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AN EMPIRICAL STUDY ON FACTORS AFFECTING INTRA-INDUSTRY TRADE WITH SOME SELECTED COUNTRIES IN TURKISH MANUFACTURING INDUSTRY

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Abstract: The aim of this study is to analyze the factors affecting intra-industry trade in Turkey's manufacturing industry. To measure intra-industry trade in Turkey's manufacturing industry with 29 countries Grubel Lloyd index is used in the study. The factors affecting intra-industry trade in the period of 1998-2017 are analyzed by panel data method. Country and policy-based determinants of intra-industry trade are dealt with development level, development level differences, market size, market size differences, outward-openness ratio, outward-openness ratio differences, geographical distance, and participation in economic integration. The results obtained from the established models are that the level of development, market size and participation in the customs union has a positive effect on intra-industry trade while the geographical distance is negative. It also concluded that Turkey's intra-industry trade between the EU member countries has the high rates.

Keywords: Intra-industry Trade, Manufacturing Industry, Grubel Lloyd Index, Panel Data Analysis.

1 INTRODUCTION

While traditional foreign trade theories explain the inter-industry trade between developed and less developed countries, new foreign trade theories have tended to explain intra-industry trade (IIT) between developed countries. While factor endowment theory deals with inter-industry trade in agricultural products, raw materials, and labor-intensive industrial goods, new foreign trade theories have focused on explaining intra-industry trade of capital and technology-based industrial goods. Intra-industry trade is a concept that emerged as a result of studies investigating the effects of economic unions such as the European Economic Community on foreign trade in the 1960s. Intra-industry trade is defined as the simultaneous export and import of similar goods produced in the same industrial sector by Grubel Lloyd.

In intra-industry trade literature, It is also used as intra-industry foreign trade, two-way trade, horizontal trade, mutual traction, two-way trade in similar products, trade overlap.

Empirical studies related to Turkey in the study and the results will be analyzed. Turkey's intra-industry trade is calculated using the standard Grubel-Lloyd Index. Later, these calculations were used in panel data analysis.

His study is aimed at modeling the determinants of Turkey's intra-industry trade. Using this modeling, Turkey's intra-industry trade with selected 29 of the country has been analyzed for the period of 1998-2017.

In the study, the literature on the subject was first reviewed.

Then the method to be used in the study was determined. Then, the methods used were explained. In the conclusion part of the study, analysis results regarding the factors determining intra-industry trade are included. According to the results, the study was finalized with some policy recommendations and evaluations.

2 LITERATURE REVIEW

In recent years, many studies have been conducted on measuring intra-industry trade. Some of these studies are summarized below. An essential feature of the study put forward by the Schüller (1995) is that it is the first example of Turkey's intra-industry trade. In the study made a comparison of Turkey's intra-industry trade with Spain, it has been drawn attention that Turkey's intra-industry trade increases year by year, but Spain's intra-industry trade increases more than Turkey. In the study, the difference between the two countries is due to the low level of industrialization in Turkey. In addition, during the period covered in the study, Spain's intra-industry trade level of European Community countries was high; the value of Turkey's intra-industry trade with the European Community is observed to be approximately level with other countries. As a result, it is understood that participation in economic integration has a significant effect on intra-industry trade.

In the study by Erk and Tekgül (2001) examining the foreign trade between Turkey and EU countries, intra-industry trade ratios in product group with 3 digit level of SITC between the years 1993-1998 are analyzed by Grubel Lloyd Index Calculation method. In the study, it has been determined that the intra-industry trade of Turkey with Greece and Portugal is more than other member states. This situation is explained by similarities in the geographical structure, the export products, and the income of the countries.

Gönel (2001a), in his study, the foreign trade of Turkey with the EU and Central Asian Turkish Republics in the years 1992 to 1997 has analyzed by the Grubel Lloyd Index Calculation method. It is observed that Turkey’s intra-industry trade with the EU increases during the period examined. It is concluded that the trade with the Central Asian Turkic Republics is in an increasing trend but has a lower share compared to the EU countries.

