THE EFFECT OF FOREIGN TRADE ON REAL WAGES: THE CASE OF TURKEY

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Abstract:
The main objective of this article is to test the existence of Stolper-Samuelson theorem between Turkey and EU-15 countries for the period 2005–2014. According to the results, a significant relationship is found between exports and real wages especially in the labour and raw intensive sectors of Turkish exports, where Turkey is relatively labour and raw abundant in comparison with the EU-15. Test results indicate a long-run relationship between exports of manufacture of wearing apparel, food, textiles and real wages, a unidirectional Granger causality relationship is found from exports to wages in manufacture of wearing apparel and food. The international trade between Turkey and the EU-15 validates to some extent the Stolper-Samuelson theorem.

1. Introduction

The determinants and results of trade flows among countries are subjects of a tremendous amount of empirical research. One of the most prominent international trade theories is Heckscher-Ohlin (HO) Model, which was first conceived by Eli Heckscher (1919) and Bertil Ohlin (1933). According to the model, countries are endowed with different factor supplies. It is expected that if a factor is relatively abundant in a country, it will also be relatively cheaper than its partner country. This theory argues that a country will have comparative advantage if it exports the goods which are produced intensively by employing the abundant factor. In other words, a capital abundant country exports capital intensive goods and imports labour intensive goods from relatively labour abundant country. International trade causes a shift in the production process from the import competing industries towards production of export industries, so there will be an increase in demand for the abundant factors. As a result it is expected that each country's real return of the abundant factor has a tendency to increase, which is known as Factor Price Equalization theorem. In this context, Stolper-Samuelson theorem (1941) states that international trade causes abundant factor to gain and scarce factor to lose. On the other hand, international trade lowers the real return of the scarce factor but increases the real return of the abundant factor due to the increase in the price of the intensively produced goods. Not only real return of wages but also real return of capital converges between trading partners due to free movements

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of capital. Perfect factor mobility results in factor price equalization. In case of differences in return, owners of capital could easily transfer their capital investments from one country to another.

Turkey liberalized its capital account in 1989, taking the final step of economic and financial liberalization reforms with the 24th January 1980 decisions. Although the customs union agreement was established between Turkey and the EU in 1996, free movements of labour have not been achieved. It is expected that factor price equalization is attained by means of trade instead of factor movements because commodity movements and factor movements can be considered as substitutes. Under these circumstances, purchasing power parity theorem argues that commodity price comes to the equilibrium in the long run through trade. The relationship between non traded goods and the price of capital is not included into the analysis. To that end, this study focuses on only the relationship between labour return (wages) and traded goods (exported goods).

Morever, in many studies, the Stolper-Samuelson theorem has been used to adress the trade and wage debate. Some empirical studies argue that trade between developed and developing countries causes wage inequality or an increase in unemployment in developed countries. Developed countries export capital intensive or skilled labour intensive goods, as a result unskilled labour demand and also wage level have a tendency to decrease. In addition to that skilled labour real return increases more than unskilled labour real return.

Whether globalization and intense international trade increase income inequality within and between the countries or not is a subject of debate. The reasons of wage inequality are generally explained by many variables, which are grouped into demand side variables, supply side variables, and institutional changes such as changes in technology, education level and labour union organizations (Faggio *et al.*, 2007). There is a bulk of the literature, which is investigating the relationship between trade flows and wage levels. Some studies have found a statistically significant and positive relationship between trade flows and wage levels, and some others others just the opposite.

The aim of this study is to find out the validity of Stolper-Samuelson theorem (1941) under the scope of whether the real wages of leading Turkish exported sectors (manufacture of motor vehicles, trailers and semi-trailers, wearing apparel, textiles, electrical equipment and food products and total manufacturing) are increasing or not through exports. In accordance with this purpose the cointegration and causality relationship between Turkish exports to the EU-15 and real wages were investigated. This article proceeds as follows: Section 1 summarizes recent empirical studies, then Section 2 that describes variables and discusses the empirical findings of the model, and finally Section 3 provides concluding remarks.

