(REFEREED RESEARCH)

DETERMINANTS OF TURKEY'S TEXTILES EXPORTATION: THE GRAVITATION MODEL APPROACH

TÜRKİYE'NİN TEKSTİL ÜRÜNLERİ İHRACATININ BELİRLİYİCİLERİ: ÇEKİM MODELİ YAKLAŞIMI

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ABSTRACT

In this study, factors that affect Turkey's textile exportation have been analyzed. Data that include the years from2007 to 2012 in regard to142 countries to which Turkey exports textiles have been used. The factors that affect textile exportation have been examined through panel data and quantile regression analyses. The explanatory variables, GDP per capita, population, distance, real exchange rate, and the beliefs of countries with EU membership to which Turkey has exported textiles have been explored. In the results of the analysis, an exportation stimulant effect has been demonstrated between population growth and an increase in demand. An increase that occurs in Turkey's real exchange rate is estimated to be a development that benefits its textile exportation. In addition, decreasing the tariffs that affect world trade negatively towards textile products customs tariffs and quotas decrease Turkey's competitive power, contrary to expectations.

Key Words: Textile exportation, Panel data, Quantile regression, Real exchange rate, Gravity.

ÖZET

Bu çalışma, Türkiye'nin Tekstil ihracatını etkileyen faktörler analiz edilmiştir. Türkiye'nin tekstil ürünleri ihracatını gerçekleştirdiği 142 ülkeye ilişkin 2007-2012 yıllarını kapsayan veriler kullanılmış. Tekstil ihracatını etkileyen faktörler, panel veri ve kantil regresyon analizleri yardımıyla incelenmiştir. Açıklayıcı değişkenler, kişi başına düşen GSYİH, nüfus, mesafe, reel döviz kuru, AB üyeliği ile ihracat yapılan ülkelerin inançları kullanılmıştır. Analiz sonucunda, nüfus büyüklüğü ile talep artışı arasında, ihracatı uyarıcı bir etkiye sahip olduğu analiz sonucunda elde edilmiştir. Türkiye'nin reel döviz kurunda gerçekleşecek bir artışın, tekstil ihracatı lehine gelişeceği tahmin edilmektedir. Ayrıca, Tekstil ürünleri gümrük tarifeleri ile kotalara yönelik dünya ticaretini olumsuz yönde etkileyen tarifelerin azaltılması beklenenin aksine Türkiye'nin rekabet gücünü azaltmaktadır.

Anahtar Kelimeler: Tekstil İhracatı, Panel Veri, Kantil Regresyon, Reel Döviz Kuru, Gravitiy.

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1. INTRODUCTION

The employment gained in the textile industry is an aspect of the industry that has an important role in the economic recovery process of both developed and developing countries in terms of exportation revenues, with the added value made in the production phase. However, due to the raising of quotas and deregulations in the industry, the sector faces a fast and challenging change process.

As of 2013, 7.8% of total export revenues (1) have been materialized by this sector. Because of Turkey's geographical location, it has an advantageous position in textile-product exportation compared with numerous other countries worldwide.

In spite of all its limitations, the global textile trade shows a much greater increase than global textile production. In the period from 1980 to 1999, as world textile production increased only 16%, textile trade increased 166%. The textile production and trade of developing countries increased faster than that of developed countries. The most important reason for this is that the production of labor-intensive textiles and the confection production moved to countries with low labor costs. In addition, as a result of the development of inter-country regional cooperation, intra-regional trade is gradually gaining more importance (2).

Turkey has enjoyed an important place in the worldwide textile sector since the 1990s; it was 11th among countries

that had the most exportation in the textile sector's foreign trade in 2005 worldwide and rose to 9th place in 2012 (3).

Furthermore, when the world textile sector is examined, its share in total industrial production trade for 2012 wasapproximately1.55 to 1.62%. In addition, the share of the textile sector in Turkey's total industrial production exportation has been around 7.25% and in exportation, it has been approximately2.72% (Table 2). Therefore, it can be noted that the textile sector in Turkey's economy has much more importance than the worldwide average for countries. For the first six months of 2013, the countries for which Turkey produced the most textiles and to which it exported raw materials include the Russian Federation, Italy, Germany, Romania, the USA, the UK, Bulgaria, Poland, Ukraine, Egypt, and Spain (4).

Generally, multiple analysis methods are used to analyze foreign trade currents. The studies among the first examples of those (5,6) could be mentioned about the models that start with the studies towards economic source transfer to a third country or to another association. In some studies (7–10), formal analysis of international trade has been performed using the section data. However, the most-common studies (10–15) are those where agricultural currents in international trade have been examined using the panel data analysis method. In addition, there are numerous studies (16–18) that examine the effect of trade currents on country and regional integration through computable general balance models.