In another study conducted by Gönel (2001b), Turkey's intra-industry trade in the textile sector in 1990-1997 is analyzed using the Grubel Lloyd Index Calculation method. In the study on the basis of sector and the country, it has been reached the conclusion that while Turkey's intra-industry trade in the textile sector increases in the years 1990, the industrial performance calculated according to marginal intra-industry trade value in the sub-sectors of the textile has a downward trend. In the study, it is emphasized that the comparative advantage of the sector is gradually decreasing as a result of liberal foreign trade policies.

Çepni and Köse (2003) present Turkey's foreign trade data in the two-digit level product group of SITC Rev. 3 with the EU and some selected OECD countries for the 1988-1998 period were calculated by Grubel Lloyd Index and analyzed by panel data method. It has been understood from the study that the EU countries have the largest share in Turkey's intra-industry trade. The most critical factors affecting intra-industry trade are the per capita income, trade barriers, and geographical distances of the countries.

Emirhan (2005), in his work dealing with Turkey's foreign trade with the EU and with selected countries, analyzes data from 1989-

2002 periods in a 3-digit level product group of SITC Rev. 3 with panel data method. It appears in the study that Turkey's ratio of the intra-industry trade with EU countries is more significant than in other countries.

It is noteworthy that the intra-industry trade rate with EU member countries has an increasing trend over the years. It is also stated that the determinants of horizontal and vertical intra-industry trade are different. It is concluded that while industry-based variables affect horizontal intra-industry trade, country-based variables have a more significant effect on vertical intra-industry trade and a more limited effect on horizontal intra-industry trade.

Kaya and Atış (2007), in their work dealing with Turkey's foreign trade with the EU and with selected countries, analyzes data from 1990-2005 periods in a 5-digit level product group of SITC Rev.3 with Grubel- Lloyd Index Calculation method. The study states that the intra-industry trade ratio is at the low level, and Turkey's foreign trade in chemical industry products shows intra-industry characteristics.

Gürel and Yalçın (2018), in their work dealing with Turkey's foreign trade with the Black Sea Economic Cooperation (BSEC) countries, analyzes data from 1992-2017 periods in a one-digit level product group of SITC Rev.3 with Grubel- Lloyd Index Calculation method. The study shows that the BSEC countries that the highest average rate of intra-industry trade with Turkey, respectively, are Romania, Bulgaria, and Greece.

In contrast, the countries with the lowest intra-industry trade rate are Armenia, Albania, and Azerbaijan. Countries with a high intra-industry trade rate are also EU member countries, so it is stated that being a member of the customs union has a positive effect on intra-industry trade. It is stated that the low rate of intra-industry trade is due to the political characteristics, management styles, and policies of countries.

3 THE METHOD

Product definitions related to IIT are determined according to the United Nations Statistics Division (UNSD). Export and import data of product groups in SITC 5-8 taken from TURKSTAT are calculated. Based on TURKSTAT data, data belonging to Belgium and Luxembourg are combined and included in the analysis. In the study, the standard Grubel-Lloyd index, which is the most preferred in IIT studies and is generally accepted in the literature, was used.

$$IIT=1-[|Xi-Mi| \ / \ (Xi+Mi)] \qquad (1)$$

The value that can be calculated as a percentage can also be expressed as 0 ≤EİT≤ 100.

If IIT = 0, it means that there is no intra-industry trade in the commodity group, that is, only exports or imports are made in that commodity group and that trade is inter-industry.

If IIT = 1, it means that the export and import values of the commodity group are close to each other and there is full intra-industry trade.

If IIT > 0.50, it is understood that intra-industry trade is high, and when IIT is <0.50, intra-industry trade is low. The tables used in the study are created according to these evaluations.

The stage of collecting data on variables is indicated among the most essential stages of econometric research. There are three types of analysis methods, namely cross-section, time series, and panel data series. The method to be used in practice is the panel data analysis method. Since panel data analysis includes more observations than other methods, it enables the analysis to be made more comprehensively and offers the researcher the opportunity to work with a more extensive data set. Besides, the problem of multi co linearity between explanatory variables is less in the panel data analysis method compared to other methods, and thus more effective econometric estimates can be obtained.