2.   Literature Review

There have been contentious debates about whether globalization increases income inequality or not. The literature, investigating the relationship between trade and wages, can be divided in four groups. The first strand of the literature gives emphasis on the effects of imports on trading partners' wage level. If the overwhelming ratio of the trade has been occurring between the developed and developing countries, it is expected that developed country's unskilled wage level will have a tendency to decrease. According to Stolper-Samuelson theorem, international trade benefits the abundant factor and harms the scarce factor. As developed countries export skilled intensive goods and import unskilled

intensive goods, income inequality within the country has a tendency to increase. Domestic producers are forced to make structural change in their production process to choose an optimal production technique. They have to use labour saving production technology or to implement lower wages. In other words relative decline in demand for less skilled labour causes relatively lower wages in these countries. Freeman (1995) indicated that the goods, imported from low wage countries, increase the intense of competitiveness of a developed country's industry. If imported goods are substitutes, producers in the developed country will have to decrease their production cost; otherwise they might lose their market share. In this situation, there is a downward pressure on wage levels. Katz and Summer, (1989) and Grey (1993) analysed the impact of trade openness on wage levels for US and Canadian economy, respectively. Their results revealed that the import intensive industries receive lower wage premiums, compared to the export intensive industries. McDougall and Tyers (1997) found that with the liberalization of trade, the ratio of the wages to capital returns has declined in developed countries. This is consistent with the Stolper-Samulson theorem (De Santis, 2001). Melvin and Waschik's (2001) study based on the specific factor model indicated that if the elasticity of substitution is sufficiently low, the real wage of labour is subjected to downward pressure compared to its pretrade level. Babecky *et al.* (2009) found, by using the GMM method, that the export performance raised the wages for the period from 1999 to 2006. In contrast to that the increase in import activities had a statistically significant and negative effect on the wages. They further pointed out that the imports coming from low waged countries further intensify this negative relationship. Krugman (2008) underlined that the trade between North and South, which features the trade relationship among countries endowed with different factors, has moderate negative effect on wages. Some of the empirical studies are summarized in Table1.

Table1 | Well-known Estimates of the Effect of Trade on Wages

Study	Estimated effect on skilled-unskilled wage ratio	Date of Data
Krugman (1995)	3%	1992
Lawrence (1996)	3%	1993
Cline (1997)	7%	1993
Borjas, Freeman and Katz (1997)	1.4%	1995

Source: Krugman, P. (2008), Trade and Wages, Reconsidered, Brookings Panel on Economic Activity, pp.1–42.

The second strand of the literature tries to explain the relationship between trade and demand elasticity of labour. If an exporting firm begins taking part in international trade, there would be many rivals. In this context even a slight increase in product price may cause a sharp decrease in quantity demand for the concerned product. In other words, traded goods' price elasticity of demand has tendency to increase. The supply and demand forces, which determine market price of factors of production, depend on price elasticity of the products. Factor markets are derived market. Demand and supply forces of factors depend on product market demand and supply forces. Therefore, if price elasticity of product demand has a tendency to increase with globalization, price elasticity of factor (especially

labour) demand will also increase. If domestic firms' price is above the world price, they might lose their market share. Intense competition with trade affects the wages negatively. Domestic firms are obliged to decrease their product price to increase the demand for the product as it is known "law of demand". Therefore, it is expected that when product price elasticity increases with exports, labour demand elasticity has also a tendency to increase. Slaughter (2001) found the direct effect of trade on wages to be weak. In contrast to this finding Hasan *et al.* (2007) found that trade liberalization raised own-wage elasticity of labour demand in India. Andreas *et al.* (2013) investigated this relationship by using micro-level data for Germany. Their results confirm the positive relationship between export volume and wage elasticity of unconditional labour demand. Abowd and Lemieux (1993) found that liberalization and import competition apply pressure on domestic wage levels for Canadian firms. Some other studies investigated causality relationship between trade liberalization and absolute value of own-wage elasticity of labour. However, they found statistically limited effects (Fajnzylber and Maloney, 2005).