In this study, the factors that affect Turkey's export of textile products have been studied with analyses by creating a conjugation model in the quantile regression model with panel data analysis. The conjugation models have proved themselves to be useful tools to explain trade, and they are being implemented intensely on panel data in various trade studies currently (8,15).In the results of this study, the factors that determine Turkey's textile exportation are expected to help us understand by putting it forth on the panel data analysis and with the quantile regression analysis that ignores some of the problems experienced with panel data analysis.

2. MATERIAL AND METHODS

In the study, an exportation model has been presented using the total textile export data collected by Turkey from2007 to 2012. The data regarding textile products is taken from the TÜİK foreign trade (ISIC Rev.4) database as US dollars in millions (1). The export data that is in USD in millions is from the Foreign Trade Index, in which the export data reference period was the year 2005.

The variables of GNP per capita for the years from2007 to 2012 regarding the 142 countries to which Turkey exports textiles and the population data (19), Turkey's real exchange current parity (20),and the distance between the importer country and Turkey (the distance between the capitals in km) has been used (21):

Table 1. World Textile Products Exportation in 2012

	Milyon $	**%**
World	285668.24	100.00
China	95450.16	33.41
India	15273.94	5.35
Germany	14438.44	5.05
USA	13485.32	4.72
Italy	13153.05	4.60
South Korea	11969.79	4.19
Turkey	11054.29	3.87
Hong-Kong	10545.95	3.69
Taiwan	10292.64	3.60

Source: WTO 2014.

Table 2. The Share of the Total Industrial Production Trade of Turkey and the World Textile Trade (%)

	World		Turkey	
	Export	Import	Export	Import
2008	1.54	1.59	7.12	2.80
2009	1.68	1.75	7.56	3.35
2010	1.65	1.72	7.87	3.52
2011	1.61	1.69	7.99	3.14
2012	1.55	1.62	7.25	2.72

Source: WTO 2014.

$$LnE_{it} = \alpha + \beta_1 LnY_{it} + \beta_2 LnP_{it} + \beta_3 LnDIS_i + \beta_4 LnRD_T + D_{EU} + D_{ri} + D_{cus} + \varepsilon_{it}$$

The E_{it} variable expresses textile product exportation based on the year 2005 deflated from Turkey to the *i* country; Y_{it} expresses the GNP per capita of the *i* exporter country in the year *t; P* expresses the population of the *i* importer countries in the year; DIS_i expresses the geographical distance from Turkey to the *i* country; and RD_T expresses Turkey's (T) real exchange rate parity ($).

The dummy variables used in the analysis are respectively as: D_{EU}, the dummy variable of the textile products exported to a country that is a member of the European Union is 1;not being a member is 0; D_{rl}, the dummy variable of the textile product exported to a Muslim country is 1;to a non-Muslim country it is 0; and D_{cus} the dummy variable of the custom tariff towards the textile products of countries being bigger than the 6.6% rate made by the European Union is 1, being smaller is 0.

In the literature, the distance variable that affects foreign trade and shows transportation expenses is being defined as a DIS_i gravity model. The gravity model also allows spatial elements to be included in the bilateral trade flow analysis. The gravity model in which Tinbergen (5) and Pöyhönen (6) made the econometric application for the first time and that Linnemann (22) used in the analysis of the international trade currents by adding other explanatory variables being placed in theoretical foundations was developed afterwards by Anderson (23) and Bergstrand (7). The gravity model is in the style of Newton's Universal Law of Gravitation adapted to bilateral trade relations. It has been estimated that, for countries that have geographic proximity, the costs related to transportation for foreign trade and other expenses are lower than other countries, and that there is a retrograded relationship between exportation and distance. For this reason, with the estimation results of the $DIS_{ivariable}$, negative values are expected.

The relationship between exportation and the exchange rate has been prevailed on frequently in foreign trade models. The changes that have occurred in textile exportation and the real exchange rate have been examined using the RD_T variable. The uncertainties that arise depending on the exchange rate fluctuations have been affecting countries 'foreign trade levels in different ways. While the results of some studies show exchange rate uncertainty, affecting foreign trade negatively (24,25), the results of others show that the effects are positive (26,27). In addition, results with no effects or mixed effects have been seen (28,29).

Usually, horizontal section data has been used in gravity models. However, on the horizontal section estimation, there is a risk of choosing a non-representative year, and it is not possible to follow the individual effects that are unique to a particular country. For this reason, the panel data usage in studies of recent years is a frequently used method (30).

