \hat{\beta} \right) \qquad (8)$$

where b_i: OLS panel-specific estimator; $\hat{\sigma}_i^2 = \frac{\hat{u}_i^2 \hat{u}_i}{n_i - k}$;

$\hat{V}_i = \hat{\sigma}_i^2 \left(X_i^{'} X_i \right)^{-1}$; $\bar{b} = \frac{1}{n} \sum_{i=1}^{n} b_i$; $\hat{\Sigma} = \frac{1}{n-1} \left(\sum_{i=1}^{n} b_i b_i^{'} - n \bar{b} \bar{b}^{'} \right) - \frac{1}{n} \sum_{i=1}^{n} \hat{V}_i$

To test the parameter constancy ($H_0 : \beta_1 = \beta_2 = ... = \beta_n$), following test statistics are considered (Stata, 2009).

$$\chi^2_{k(n-1)} = \sum_{i=1}^{n} \left(b_i - \overline{\beta}^*\right)\hat{V}_i^{-1}\left(b_i - \overline{\beta}^*\right)$$

where $\overline{\beta}^* = \left(\sum_{i=1}^{n} \hat{V}_i^{-1}\right)^{-1} \sum_{i=1}^{n} \hat{V}_i^{-1} b_i$ (9)

Results

Base model and extended model are estimated using random coefficient approach proposed by Swamy (1970) and presented in Table 1. Standard error are "robust" to panel-specific autocorrelation and heteroskedasticity (Wu, 1986), since jackknife corrected standard error estimates are used. The baseline and augmented specification report significant Wald test which means independent variables are statistically valid in explaining the employment.

Table 1: Results of the Estimations

Model Number	**1**		**2**	
Dependent Variable	$\ln L$		$\ln L$	
Variables	**Coefficient**	**Std. Error**[1]	**Coefficient**	**Std. Error**[1]
Constant	0.6626[a]	0.132	0.9868[a]	0.136
$\ln L_{t-1}$	0.8780[a]	0.064	0.683[a]	0.055
$\ln L_{t-2}$	-0.0596	0.056	0.0111	0.054
$\ln L_{t-3}$	-0.0885[c]	0.045	-0.0353	0.045
$\ln L_{t-4}$	0.0802[c]	0.046	0.0452	0.045
$\ln Q$	0.0219[b]	0.009	-0.0007	0.010
$\ln Q_{t-1}$	0.0003	0.006	-0.0008	0.008
$\ln Q_{t-2}$	-0.0003	0.007	0.0033	0.007
$\ln Q_{t-3}$	0.0178	0.011	0.0265[b]	0.010
$\ln Q_{t-4}$	-0.0042	0.006	-0.0110	0.007
$\ln W$	0.0139	0.035	0.0169	0.029
$\ln W_{t-1}$	-0.0020	0.043	0.0268	0.036
$\ln W_{t-2}$	0.0103	0.026	0.0183	0.023
$\ln W_{t-3}$	-0.0337[c]	0.019	-0.0142	0.032
$\ln W_{t-4}$	0.0219	0.032	-0.0632[b]	0.029
$\ln X$			0. 0332[c]	0.016
$\ln X_{t-1}$			-0.0064	0.015
$\ln X_{t-2}$			0.0038	0.011
$\ln X_{t-3}$			-0.0008	0.013
$\ln X_{t-4}$			0.0196	0.013
$\ln M$			0.0356[a]	0.009
$\ln M_{t-1}$			0.0026	0.009
$\ln M_{t-2}$			-0.0040	0.007
$\ln M_{t-3}$			-0.0143	0.010
$\ln M_{t-4}$			0.0019	0.010
$D(1999)$	-0.0372[a]	0.008	-0.0240[a]	0.008
$D(2001)$	-0.0239[a]	0.008	-0.0348[a]	0.009
$D(2008)$	-0.0159[b]	0.007	-0.0265[a]	0.006
Test of parameter constancy	χ^2_{288} =750.03 (0.000)		χ^2_{448} =1023.46 (0.000)	
Wald test of model	χ^2_{17} =1982.60 (0.000)		χ^2_{27} =2474.70 (0.000)	

Notes: a, b and c respectively indicate significance at 1%, 5%, 10% levels. In parenthesis are probability ratios
[1]Standard errors are jackknifed small sample ratios for 17 clusters

The test of parameter constancy are rejected which suggest that slope coefficients are heterogeneous across industries. The number of lag is determined empirically. Here, in order to capture one year time period, 4 lags are considered for all variables.

The results of base specification are reported in the first column of Table 1. The coefficient of the first lagged employment variable is positive and significant at 1% level. This indicates that increase in employment has a significant impact on employment for the next quarter. Industrial production index has a positive and significant impact on employment in the same quarter. The industrial wage index has a negative and statistically significant impact on employment index after three quarter. The dummy variables that represent depressions where in 1999, 2001 and 2008 in Turkish economy are found negative which is in accordance with expectations and statistically significant at least at 5% level.