The third strand of the literature argues that exporters, producing at a larger scale, are more productive and pay higher wages than non-exporters (Bernard and Jensen, 1995; Schank *et al.*, 2007). The main argument in this view is that there is a more intense competition among exporters in international market than in domestic market. That makes firms to be productive as much as they can. The companies which have an ambition to operate effectively and efficiently would rather work with skilled workforce. Besides that firms learn and easily adopt new technologies when they become exporters (Bustos, 2011). The technological innovations force the workforce to be more qualified and this situation leads to higher wages. In this context not only trade volume but also the pattern of the trade is important. The larger the percentage of trade pattern is composed of technological intensive goods and services, the more the firms demand skilled labour (Brambilla *et al.*, 2012). International trade causes a technological spillover among trading countries. Adopting new technologies increases both labour and capital productivity and thus indirectly affects wages. In the literature, empirical research found evidence that when developing countries trade volume increases with developed countries, their total productivity rises as well (Coe and Helpman, 1995; Coe, *et al.*, 1997). Lundin and Yun (2009) stated that exporting industries increase their profits. The firms earning higher profits pay higher wages (Caju, *et al.*, 2011). Riker (2010) considered 60,000 manufacturing worker earnings for the period from 2006 to 2008, and found that exporting capability increases wage premium. Exporting firms stimulate investment on technology and capital, so this leads to increase in productivity, technological innovation and then wage return. Bernard *et al.* (2007) used plant level census data and their findings also confirmed Riker's (2010) results. In their study, Martins and Opromolla (2009) analysed the effects of the import and export performance of the Portuguese manufacturing companies on wages for the period ranging over 1995 to 2005. The results support that the companies that export high technology products tend to pay higher wages than the firms exporting low technology products.

Hein and Tarassow (2010) reported a faster real wage growth leading to a higher productivity growth for 6 OECD countries for the period from 1960 to 2007. Kremer's O ring theory (1993) also states that while low skill labour works in low productive firms, skilled labour works in high productive firms. As a result the high productive firms pay higher wages than the unproductive or low productive ones.

The results of the study, conducted by Schank *et al.* (2007) at industry level for different firms, also confirm the observation that the exporting companies pay a higher level of wages compared to the non exporting ones.

Lastly, in addition to the effect of the foreign trade on the wages, whether the wages improve the export performance or not should also be examined. In general only productive firms are able to carry out export activities because supplying products in foreign markets, conducting marketing activities, and employing skilled labour are all additional financial burden on the companies. This extra financial burden can only be sustained by profitable and efficient companies. Some empirical studies conclude that there are no productivity improvements for the firms after they start to export. Clerides *et al.* (1998) confirm this outcome stating that exporting companies have already been paying higher wages. When they start to export, there is no further increase in their wage level. Greenaway and Kneller (2007) argue that searching foreign markets for export is costly and also necessitates skilled labour so only self selected productive firms can manage this issue. An empirical research of Schank *et al.* (2010) for Germany showed that the more productive firms can enter foreign markets without leading the export to increase productivity and wage level. Easterly (2007) suggested that the main model that is commonly used to explain the poverty and the wage inequalities among the countries is the factor endowment theory. However, he also states that the most effective factor for explaining the poverty and wage inequality is the efficiency increase rate. Paus and Robinson (1997) analysed the effects of the trade openness on the real wages in 32 developing countries between 1973 and 1990. The results revealed that the main factors that are influential on determining the real wages are economic growth and growth in investments and efficiency, rather than the increase in exports. This study points out that it should be focused on the increase of the efficiency in order to raise the living standards of the workers.

To the best of our knowledge, there is a limited number of studies for Turkey. Kızılırmak (2003) revealed that the foreign trade in Turkey increases the relative demand and income of labour for the skilled workforce in manufacturing and decreases the demand and income of labour for the unskilled workforce. These results also corroborate the study of Ansal *et al.* (2000). Emirhan and Konyalı (2010) investigated the effect of the foreign trade on the wages for the period between 1983 and 2000. Their results indicated that industry groups should be analysed separately instead of examining the manufacturing industry as a whole. They found a negative relationship between the export levels and the wages and also found a positive relationship between the import levels and wages. Gökalp *et al.* (2011) analysed the relationship between the trade openness and the income inequality for the period from 1980 to 2001. The study showed that the increase in trade openness does not increase wages of the workers in labour intense sectors compared to the capital and research intense sectors. On the contrary, the study underlined that the income of the skilled workers rises at a higher rate.

3. Methodology and Empirical Results

In order to explore the validity of Stolper-Samuelson theorem (1941) within the scope of how Turkish exports to the EU-15 affected the real wages can be written as:

$$Y_t = \alpha_0 + \alpha_1 X_t + \varepsilon_t \tag{1}$$

where, Y_t indicates real wages, X_t exports and ε_t error term.