Panel data analysis is more advantageous than cross-section series and time series methods in the study of change dynamics in a certain time period. Models established with panel data analysis also allow quantitative and qualitative factors to be determined together on the same model (Şentürk, 2014).

3.1 Classical model- pooled least squares method

In the classical model, both constant and slope parameters are assumed to be constant concerning each other and time. With this assumption, the panel data model is expressed as follows.

$$Y_{it} = \beta_0 + \sum_{k=1}^{k} \beta_k X_{kit} + u_{it} \quad (2)$$

$$Y_{it} = \beta_0 + \sum_{k=1}^{n} \beta_k X_{kit} + u_{it} \; Y_{it} = X_{it}\beta + u_{it} i = 1, ..., N \; ; t = 1, ..., T \quad (3)$$

The term β in the equation includes the constant and slope parameters. In this case, the pooled least squares estimator for β is shown in the following equation (Tatoğlu, 2012):

$$\hat{\beta} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} X'_{it} X_{it} \right) \quad (4)$$

In the equation, i denominates the cross sectional unit; t is time; X_{it} the matrix of arguments; Y_{it},, the dependent variables vector; u_{it} is the error terms vector. In such models, the error term is assumed to have zero mean and normal distribution. For this reason, there is no unit or time effect in the pooled least squares method; Estimates are made with the assumption that the slope and constant parameters are constant. In addition, the general features of the method can be listed as follows;

- If there are no unit or time effects in the error term, the pooled least squares method is assumed to be the appropriate estimation method and gives consistent estimators,
- If there are unit or time effects in the error term, the error term in the method refers to the combined error showing the unit effects and time effect,
- If there are unit or time effects in the error term; pooled least squares estimators are considered consistent only if these effects are uncorrelated with the independent variables,
- If the error term is heteroskedastic, estimates can be made using the generalized least squares method, since effective estimators cannot be obtained. (Tatoğlu, 2012).

3.2 Fixed effects model

In this model, also known as the constant-coefficient model, changes in the units cause differences in the fixed coefficient. The fixed-effect model leads to the formation of an estimator called the fixed effect estimator. It is assumed that the differences in the units in the model can arise with the differences in the fixed term. Therefore, panel data analysis is estimated with the help of dummy variables. In the fixed-effect model, the arguments are assumed to be independent of the error term. Besides, while the slope parameters are the same in all cross-section units, the constant coefficient varies from unit to unit because the constant-coefficient contains a unit effect.

In order to explain the fixed effect model with dummy variable;

$$Y_{it} = \beta_{0it} + \beta_{1it}X_{1it} + \beta_{2it}X_{2it} + \beta_{3it}X_{3it} + ... + \beta_{kit}X_{kit} + u_{it} \quad (5)$$

The equation used for the fixed effect model is expressed as follows: β0it denominates the fixed effect containing unit effect; μi refers to unit effects, and uit refers error term.

While slope parameters do not change according to units and time, the fixed parameter varies according to units (Tatoğlu, 2012). If there is a relationship between the error term and the explanatory variables, the fixed-effects model is considered a suitable model since the estimators will be unbiased.

3.3 Random effects model

In panel data analysis, the fixed effects model is a model that is mostly used and has preferred features in terms of statistical properties. If more effective results are obtained when using the random effects model compared to the fixed effects model, the random effects model should be used. In this case, it is necessary to determine which of the two models is more effective.

In the Hausman test, rejection of the null hypothesis showing that the coefficients obtained from the random effects model and the coefficients obtained from the fixed effects model are the same, and the fact that the fixed effects model cannot be rejected shows that the random effects model gives more effective results.

4 MODELING OF COUNTRY POLICY-BASED DETERMINANTS OF TURKEY'S INTRA-INDUSTRY TRADE AND ANALYSIS RESULTS

In studies on the country-specific determinants of intra-industry trade, the market size and development levels of countries, whether the country is included in the economic integration process, and the geographical distance of the country with its trading partners are among the variables used in the analysis. These variables are expressed using indicator variables in empirical studies, and in many studies, the average income of trading partner countries is used to represent the market size, and the average per capita income of the trading partner countries is used to represent the development levels of the countries.