The results of the augmented model presented by equation (2) are given in the second column of Table 1. The coefficient of the first lagged employment variable is positive and significant at 1% level. The third lag of production variable had a positive impact and the fourth lag of wage variable had a negative impact on employment which is statistically significant at the 5% level. Both the import and export quantity index had a positive impact on employment and are found statistically significant respectively at 1% and 10% level. The depression dummies had negative impact with statistical significance similar to coefficients of the base specification.

The sector-specific results of estimations are presented in Table 2. Descriptions of sectors are reported in Appendix 1. Classification of these sectors according to their global technological intensity is presented in Appendix 2. The coefficients of the first lagged employment variables are positive and significant at 1% level in all sectors. In general, impact of wages on employment is positive high technology sectors, but negative in low technology sectors.

Table 2: Coefficients Estimations of Sectors in Manufacturing Industry

Variables	**15**	**16**	**17**	**19**	**20**	**21**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**34**	**36**
lnL_{t-1}	0,484[a]	0,591[a]	0,802[a]	0,493[a]	0,485[a]	0,622[a]	0,363[a]	0,512[a]	0,882[a]	0,664[a]	0,728[a]	0,856[a]	0,524[a]	0,880[a]	0,877[a]	0,811[a]	0,735[a]
lnL_{t-2}	0,100	0,371[a]	0,199[c]	0,024	-0,004	0,103	0,050	0,153	-0,333[a]	-0,023	0,054	-0,163	0,113	-0,145	-0,026	-0,187	-0,086
lnL_{t-3}	0,194[b]	-0,011	-0,240[a]	0,027	-0,020	-0,169[c]	-0,147[c]	-0,085	0,187[b]	-0,065	0,037	-0,058	-0,161[c]	-0,007	0,127	-0,061	-0,015
lnL_{t-4}	-0,043	-0,072	0,002	0,068	0,099	0,210[a]	0,457[a]	0,198[b]	-0,112	0,099	-0,060	-0,030	0,107	-0,069	-0,128	0,134[c]	0,039
lnW	0,057	0,006	0,047	0,222[a]	0,110	-0,043	-0,045	0,014	-0,024	0,028	-0,120[c]	0,092	-0,005	0,051	0,127[b]	-0,137[c]	-0,057
lnW_{t-1}	-0,139[b]	0,093	0,016	-0,177[b]	-0,043	0,104	0,048	0,021	0,148[b]	-0,106	0,175[b]	-0,056	0,017	-0,030	-0,027	0,219[a]	0,166[b]
lnW_{t-2}	0,046	-0,050	0,010	0,022	-0,048	0,032	-0,009	0,011	0,012	0,072	-0,049	0,091[c]	-0,058	0,060	0,120[b]	0,040	0,013
lnW_{t-3}	0,236[a]	0,067	0,087	-0,172[c]	-0,033	-0,078[c]	-0,086[c]	0,009	-0,067	0,200[b]	0,018	0,024	-0,022	-0,072	-0,074	-0,178[b]	-0,047
lnW_{t-4}	-0,193[a]	-0,096	-0,159[a]	0,067	-0,049	-0,004[b]	0,100[b]	-0,053	-0,072	-0,268[a]	-0,037	-0,157[a]	0,058	-0,065	-0,147[a]	0,032	-0,080
lnQ	-0,025	-0,011	0,010	0,015	-0,076[c]	0,042	-0,125[a]	-0,015	0,017	-0,020	0,033[c]	-0,008	-0,019	-0,006	0,070[b]	0,014	0,039
lnQ_{t-1}	0,002	0,009	0,033[c]	-0,020	0,116[c]	-0,018	0,028	0,025	-0,011	0,006	-0,012	0,007	-0,005	-0,003	-0,040	-0,030	-0,057
lnQ_{t-2}	-0,046[b]	0,039	-0,003	0,004	-0,014	-0,003	0,069	-0,003	-0,022	0,030	0,000	0,007	-0,005	-0,016	0,013	-0,025	-0,006
lnQ_{t-3}	0,058[a]	0,002	0,013	0,033	-0,032	0,013	0,075[a]	-0,006	0,044[b]	0,035[c]	0,010	0,046[b]	0,033	0,044[b]	0,082[a]	0,020	0,002
lnQ_{t-4}	-0,025	0,023	0,011	-0,055[c]	-0,037	0,007	-0,020	-0,028	0,000	-0,021	0,010	-0,005	-0,035	0,043	-0,031	-0,014	0,002
lnX	0,007	-0,027	0,138[a]	0,105[a]	0,039	0,013	-0,002	-0,014	0,000	-0,051	-0,024	0,061[b]	0,071[b]	0,077[b]	0,069[b]	0,034	0,022
lnX_{t-1}	-0,086[a]	0,009	-0,068[b]	-0,026	0,020	0,052[c]	0,001	0,052	-0,030	0,077[b]	-0,014	-0,016	-0,051	-0,022	-0,034	0,011	0,019
lnX_{t-2}	0,020	-0,010	0,059[b]	-0,015	-0,002	-0,038	-0,004	-0,040	0,036	-0,050[c]	0,009	0,003	0,013	0,025	0,041[b]	0,013	-0,011
lnX_{t-3}	0,102[a]	-0,024	-0,040	0,064[b]	0,026	-0,037	-0,006	-0,026	0,025	-0,057[c]	0,024	-0,014	0,050	-0,010	-0,032	-0,009	-0,017
lnX_{t-4}	-0,007	-0,013	0,009	-0,041	0,027	0,007	0,026	0,044	0,017	0,154[a]	0,019	0,040	-0,011	0,011	-0,025	0,029	0,049[c]
lnM	0,045	0,012	0,049[a]	-0,022	0,058	0,018	-0,016	0,038	0,071[b]	0,131[a]	0,027	0,048	-0,005	0,015	0,074	0,036	0,032
lnM_{t-1}	0,003	-0,021	-0,054[b]	-0,022	0,050	-0,039	0,029	0,005	0,021	-0,030	0,035	-0,015	0,114[b]	0,037	-0,008	0,045	-0,029
lnM_{t-2}	0,014	0,004	-0,018	-0,039	-0,046	0,050	-0,017	0,026	-0,024	-0,007	-0,026	-0,009	-0,057	-0,033	-0,047	0,028	0,048[c]
lnM_{t-3}	-0,023	-0,025	-0,013	-0,027	-0,049[c]	-0,025	0,013	-0,010	-0,024	-0,025	-0,003	-0,026	0,048[c]	0,001	-0,086[a]	-0,007	0,017
lnM_{t-4}	0,005	-0,012	-0,041[c]	0,122[a]	0,018	-0,061	0,020	-0,055	0,024	0,033	0,019	0,005	-0,029	0,003	0,035	-0,004	-0,019
d2008	0,010	0,002	-0,019[b]	-0,101[a]	-0,064[b]	-0,051[b]	-0,053[a]	-0,014	-0,011	-0,056[a]	-0,018	-0,001	-0,020	-0,027	0,059[b]	-0,032[b]	-0,031
d2001	-0,029[b]	-0,012	0,003	-0,101[a]	-0,006	-0,043	-0,066[b]	-0,020	-0,050[a]	-0,012	-0,045[a]	-0,066[a]	-0,092[c]	-0,031	0,043	-0,017	-0,054[b]
d1999	-0,039[b]	-0,028	-0,043[a]	-0,080[c]	0,015	-0,034	-0,028	-0,018	-0,016	0,022	0,000	-0,064[b]	-0,024	0,024	-0,023	-0,048[b]	-0,045
Constant	0,983[a]	0,584[b]	0,621[a]	1,580[a]	1,777[a]	1,076[a]	0,910[a]	1,026[a]	1,055[a]	0,846[a]	0,668[a]	1,177[a]	1,481[c]	1,018[a]	0,220	0,874a	1,000[a]