3.1 Data

In this context, Turkey's top five exported goods, according to the ISIC Rev. 4 level 2 and level 1 classification, (manufacture of motor vehicles, trailers and semi-trailers (29), manufacture of wearing apparel (14), manufacture of textiles (13), manufacture of electrical equipment (27) and manufacture of food products (10) and manufacturing (C)) to the EU-15 are selected. Data for the individual exports in USD mil. are taken from TurkStat (Turkish Statistical Institute). Industrial Gross Wage-s-Salary Indexes (2010=100) are taken from TurkStat Data according to NACE Rev. 2. The CPI based real effective exchange rate (REER) (2003=100) is used to convert nominal wages into real wages. All values of REER converted to the base year 2010 and are taken from the Central Bank of the Republic of Turkey (TCMB). The quarterly data period ranges from 2005:01 to 2014:01.

3.2 Unit root tests

The implementation of the Granger Causality Test (Granger, 1969) requires all variables to be stationary. Engle and Granger (1987) stated that it is necessary to take the differential of a non-stationary series to make stationary. In order to avoid the potential problem of spurious relationships and incorrect inferences, all variables are stationarized. In this context, The Augmented Dickey Fuller Test (ADF) is used for unit root tests (Dickey and Fuller, 1979). The ADF test, which comprises an intercept and trend, is shown in the following equation:

$$\Delta X_t = \alpha_1 + \Theta_1 t + \Phi_1 LX_{t-1} + \sum_{i=1}^{k} \delta_i \Delta LX_{t-i} + \varepsilon_t \tag{2}$$

$$\Delta W_t = \alpha_2 + \Theta_2 t + \Phi_2 LW_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta LW_{t-i} + \upsilon_t \tag{3}$$

where Δ first difference operator; $\Delta LX_t = LX_t - LX_{t-1}$; $\Delta LW_t = LW_t - LW_{t-1}$; $\alpha_1, \alpha_2, \Theta_1$, $\Theta_2, \Phi_1, \Phi_2, \delta_i$ and γ_i are the coefficients, and ε_t, υ_{t1} are error terms. The null hypothesis is tested LX_t and LW_t have unit roots, $\Phi_1 = \Phi_2 = 0$. The alternative is the variables are integrated are of order zero I(0), LX_t and LW_t have no unit roots. The hypothesis is rejected when the t-statistics are greater (in absolute values) than the MacKinnon (1991) critical value.

Since data used in this study include quarterly series, the seasonality problem exists. This problem is corrected by using the TRAMO/SEATS (T/S) method for each series individually. The summary of the results of ADF tests are presented in Table 2.

All series' ADF test results failed to reject the null hypothesis of existence of a unit root for the data at log levels and were found stationary at their first difference I(1). According to the recent studies, in order to investigate Granger causality relationship between variables, cointegration tests are required to be investigated. Otherwise, the results obtained using the Granger test of causality become invalid. In this case, causality tests present evidence of simultaneous correlations rather than causal relations between the variables. Therefore, a long-term causal relationship is investigated between nonstationary time series, when the concerned variables are cointegrated (Doyle, 1998).

Table 2 | Augmented Dickey Fuller (ADF) Unit Root Tests

Variables	Level		First Difference	
	Intercept	Trend and intercept	Intercept	Trend and intercept
MANU$_x$	−1.670[0]	−2.021[0]	−4.100[1]*	−4.024[1]**
MANU$_w$	0.482[1]	−1.588[2]	−3.137[0]**	−3.510[0]**
APP$_x$	−2.587[4]	−3.031[2]	−5.413[0]*	−5.332[0]*
APP$_w$	−0.439[1]	−0.739[0]	−4.560[0]*	−5.122[0]*
ELECT$_x$	−1.844[3]	−2.514[0]	−4.642[1]*	−5.148[2]**
ELECT$_w$	0.404[1]	−1.775[7]	−7.188[0]*	−7.160[0]*
FOOD$_x$	−0.439[0]	−2.854[0]	−5.973[0]*	−5.879[0]*
FOOD$_w$	0.992[0]	−1.578[0]	−5.967[0]*	−6.224[0]*
MOTOR$_x$	−2.510[0]	−3.013[1]	−5.607[0]*	−5.527[0]*
MOTOR$_w$	−0.789[1]	−2.389[2]	−4.136[0]*	−4.135[0]**
TEX$_x$	−1.446[3]	−2.632[3]	−6.055[2]*	−5.992[1]*
TEX$_w$	−0.230[1]	−0.622[1]	−3.858[0]*	−4.558[0]*

Note: (*) and (**) indicate that the corresponding coefficient is significant at 1% and 5% levels, respectively. The optimal lag lengths are indicated within parenthesis and determined by the AIC.