In this part of the study, Turkey’s intra-industry trade with the 20 countries with the most share in Turkish foreign trade and other selected countries for the 1998-2017 period were analyzed by the panel data method. Table 1 shows the expected effects within the scope of the definitions and hypotheses of the variables included in our empirical study, one of the determinants of intra-industry trade:

Table 1. Definitions Regarding the Variables Used in the Model

	Dependent Variable: IIT		
Independent variables	Definition of Variables	Expected Sign	Source of Data
KORT	The arithmetic average of Turkey's trading partner countries' per capita income is calculated.	+	World Bank
KFARK	It is calculated by a formula that included the absolute difference of Turkey's trading partner countries' per capita income.	-	World Bank
GORT	The arithmetic average of Turkey's trading partner countries' gross domestic product is calculated.	+	World Bank

	Dependent Variable: IIT		
Independent variables	Definition of Variables	Expected Sign	Source of Data
GFARK	It is calculated by a formula that included the absolute difference of Turkey's trading partner countries' gross domestic product.	-	World Bank
DA	It is calculated by the ratio of the foreign trade volume of the countries to their GDP.	+	World Bank
DAF	It is calculated by taking the absolute difference of Turkey's trading partner countries' openness ratio.	-	World Bank
CU	$CU=(GDP_P*DISTANCE_{TP})/ \sum GDP$	-	World Bank and https://www.google.com.tr/maps
GB	A dummy variable is assigned according to whether the countries are members of the EU customs union or not.	+	https://www.avrupa.info.tr/tr/etkilesimli-avrupa-haritasi-9

4.1 The implementation of empirical analyzes

In this part of the study, firstly, intra-industry trade of a total of 29 countries, 20 of which has the largest share in Turkish foreign trade according to TURKSTAT data and selected nine countries have been to be tested on the basis of country and policy-based hypotheses. A Panel data analysis method, which has a cross-section of 20 years, including 1998-2017 and 29 countries, is applied.

As a result of the analyzes made in the panel data analysis, it has been determined that the pooled least squares, fixed-effects model, and random effects model are used, which generally show the combination of the data. Therefore these models are discussed in the study. While testing intra-industry trade with the country and policy-based hypotheses, it is decided by applying the Hausman test whether the model will give appropriate results with a fixed effect or a random effect model. STATA, Statistics and Data Analysis, and Eviews programs are used in the analyzes. Table 2 includes pooled least squares (classical effects), fixed effects, and random effects model results. There are F test results to decide between the least-squares method and fixed effects, and Hausman test results to choose between fixed effects and random effects. In addition, LM test statistics are used to decide between random effects and pooled least squares.

F test was used to decide between fixed effects and pooled least squares (Classical model). The result requires the use of the fixed effects model (FE). As a result of the Hausman test, which is used to make a choice between Fixed Effects and Random Effects estimators, it is decided whether the unit and time effects are constant or random. The most important difference between fixed and random effects models is whether unit effects are correlated with independent variables.

Basic hypothesis; There is no correlation between explanatory variables and unit effect. For this reason, since both estimators are considered consistent, a small difference is expected between the fixed effects and random effects estimators, and the use of the random effects estimator is considered appropriate because it is more effective (Tatoğlu, 2013).

In addition, according to the test statistics and probability values expressed in the table, it is concluded that the random effects estimator is consistent.

Table 2. Test of Determinants of Intra-Industry Trade of Turkey with 29 Trading Partner's: Appropriate Model Selection