Notes: a, b and c respectively indicate significance at 1%, 5% and 10% levels.

Output of sectors (16), (21), (24), (29), (34) and (36) have no significant impact on employment level. That shows jobless growth in these sectors. In the rest of the sectors, output variables have positive impact on employment in general. Exports have no significant impact on employment level in low technology sectors such as (16), (20), (23), (24), (25), (27). But in high technology sectors such as (29), (30) and (31), exports are found to have significant and positive impact on employment level. More than half of the sectors, imports have no significant impact on employment level. The impacts of imports on employment level are significant and positive in sectors (17), (19), (25), (26), (29) and (36). This indicates that increase of imports in these sectors indirectly increase employment levels, since significant part of imports of Turkey is constituted by raw materials used in production (TURSTAT, 2011). The impacts of imports on employment level are found to be negative in sectors (20) and (32). According the results, economic crises in 1999, 2001 and 2008 were effective particularly in low technology sectors and decreased employment levels in these sectors.

Conclusion

This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between the years 1994 and 2010. Data are seasonally adjusted by TRAMO/SEATS method before data evaluation, since the data used are quarterly. Data used in this study are more current with longer and much more frequency when compared with previous studies. Besides, the random coefficient panel data analysis used in this study enables to obtain sector specific estimations for trade variables.