3.3 Johansen cointegration tests

The existence of a long-run relationship between variables was tested using the "Johansen Cointegration Tests" (Johansen, 1988; Johansen and Juselius, 1990). The optimal lag lengths of the analysis are found according to Akaike Information Criteria (AIC), which suggested different lag lengths for each analysis. The results of the Johansen Cointegration Tests are shown in Table 3.

The null hypothesis of no cointegration is rejected by all other relationships. In this context, the existence of a cointegration relationship was found between exports and wages for total manufacturing and top five exported sectors to the EU-15, which indicates a long-run equilibrium relationship between these series for Turkey in the aforementioned period. Granger (1988) pointed out that Granger causality must exist in at least one direction as one variable aids facilitates prediction of the other, if there are two cointegrated variables are I(1)(Doyle, 1998). After validation of the cointegration the error correction term indicates that changes in the dependent variable are a function of magnitude of disequilibrium in the cointegration relationship and of changes in other independent variables (Cushin *et al.,* 2008). Following Engle (1984), Engle *et al.,* (1983) and Cushin *et al.,* (2008), a Lagrange multiplier test statistic is applied to test for weak exogeneity before estimating the error correction model.

Table 3 | Johansen Cointegration Tests and Estimates

Variables	AIC	Trace Statistics	Max Statistics	Critical value		Results	
				5% (trace)	5% (max)		
MANU$_w$-MANU$_x$	2	16.436** 1.836	14.599** 1.836	15.41 3.76	14.07 *3.76*	r=0, r>=1 r=1, r>=2	Cointegrated
APP$_w$-APP$_x$	7	22.320** 1.339	20.980** 1.339	15.41 3.76	14.07 3.76	r=0, r>=1 r=1, r>=2	Cointegrated
ELECT$_w$ ELECT$_x$ -	7	22.320** 1.339	20.980** 1.339	15.41 3.76	14.07 3.76	r=0, r>=1 r=1, r>=2	Cointegrated
FOOD$_x$ FOOD$_w$-	4	28.034** 2.997	25.036** 2.997	15.41 3.76	14.07 3.76	r=0, r>=1 r=1, r>=2	Cointegrated
MOTOR$_w$ -MOTOR$_x$	7	15.857** 0.018	15.838** 0.018	15.41 3.76	14.07 3.76	r=0, r>=1 r=1, r>=2	Cointegrated
TEX$_w$-TEX$_x$	5	19.119** 2.747	15.372** 2.747	15.41 3.76	14.07 3.76	r=0, r>=1 r=1, r>=2	Cointegrated

Note: (**) indicates that test statistics is significant at 5% level, AIC

3.4 Weak exogeneity tests

Generally, a variable is regarded as endogenous if it is determined in a model; otherwise is called exogenous if its value is determined out of the model. While endogenous variables can be determined as joint dependent variables, exogenous variables can be considered as the predetermined value variables. A weak exogenous variable takes place only the right side of the model and cannot be determined by other variables, an endogenous variable can be in the left side of the model as dependent variable (Kaplan and Aktaş, 2012).

If the null hypothesis of weak exogeneity is not rejected (if it is accepted), the aforementioned variable is considered to be exogenous. This means that the aforementioned variable does not respond to any deviation from the long-run equilibrium. Therefore, all of the adjustments to the deviations from the long-run equilibrium (through the error correction component) correspond to the adjustments in the explanatory variables (Cushin *et al.*, 2008). As a result, after the nonrejection of the null hypothesis of the weak exogeneity, the exogenous variable cannot be regarded as dependent variable; hence the error correction model cannot be applied and becomes redundant.

In this context, error correction models (ECMs) are defined as in the Equations (4) and Equation (5) for each sector where variables represent exports and wages for each sector.

$$\Delta X_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta X_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta W_{t-i} + \sum_{i=1}^{r} \alpha_{3i} ECT_{r,t-1} + \varepsilon_{1t} \qquad (4)$$

$$\Delta W_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta W_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta X_{t-i} + \sum_{i=1}^{r} \beta_{3i} ECT_{r,t-1} + \varepsilon_{2t} \qquad (5)$$

where α_0 and β_0 are constant terms, Δ indicates first-order difference, m, n and r indicates lag lengths, ε_{1t} and ε_{2t} are error terms, respectively. The lagged error correction term, $ECT_{r,t-1}$ is the lagged residual from the cointegration regression between X_t and W_t. In order to

find significant results from the model, in the right side, one or both of the coefficients of the independent variables (α_{2i}, β_{2i}) should be significant (short-run Granger Granger causality) and coefficients of $ECT_{r,t-1}$, the lagged error correction term (α_{3i}, β_{3i}) should be significant (long-run Granger causality). The coefficients (α_{3i}, β_{3i}) denote the speed of adjustment parameters, which indicate how quickly the system returns to its long-run equilibrium after a temporary variation (Cushin *et al.*, 2008).