Independent Variables	**Dependent Variable: IIT**		
	Pooled Least Squares	Fixed Effects Model	Random Effects Model
KORT	0.0007 (0.062)	0.0005 (0.109)	0.0005 (0.001)
KFARK	-0.2404 (0.031)	-0.1894 (0.156)	-0.1787 (0.005)
GORT	2.53 (0.395)	1.38 (0.603)	1.66 (0.144)
GFARK	0.2255 (0.088)	0.2804 (0.135)	0.2669 (0.000)
DA	-0.3292 (0.043)	-0.0576 (0.682)	-0.0758 (0.208)
DAF	0.6438 (0.010)	0.041 (0.867)	0.0842 (0.383)
CU	-0.0050 (0.035)	-0.0025 (0.091)	-0.0032 (0.002)
GB	22.8600 (0.000)	9.4300 (0.116)	13.9682 (0.000)
CONSTANT	57.9563	53.1620	52.6694
F Test		18.8313 (0.000)	
$LM_{1\ Breusch\ pagan}$	810.8667 (0.000)		
$LM_{2\ Honda}$	19.5396 (0.000)		
$LM_{3\ King\ Wu}$	17.5381 (0.000)		
$LM_{5\ Standardized\ King\ Wu}$	14.2789 (0.000)		
Hausman Test			13.6313 (0.0919)
R^2	0.4123	0.7122	0.1833
F statistics	46.8436	34.7892	14.9882
Number of Observation	543		

Note: Test results in parentheses represent calculated probability values.

Different LM (Lagrange Multiplier) tests were applied, namely Breusch-Pagan, Honda, King Wu, Standardized Honda, and Standardized King Wu, in order to decide between pooled least squares (Classical effects) with the random effects model. LM tests are used to test the hypothesis that the variance of the random unit effects is zero with Lagrange multipliers, which are the residuals of pooled least squares. LM test statistics and probability values are given in the table, and it is concluded that it is more appropriate to use the random effects model among the estimators. In line with this information, it is considered appropriate to use the random effects model as a result of the estimations made for the selection of the appropriate model and the tests applied. In addition, the model included in the study is tested with the White test with robust estimators in order to test standard errors and correct any deviations. Robust estimators of random effects as a result of the White test are included in Table 3.

Table 3. Estimation Results of Random Effects Model with Corrected Standard Errors

Dependent Variable: IIT				
Independent Variables	Parameter	Standard Error	T- statistics	Probability
SABİT	52.6694	9.6495	5.4582	0.0000
KORT	0.0005	0.0003	1.7223	0.0856
KFARK	-0.1787	0.1143	-1.5636	0.1185
GORT	1.66	2.41	0.6896	0.4907
GFARK	0.2669	0.1601	1.6675	0.0960
DA	-0.0758	0.1244	-06093	0.5426
DAF	0.0842	0.2263	0.3720	0.7100
CU	-0.0003	0.0013	-2.4695	0.0138
GB	13.9682	4.9288	2.8339	0.0048
R^2	0.1833			
R^2	0.1711			
F statistics	14.9882			
Probability (for F-statistics)	0.0000			
Durbin-Watson	0.7512			
Number of Observation	543			

"Intra-industry trade increases if the development level of Turkey and its partners increase" KORT variable is both statistically significant and are also achieved in accordance with the theoretical expectations to the conclusion that in confirmation of the hypothesis due to the positive value.

"Intra-industry trade decreases if the deference of development level between Turkey and its partners increase." While the KFARK variable was compatible with the theoretical expectation, it was not statistically significant. In this case, it is understood that the variable does not affect intra-industry trade.

"Intra-industry trade decreases if the average market size of Turkey and its partners increase." While the GORT variable is not found to be statistically significant, it gives results in accordance with the theoretical expectation. In this case, it is understood that the variable does not affect intra-industry trade.

"Intra-industry trade decreases if the difference of the average market size between Turkey and its partners increase." While the GFARK variable is found to be statistically significant, it does not give results in line with theoretical expectations.

"Intra-industry trade increases if the openness ratio of Turkey and its partners increase." DA variable is not found to be statistically significant and does not meet the theoretical expectation, so it is concluded that it does not affect intra-industry trade.

"Intra-industry trade decreases if the difference of openness ratio between Turkey and its partners increase." The DAF variable is not found to be statistically significant and does not fit the theoretical expectation. Therefore, it is concluded that the values of the variable do not affect intra-industry trade.

"Intra-industry trade decreases if the geographical distance between Turkey and its partners increase." The CU variable is both statistically significant, and its sign is negative, in line with theoretical expectations. Therefore, it is concluded in the study that the values of this variable confirm the hypothesis. In accordance with the information in Table 4, it is possible to examine the random effects model's values and the hypotheses as a whole.