The results of estimations show that impact of production on employment level is positive, while impact of wages on employment level is negative. Furthermore it is found that imports and exports have a significant and positive impact on employment level. Thus the results of the study point out that foreign trade positively affect the economy. In this framework, export supporting strategies applied by the governments in Turkey since 1980 can be considered as meaningful steps for creating new job opportunities in manufacturing industry.

Sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis enable detailed analysis in manufacturing industry. Impact of the wages on employment is found to be positive high technology sectors, but negative in low technology sectors. Incentive policies for wages in high technology sectors can be implemented to increase employment in these sectors. Increase of output in some sectors has no significant impact on employment levels indicating jobless growth. Since exports have significant and positive impact in most of high technology sectors, policies such as export incentive policies and cost reduction measures should be considered in order to increase employment in these sectors. Tariff reduction policies can be implemented to increase employment in specific sectors in which imports have significant and positive impact on employment level, considering competitiveness of domestic firms.

References

Erlat, Guzin (2000), "Measuring the impact of trade flows on employment in the Turkish manufacturing industry," *Applied Economics*, 32 (9), 1169-80.

EUROSTAT, (2012), http://epp.eurostat.ec.europa.eu/

Greenaway, David, Hine, Robert C., and Wright, Peter (1999), "An empirical assessment of the impact of trade on employment in the United Kingdom," *European Journal of Political Economy*, 15 (3), 485-500.

Gómez, V. and Maravall, A. (1997), "Programs TRAMO (Time series Regression with Arima noise, Missing observations, and Outliers) and SEATS (Signal Extraction in Arima Time Series): Instructions for the User", *Banco de España Research Departmen*t, Working Paper 97001.

Hoekman, B. and Winters, A.L. (2005), 'Trade and Employment: Stylized Facts and Research Findings', *Working Papers 7* (Working Papers 7 edn., Working Papers 7: United Nations, Department of Economics and Social Affairs).

Jansen, M. and Lee, E. (2007), 'Trade and Employment: Challenges For Policy Research', (Geneva: World Trade Organization).

Lee, E. (2005), 'Trade liberalization and employment', (Working Papers 5 edn., Working Papers 5: United Nations, Department of Economics and Social Affairs), Working Papers 5.

Milner, Chris and Wright, Peter (1998), "Modelling Labour Market Adjustment to Trade Liberalisation in an Industrialising Economy," *The Economic Journal*, 108 (447), 509-28.

Polat, Ö. and Uslu, E. E. (2010), "Employment Impact of Foreign Trade in Manufacturing Industry of Turkey," *Gaziantep University Journal of Social Sciences*, 9 (3), 489 -504.

--- (2011), "Impact of international trade on employment in manufacturing industry of Turkey," *African Journal of Business Management*, 5 (13), 5127-35.

Polat, Ö., Uslu, E. E., and Aydemir, C. (2011), "Analysis of Trade and Employment in Manufacturing Industry Using Panel Data Method," *Business and Economics Research Journal*, 2 (3), 161-71.

Stata (2009), *Stata Longitudinal-Data/Panel-Data Reference Manual* (Stata Press).

Swamy, P. A. V. B. (1970), "Efficient Inference in a Random Coefficient Regression Model," *Econometrica*, 38 (2), 311-23.

TURKSTAT, (2011), " Statistical Indicators: 1923-2010", Turkish Statistical Institute, http://www.tuik.gov.tr/IcerikGetir.do?istab_id=158 (Visited at 3rd May 2012)

Wu, C. F. J. (1986), "Jackknife, Bootstrap and Other Resampling Methods in Regression Analysis," *The Annals of Statistics*, 14 (4), 1261-95.

Appendix 1 Statistical Classification of Economic Activities (NACE Rev.1.1)

15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling

Source: EUROSTAT (2012)

Appendix 2 Classification of sectors in manufacturing industry according to their global technological intensity (NACE Rev 1.1)

High-technology	NACE Revision 1.1
1. Aerospace	35.3
2. Computers, office machinery	30
3. Electronics-communications	32
4. Pharmaceuticals	24.4
5. Scientific instruments	33
Medium-high-technology	
6. Motor vehicles	34
7. Electrical machinery	31
8. Chemicals	24-24.4
9. Other transport equipment	35.2+35.4+35.5
10. Non-electrical machinery	29
Medium-low-technology	
11. Rubber and plastic products	25
12. Shipbuilding	35.1
13. Other manufacturing	36.2 - 36.6
14. Non-ferrous metals	27.4+27.53/54
15. Non-metallic mineral products	26
16. Fabricated metal products	28
17. Petroleum refining	23
18. Ferrous metals	27.1 - 27.3+27.51/52
Low-technology	
19. Paper printing	21+22
20. Textile and clothing	17 - 19
21. Food, beverages, and tobacco	15+16
22. Wood and furniture	20+36.1

Source: EUROSTAT (2012)