According to the Equation (4), the null hypothesis of Engle's (1984) weak exogeneity test is $\alpha_{3i} = \sigma_{12} = 0$, where $\sigma_{12} = $ corr (ε_{1t}, ε_{2t}) (see Cushin *et al.,* 2008). Nonrejection of the null of weak exogeneity indicates no long-run relationship of other variables to weak exogenous variable.

In the other words, the weak exogeneity test is being important whether for the significance of adjustment coefficient during the determination of the direction of the long-term (cointegration) relation. In this context, before applying the Granger causality tests, we tested whether cointegrated variables are weak exogenous or not by using the Likelihood Ratio (LR) Test.

Table 4 | Tests for Weak Exogenity

Variables	Constraint vectors	LR Test (χ^2)	p-value
MANU$_X$ MANU$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	9.841** 5.187***	0.020 0.075
APPAREL$_X$ APPAREL$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	10.77* 0.005	0.001 0.941
ELECT$_X$ ELECT$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	0.971 0.602	0.324 0.438
FOOD$_X$ FOOD$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	7.297* 4.593	0.007 0.101
MOTOR$_X$ MOTOR$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	1.536 0.973	0.679 0.615
TEXTILE$_X$ TEXTILE$_{RW}$	$H_1^{'}(1\ 0)$ $H_1^{'}(1\ 0)$	3.403*** 0.000	0.065 0.988

Note: (*) (**) and (***) indicate that the corresponding coefficient is significant at 1%, 5% and 10% levels, respectively.

Table 4 reports the results of the weak exogenity tests. The H0 null hypothesis, weak exogeneity is rejected only for five variables. These results indicate that only exports and wages of manufacturing, exports of manufacture of wearing apparel, manufacture of food and exports of manufacture of textiles are found to be endogenous variables. These results also verify the analysis of cointegration vectors, where each sectoral export is accepted as a dependent variable.

On the other hand, in the long-run analysis, a weak exogeneity test is applied to examine whether the normalization of a cointegrated vector as a dependent variable is acceptable or not (Arslan and Yapraklı, 2008). Table 5 also indicates that all cointegration results, which are set by normalization constraint to wage equation, in other words, determined by real wages as dependent variables for textile, wearing apparel, food and manufacturing sectors are valid.

Table 5 | Long-run Relationship

Equations	t-statistics
MANU$_{rw}$ = 2.22 MANU$_x$	(-5.89)*
MANU$_x$ = - 6.77MANU$_{rw}$	(0.00)
APP$_{rw}$ = 9.85 APP$_x$	(-3.13)*
FOOD$_{rw}$ = 1.47FOOD$_x$	(-4.22)*
TEXILE$_{rw}$ = 8.17 TEXTILE$_x$	(-2.63)*

Note: (*) indicates the corresponding coefficient is significant at 1% level.

According to test results, the long-run relationship between exports of manufacture of wearing apparel, food, textiles and exports and wages of manufacturing are found statistically significant at the 1% significance level, where these variables are also found endogenous through weak exogeneity tests. The results also indicate that by applying normalization constraint to wage equation, namely, the cointegration result where real wages are regarded as a dependent variable is valid for manufacture of wearing apparel, food, textiles and total manufacturing sectors. While 1% increases in exports leads to increase the real wages by 9.8% in manufacture of wearing apparel and 8.1% in manufacture of textiles, 1% increases in exports increases real wages by 1.4% in manufacture of food and 2.2% in total manufacturing. In the long-run, the effect of exports on wages is greater in textiles than other sectors.

3.5 Error correction models and granger causality

After finding a cointegration relationship between a series in terms of the Johansen method and testing the weak exogeneity, a vector error correction model (VECM) which includes an error correction term (ECT) is employed (Engle and Granger, 1987; Cushin *et al.*, 2008; Gries, *et al.*, 2009).