Table 4. Test of Determinants of Intra-Industry Trade of Turkey with 29 Trading Partner's

Independent Variable	**Dependent Variable: IIT**			
	Expectation		Result	
	Hypothesis	Expected Sign	Compliance with Expectations	Statistical Significance
KORT	Hypothesis 1 "Intra-industry trade increases if the development level of Turkey and its partners increase"	+	Consistent with the theory	The variable is statistically significant.
KFARK	Hypothesis 2 "Intra-industry trade decreases if the deference of development level between Turkey and its partners increases."	-	Consistent with the theory.	The variable is not statistically significant.
GORT	Hypothesis 3 "Intra-industry trade decreases if the average market size of Turkey and its partners increase."	+	Consistent with the theory.	The variable is not statistically significant.
GFARK	Hypothesis 4 "Intra-industry trade decreases if difference of the average market size between Turkey and its partners increase."	-	Inconsistent with the theory.	The variable is statistically significant.

Independent Variable	**Dependent Variable: IIT**			
	Expectation		Result	
	Hypothesis	Expected Sign	Compliance with Expectations	Statistical Significance
DA	Hypothesis 5 "Intra-industry trade increases if the openness ratio of Turkey and its partners increase."	+	Inconsistent with the theory.	The variable is not statistically significant.
DAF	Hypothesis 6 "Intra-industry trade decreases if difference openness ratio between Turkey and its partners increase."	-	Inconsistent with the theory.	The variable is not statistically significant.
CU	Hypothesis 7 "Intra-industry trade decreases if the geographical distance between Turkey and its partners increase."	-	Consistent with the theory.	The variable is statistically significant.
GB	Hypothesis 8 “Participation in economic integration increases intra-industry trade."	+	Consistent with the theory.	The variable is statistically significant.

5 CONCLUSION

"Participation in economic integration increases intra-industry trade." It is concluded that the GB variable is both statistically significant and positive for the theoretical expectation, thus confirming the hypothesis. While the determinants of intra-industry trade are tested with the help of hypotheses, the F test is applied between the pooled least squares (classical model) and the fixed effect model in the selection of the model to be used in panel data analysis, and it is concluded that the fixed effect model is appropriate. In order to choose between the fixed effect and the random effects model, the random effects model is considered appropriate as a result of the Hausman test. In addition, as a result of the LM tests, it is considered appropriate to choose the random effects model. Random effects model is examined and White test is used to correct standard errors. Among the programs used in analysis, STATA (Statistics and Data Analysis) and E-views are preferred The analysis results confirm the following hypotheses. These results are consistent with some studies in the literature review.

- "Intra-industry trade increases if the development level of Turkey and its partners increase."
- "Intra-industry trade decreases if the average market size of Turkey and its partners increase."
- "Intra-industry trade decreases if the geographical distance between Turkey and its partners increase."
- "Participation in economic integration increases intra-industry trade."
- According to the results of the analysis, the following hypotheses are not statistically significant.
- "Intra-industry trade increases if the openness ratio of Turkey and its partners increase."
- "Intra-industry trade decreases if the difference of openness ratio between Turkey and its partners increase."

The results can be interpreted that these variables do not affect Turkey's intra-industry trade with the countries that are examined. Turkey should give importance to advanced technological goods with high value-added and should encourage exports. In order to increase production, a qualified workforce is also essential together with technological development. It is noteworthy that developed countries export more technology-based products in the manufacturing industry, as in other sectors. The primary reason for this may be its R&D expenditures and human capital investments. Therefore, to provide the necessary support to Turkey's R & D spending and investment in human capital is quite an important issue. The manufacturing industry is thought to be very useful in terms of technology transfer. However, it is not enough to increase technological development and R&D expenditures alone. It is also essential to create human capital to use innovations in the right direction and direct them to the right areas.

The efficient use of resources with increasing technological development, R&D, and human capital investments will increase production. Thus, our intra-industry trade will tend to increase in products that require high technology and high value-added. This situation will allow our competitive power to increase in foreign trade.

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