The panel data makes it possible to follow the individual effects that cannot be observed among the commercial partners and avoids the risk of choosing a non-representative year. There are two methods for estimating the individual effects that cannot be observed on the panel data: the fixed effects model (FEM) and the random effects model (REM). On the panel data study, the Hausman specification test is being consulted with the purpose of deciding which one will be used among the fixed effects or random effects models. In the Hausman test, it has been questioned whether there is a meaningful correlation between non-observed personal random effects and explanatory variables or not. If there is a correlation of this kind, the random effects model will not be suitable for the estimation, and thus the fixed effects model might be chosen (31).

It should be noted that the FEM contains large-sized parameters and causes a loss in the degree of independence frequently and, in addition, causes a multicollinearity problem. Another disadvantage is that variables that do not change overtime cannot be identified and discarded from the equation (32). The random effects model does not have those problems. Due to the change through the panels, it has the advantage of allowing the variables that do not change over time to be included among the descriptive variables (33).

On estimating the random effects model, three estimators are used that come from the Swamy-Arora (34), the Wallace-Hussain(35), and the Wansbeek-Kapteynmodels (36). Swamy-Arora uses the residual gained from the internal and gap regressions. Wansbeek-Kapteyn and Wallace-Hussain benefit from the residuals of internal (fixed effects) and least squares regressions. As the estimators of Swamy-Arora and Wansbeek-Kapteyn are based on the internal regression, they are incapable of estimating the variables that do not change overtime (15).In this study, for estimating the model, the estimator taken from Wallace-Hussain had been beneficial as there are variables that do not change overtime, such as distance, real exchange rate, and membership in the European Union in the basic gravity model used in the panel data analysis.

The estimator of Wallace-Hussain realizes the transformation of variables using the residuals of the least squares method (LSM) as shown below (15):

The residual of the least squares method is shown as the term *u. N* indicates the number of countries and *T* indicates the time. As the *W* matrix contains personal deviation, the *B* matrix shows the averages regarding each section unit.

$$Y^* = \sigma_2\Omega^{-1/2}Y \quad and \quad X^* = \sigma_2\Omega^{-1/2}X$$

$$\sigma_2\Omega^{-1/2} = W + \left(\frac{\sigma_2}{\sigma_1}\right)B, \qquad \sigma_1^2 = \frac{u'Bu}{trace(B)}, \qquad \sigma_2^2 = \frac{u'Wu}{trace(W)},$$

$$B = I_N \otimes J_T, \qquad W = I_{NT} - B, \qquad J_T = \frac{J_t}{\square}$$

In general, the total of the error squares has been minimized in the LSM method. The minimization of different values instead of the error squares is also in question. In this situation, different regression models are being used as alternative regression models. One of these methods is quantile regression (37).

The quantile regression is the generalized state of the median regression for the determined quantiles. Those regression models are more sensitive to extreme values and inclinations than the least squares method (LSM). Quantile regression first indicated a robust regression technique that ignores the hypothesis of normal distribution of the error terms (38). As the traditional regression model struggles to explain the changes in the conditional average of the variable, quantile regression explains the changes in the quantiles. It is more flexible according to the traditional regression with this method, and different quantiles can be used according to the qualifications of the research. As the distribution of dependent variables provides important information regarding how it was affected by the independent variables, it has wide usage in the social sciences (39).

The quantile regression model is actually a placement model. When the simple placing model is expressed as,

$$Y_i = Xi\beta_\theta + \varepsilon_{\theta i} \quad (1)$$

Y_i that takes place here is an independent, identical dependent, accidental variable with the β median. This situation can be expressed as:

$$\theta\left(Y_i \middle| X_i\right) = X_i\beta_\theta \quad (2)$$

The θ^{th} simple quantile in this model,

has been gained with the minimization of the expression (40).

The quantile regression covariances are in a structure that shows distribution with different forms of asymptotic covariance matrices that depend on asymptotic normal model assumptions (38). Calculating the coefficient covariance matrix plays an important part in the quantile regression analysis.

In the quantile regression, in order to avoid inefficient estimations in calculating the covariance matrix, preload techniques have been used. Among these, the bootstrap method has been used quite frequently. In cases when the error terms and assumptions made regarding the independent variables do not happen, the bootstrap method is used to correct an operation. This method, also known as bootstrapping, was developed for the purpose of obtaining smaller estimation errors and decreasing the standard deviations, there by obtaining more-trustworthy parameter estimators and constituting confidence intervals (41). The bootstrap method has been calculated three different ways according to the asymptotic matrix of $\hat{\beta}_\theta$ .Those are the residual bootstrap, the design bootstrap method (XY pair), and the Markov Chain Marginal Bootstrap (MCMB or MSMB-A) methods.