Granger causality test results are sensitive to changes in the dependent variable lag. The lag lengths of the causality analysis are determined according to the AIC and the criterion suggesting different lag lengths for each analysis. VECM for Granger causality tests are given below

$$\Delta W_{MANUt} = \alpha_0 + \alpha_1 \Delta W_{MANUt-1} + \alpha_2 \Delta W_{MANUt-2} + \alpha_3 \Delta X_{MANUt} + \alpha_4 \Delta X_{MANUt-1} + \alpha_5 \Delta X_{MANUt-2} + \alpha_6 ECT_{1t-1} + \varepsilon_{1t}$$

(6)

$$\Delta X_{MANUt} = \beta_0 + \beta_1 \Delta X_{MANUt-1} + \beta_2 \Delta X_{MANUt-2} + \beta_3 \Delta W_{MANUt} + \beta_4 \Delta W_{MANUt-1} + \beta_5 \Delta W_{MANUt-2} + \beta_6 ECT_{1t-1} + \varepsilon_{1t}$$

(7)

$$\Delta W_{APPt} = \varphi_0 + \varphi_1 \Delta W_{APPt-1} + \varphi_2 \Delta W_{APPt-2} + \varphi_3 \Delta W_{APPt-3} + \varphi_4 \Delta W_{APPt-4} + \varphi_5 \Delta W_{APP\,t-5} + \varphi_6 \Delta W_{APPt-6} + \varphi_7 \Delta W_{APPt-7} + \varphi_8 \Delta X_{APPt} + \varphi_9 \Delta X_{APPt-1} + \varphi_{10} \Delta X_{APPt-2} + \varphi_{11} \Delta X_{APPt-3} + \varphi_{12} \Delta X_{APPt-4} + \varphi_{13} \Delta X_{APPt-5} + \varphi_{14} \Delta X_{APPt-6} + \varphi_{15} \Delta X_{APPt-7} + \varphi_{16} ECT_{2t-1} + \varepsilon_{2t}$$

(8)

$$\Delta W_{FOODt} = \delta_0 + \delta_1 \Delta W_{FOODt-1} + \delta_2 \Delta W_{FOODt-2} + \delta_3 \Delta W_{FOODt-3} + \delta_4 \Delta W_{FOODt-4} + \delta_5 \Delta X_{FOODt} + \delta_6 \Delta X_{FOODt-1} + \\ \delta_7 \Delta X_{FOODt-2} + \delta_8 \Delta X_{FOODt-3} + \delta_9 \Delta X_{FOODt-4} + \delta_{10} ECT_{3t-1} + \varepsilon_{3t}$$

(9)

$$\Delta W_{TEXt} = \gamma_0 + \gamma_1 \Delta W_{TEXt-1} + \gamma_2 \Delta W_{TEXt-2} + \gamma_3 \Delta W_{TEXt-3} + \lambda_4 \Delta W_{TEXt-4} + \gamma_5 \Delta W_{TEXt-5} + \gamma_6 \Delta X_{TEXt} + \gamma_7 \Delta X_{TEXt-1} + \\ \gamma_8 \Delta X_{TEXt-2} + \gamma_9 \Delta X_{TEXt-3} + \gamma_{10} \Delta X_{TEXt-4} + \gamma_{11} \Delta X_{TEXt-5} + \gamma_{12} ECT_{4t-1} + \varepsilon_{4t}$$

(10)

where X is the exports to the EU-15, W is the real wages, MANU is the manufacturing, APP is the manufacture of wearing apparel, FOOD is the manufacture of food and TEX is the manufacture of textiles.

If the joint of the coefficients of the independent variables is statistically significant, while the dependent variable W is given, the H0 null hypothesis: "independent variable (X) is not a Granger cause dependent variable (W)" will be rejected. This hypothesis is tested by using t-test for error correction terms and F-test by lagged values of explanatory variables.

The results of the short-run and long-run Granger causality test based on the VECM are given in Table 6.