In this study, the quantile regression model has been calculated using the bootstrap MCMB method. The most important disadvantage of the residual and design bootstrap (XY pair) is that each bootstrap-reproducing operation for relatively multidimensional linear programming problem estimation needs an intense calculation (42). In addition to this, it increases the calculation load and consistency of the bootstrap MCMB method used in the multidimensional solutions (43).

The natural logarithm of each variable except the dummy variable has been taken. The values of some years on some countries in the exportation series are shown as “0” in the databank we use. That is in order to make the estimation; to resolve the problem that arises from the missing values, the formulation of the exportation values logarithm *ln* (X+1) has been used. According to this, if X = 0, that is, when we do not have the exportation value, *ln* (0+1) = 0 has been taken into consideration. In this way, both the observations that belong to the exportation as zero have been taken into account, and the estimation results of this have been provided not to be affected seriously.

The whole of the panel data and the quantile regression analyses have been performed using the Eviews 7.1 software package.

3. RESULTS

The results regarding the two different models created by taking the gravity model as a base are shown below. The first model is the quantile regression model, calculated using the bootstrap method; the second model is Turkey’s textile exportation random effect model, using the Wallace-Hussain (WAHU) estimator.

The bootstrap method was performed as a model analysis with 500 iterations and 100 percent repetition. The random generator was obtained with the Knuth (44) algorithm. Before the estimation of the model, the Wald Test was used to measure whether it was symmetrical or not.

When the quantile regression results regarding Turkey’s textile exportation were examined (Table 3), the H1 hypothesis of the Wald test that indicates whether the model is symmetrical or not was accepted. In this situation, quantile regression giving more-robust estimations according to the LSM estimations is accepted by multiple researchers (37).

The test results of the Quasi LR goodness of fit scale of the Q_2 Median Model were calculated as 1592.0380 (Table 4). As this value is $p<0.01$, the model is understood as meaningful. In the result for the model, when the Pseudo R^2value is examined, the statement level of the independent variables of Turkey’s textile exportation have been calculated as 53.27%. This value also shows the distinctness of Q_2quantile among other quantiles.

$$min_{\beta\in R}k\left\{\sum_{i:Y_i>X_{i\beta}}\theta\left|Yi-Xi\beta_\theta\right| + \sum_{i:Y_i<X_{i\beta}}(1-\theta)\left|Yi-Xi\beta_\theta\right|\right\} \quad (3)$$

Table3: The Wald Test Results for Symmetry

Test Summary	Chi-Sq. Statistic		Chi-Sq. d.f.	Prob.
Wald Test	5475.552		1	0.0000
Restriction Detail: b(tau) + b(1-tau) - 2*b(.5) = 0				
Quantiles	Variable	Restr. Value	Std. Error	Prob.
0.25, 0.75	C	7.965976	0.107653	0.0000

* own calculations

When the coefficients of the variables that take place in the models are examined (Table 3), all of the variables are found statistically meaningful according to the quantile regression model panel data analysis. On the WAHU panel data analysis, whether the country to which textiles are exported is a member of the European Union or not is calculated as statistically insignificant. According to the quantile Regression model, however, the mentioned variable is negative directional and statistically significant. According to this, a country's being a member of EU increases the textile exportation to that country at the rate of 53.43% (i.e.,$[e^{0.4281}-1] \times 100=53.43$).

The custom tariff that the EU applies to textile products is lower than that of 71 countries ("EU 6.6 % < World %") (3). Thus, Turkey's production expenses, which are higher than other important textile producer countries, create an advantage for those producer countries to enter the EU market.

Y_{it} as the estimated coefficient is calculated as positive marked in both models. An increase of 1% in the gross national product of the countries to which Turkey exports textiles is calculated to cause an export increase of 0.9133% according to the first model and of 0.5447% according to the second model.

The other coefficients or statistics are insignificant.

With an increase in the populations of textile-exporting countries, a positive, meaningful, and proximate result was obtained for both models. The distance variable DIS_i that shows transportation expense had a negative value as expressed by multiple researchers in literature. It has been observed that there is an inverse relationship between the geographical distances and Turkey's textile exporting. When the effect of real exchange rate on textile exportation has been examined, a real exchange rate increase of 1% is calculated to cause an exportation decrease of 0.6279% WAHU or 1.7436%, according to the quantile regression. The fluctuations that occur in the real exchange rate can be said to affect textile exportation negatively.