Table 6 | Granger Causality Test

Variables	ECT$_{t-1}$ (t-statistics)	F statistics (prob)	RESULTS	
			Long-Run	Short-Run
MANU$_x$-MANU$_{RW}$	−0.024(−0.21)	0.05(0.830)	−	
MANU$_{RW}$-MANU$_x$	−0.823(−4.02)*	16.28(0.000)*	$MANU_{WR} \rightarrow MANU_x$	
APP$_x$-APP$_{RW}$	0.006(0.88)	24.73 (0.000)*	−	$APP_x \rightarrow APP_{rw}$
FOOD$_x$-FOOD$_{RW}$	−0.574(−1.92)***	11.48 (0.021)**	$FOOD_x \rightarrow FOOD_{rw}$	
TEX$_x$- TEX$_{RW}$	0.002(1.36)	4.42(0.490)	−	

Note: (*), (**) and (***) indicate that the corresponding coefficient is significant at 1%, 5%, and 10% levels, respectively.

Test results indicate that there is at least one short-run and long-run relationship between variables. As a result of the analysis, the null hypothesis of exports does not Granger cause wages is rejected only for manufacture of wearing apparel and manufacture of food. In the short run, a unidirectional causality relationship is found from exports to wages in labour intensive manufacture of wearing apparel and manufacture of food, with 1% and 5% the significance level, respectively. A unidirectional causality relationship is found from wages to exports in manufacturing with 1% significance level. Exports of wearing apparel and food sectors, where Turkey has factor abundant relative to the EU-15, affected wages. Wages affected exports only in total manufacturing sector.

4. Conclusion

The general literature describes analyses regarding the effect of the international trade on the wages without paying attention to the sectoral differences. In this study, the relationship between sectoral exports and real wages are tested by employing a time series unit root, the Johansen cointegration, weak exogeneity and Granger causality tests for the total manufacturing sector and Turkey's top 5 exported goods to the EU-15 for the period between 2005:01 and 2014:01. Johansen cointegration tests showed the existence of a long-run relationship for all sectors. However, due to the nonrejection of null hypothesis of weak exogeneity, the error correction model is estimated only for four variables which are generally labour and raw material intensive products. A positive long-run relationship between exports and real wages are found in manufacture of wearing apparel, food, textiles and exports and real wages of manufacturing. In the short-run, exports affected real wages in the manufacture of wearing apparel and food. As a result, a significant relationship is found between exports and real wages especially in the labour and raw intensive sectors of Turkish exports.

Although Turkey's export pattern is being more diversified and Turkey has been exporting capital and technology intensive products, such as manufacture of motor vehicles and electrical equipment, since the early 2000s, Turkey is a labour and raw material abundant developing country compared to the EU-15, and is still keeping its significant position in exports of labour intensive goods and raw materials. In 2013, although 22% of Turkish export to the EU-15 was manufacture of motor vehicle, 20% was manufacture of wearing apparel, 7% was manufacture of textile and 6% was manufacture of food. In this context, according to the analyses results, it can be said that the international trade between Turkey and the EU-15 validates to some extent the Stolper-Samuelson theorem. Cheap labour force is one of the most significant components of Turkish competitiveness with respect to the EU-15. However, a paradoxical result occurs, if Turkish wages increase through exports, it may loose its competitiveness in the EU-15 market. In this case, Turkish economy should transform its export pattern from cheap labour intensive goods to high technological intensive goods.

Foreign trade (free trade) increases the real income (real wages) of the abundant labour factors. Wages may increase through exports, because only productive firms are able to carry out export activities. Supplying products in foreign markets, conducting marketing activities as well as employing skilled labour are all cause an additional financial burden upon the companies, which can only be sustained by profitable and efficient companies. Moreover, competition among exporters in international markets is higher than in domestic markets, so firms are forced to be productive as much as they can. The companies which have the ambition to operate effectively and efficiently have capabilities to survive and increase their profits, in turn, they also pay higher wages than non-exporting firms. On the other hand, negative causality relationship from wages to exports in manufacturing sector mentions the importance of competitiveness in production cost. As it is stated in aforementioned literature when the production cost decreases, product price becomes lower. Then firms get the price advantage and increase their export performance in the short run. According to the results of the empirical analysis, there is a reciprocal relationship between wages and export performance. While exports cause an increase in wages in labour intensive sectors in the long run, a decrease in wage level in manufacturing sector supports export performance

in the short run. In addition to that the determination of wages may also depend more on the general macroeconomic conditions like growth level, efficiency *etc.* for corporatist countries. Moreover, market structure, legal regulations and labor market conditions are important variables in determination of the equilibrium wage level. In this context, any change in an exogenous variable may affect both wages and export performance together. For this reason, the factors affecting wage level other than export performance will be examined in a future study.

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