One of the socio cultural variables is whether the country is a Muslim country. When the dummy variables related to whether the countries approached in the model are Muslim or not were examined one by one, it was found that when the importer country was Muslim, exportation increased with a ratio of 134.32% (i.e.,$[e^{0.8515}-1] \times 100=134.32$), according to the quantile regression, and with a ratio of 252.08%, according to the WAHU model. Turkey's close proximity to the Middle Eastern countries and those countries low custom tariffs are considered reasons for increased exportation.

The decrease of 1% on the textile products custom tariff in the discussed country is calculated to have a negative and significant effect in both models. With this result, it has been concluded that the liberalization of the world textile trade is disadvantageous for Turkey.

Table4: The estimation results regarding the Textile Exportation Gravity models

	Method			
	Bootstrap (Q_2 Median)		WAHU	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
α	7.0008	(0.0767)*	14.6519	(5.1631)*
LnY_{it}	0.9133	(0.0052)*	0.5447	(0.0785)*
LnP_{it}	1.0936	(0.0063)*	1.0600	(0.0852)*
$LnDIS_i$	-1.7107	(0.0098)*	-1.5455	(0.2009)*
$LnRD_T$	-0.6279	(0.0138)*	-1.7436	(0.9818)**
D_{EU}	-0.4281	(0.0821)*	0.4638	(0.4760)
D_{ri}	0.8515	(0.0624)*	1.2587	(0.3624)*
D_{cus}	-0.2028	(0.0972)**	-1.1157	(0.3643)*
Pseudo R-squared	0.5327		R-squared	0.3303
Adjusted R-squared	0.5288		0.3247	
S.E. of regression	1.8551		1.0226	
F-statistic	21.6437*		59.4663*	
Quasi-LR statistic	1592.0380*			

* Coefficients or statistics are significant at α = 0.05 level of significance.
** Coefficients or statistics are significant at α = 0.01 level of significance.

4. DISCUSSION

In this study, the main determinants that affect Turkey's textile exportation have been examined. In accordance with the target of this study, econometric estimations were made using two different models with a gravity model.

In general, similar estimation results were found in both models. According to the WAHU panel data analysis of the quantile regression calculated with the bootstrap method, more consistent results were gained.

The population that will occur in the importer countries and the GNP increase per capita have been observed to be important determinants of textile exportation. In the result of the analysis, it was observed that there is a stimulatory effect between population growth and increase in demand. On the other hand, as expected, a negative effect was observed regarding the distance between Turkey and the countries where the textile trade is performed. Long distances for exportation affect transportation expenses negatively. In addition, bilateral agreements between nations that are close to each other and can communicate more easily, result in similar beliefs on factors such as textile trade increasing between neighboring countries..

In addition, an increase that occurs in Turkey's real exchange rate is estimated to benefit countries that have cheaper textile production. Similar results were obtained in the study by Hatirli et al. (45) on the textile sector. They found that exchange expenses are relatively higher than exchange revenues, and that this situation has caused an important block in exportation lately. For this reason, providing rate stability and having precautions towards decreasing production expenses will increase the power of textile exporters in the international markets.

On reaching a higher market share of strong economic and social bonds with the EU, being more advantageous for EU markets than opponent countries are can be mentioned. However, according to the bootstrap quantile regression model analysis results, textile exportation to EU countries is determined to be affected negatively. When the target market was examined, it was considered that Turkey's raw material and the labor-force expenses compared to other textile producers are higher. Although Turkey has transportation advantage in regard to the EU, strategies for decreasing the expenses related to textile production should be examined and analyzed. Otherwise, a decrease in Turkey's share of the EU market, which is an important market, is inevitable. Taking measures to improve production quality is required for Turkey's foreign trade volume with the EU. These measures will increase brand value products with high added value.

It had been found that the dummy variable, especially used towards the beliefs, affects the textile exportation positively. In the results of the analysis, it has been considered that increasing market research towards Muslim countries and developing the proper strategies will increase Turkey's textile exportation.

Decreasing tariffs that negatively affect world trade towards the custom tariffs and quotas of textile products have been decreasing Turkey's competitiveness contrary to expectations. For this reason, the WTO agreements should be examined carefully and necessary precautions should be taken in a timely manner.

With those discussed models, the main factors that affect textile exportation collectively have been examined. Suitable marketing strategies can be developed in future studies using this study. In the future, through this model, the effect of other variables such as external protection measures should also be investigated.

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