

Estimation of International Trade

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Abstract

The study analyzed foreign trade volume among Turkey and 37 OECD countries, especially the sway of the logistics performance index on Turkey's foreign trade volume. In light of this, the effects of the logistic performance index in determining Turkey's foreign trade volume were analyzed by using the data of Turkey and OECD countries in the 2007-2020 period. In the study, three different models were established in which the total foreign trade volume, Turkey's exports to OECD countries, and Turkey's imports with OECD countries are dependent variables. The variables used in the models are the GDP of Turkey and OECD countries, R&D investments, population, logistics performance index, and distance between countries. Since the models have problems with autocorrelation, heteroskedasticity, and cross-section dependence, the Huber-Eicker-White estimator, which is robust to these problems, was used. When the results obtained were examined, it was concluded that the sign of the relationship between GDP and foreign trade volume of the countries in the model in which the foreign trade volume was the dependent variable was positive. The gravity model has main variables used in the studies. Among these, the variable that expresses the geographical distance between countries is among the most used. In the study, the direction of relationship with trade flows is negative. Turkey's logistics performance index positively and significantly affects foreign trade volume in the first two models. It has been observed that there is a positive relationship between the populations of OECD countries and Turkey's foreign trade volume, in line with expectations. When the study's primary purpose is evaluated, Turkey's logistics performance index has a positive and significant effect on foreign trade volume.

Keywords: Cross-section; gravity; logistic; OECD; volume.

INTRODUCTION

The main task of all economies in the world is to increase the welfare level of people. Economies try to balance between limited resources and endless human needs. The main inputs used for these needs are goods and services. In order to meet these needs, that is, to grow their economies and increase their welfare, countries either produce goods and services themselves and improve their welfare by consuming what they produce, or they try to increase their welfare level by purchasing them from other countries. The exchange of countries with each other to meet their needs is called "international trade". Another reason for international trade other than supply and demand imbalances is geographical conditions. A different important reason for international trade for countries is to make a profit. A country with lower technological infrastructure and less workforce may prefer to import that product instead of producing it. This is because importing this good is less costly than producing it.

International trade is one of the most important branches of economics. Dynamics in the field of international trade simultaneously affect economic activities. International trade has undergone significant developments and changes over time. Specific breaking points in history have affected all areas of life as well as the field of commerce. The liberalization in foreign trade, which came into effect in the 1980s, in other words, the ongoing economic and technological developments with globalization have created a competitive environment between countries on a global scale. Each country has made some efforts to increase its welfare and economic growth in a competitive environment.

The purpose of international trade is to meet the needs of all consumers by purchasing goods and services that are not available in the country or that have high cost or low quality and selling the goods and services that are surplus in the country to foreign countries. Today, all countries make foreign trade. Countries sometimes produce more than they need and export the over-produced goods by selling them to other countries. Countries import the missing goods from other countries if their production does not meet their needs. Because of each country's location and technological development, the products they can produce may differ. All consumers living in a country may have different tastes and

preferences. In addition, there are differences in the prices of manufactured goods from country to country. Therefore, it tries to meet consumers' demands by importing and exporting to other countries. For example, countries with fertile agricultural land or skilled labor can become exporters of the goods they produce by producing them cheaper. Countries that do not have these characteristics, on the other hand, import from other countries instead of bearing more costs and producing these products.

In the Turkish economy, the 1980s take place in the literature as the years of liberalization and foreign trade. In these years, Turkey abandoned import substitution policies and adopted an export-based economic policy model. This transition has also increased the importance of foreign trade policies economically. The economy's main target has been economic growth by increasing net exports. This period also created the understanding of growing relations in the economy and foreign policy. Improving relations has accelerated the foreign trade process of the Turkish economy. This situation has led Turkey to seek new markets or diversify the market.

The effect of the logistic performance on the foreign trade balance of the countries constitutes the one purpose of this research. Logistics performance in a competitive environment depends on which countries the companies will be located in. It significantly impacts decisions about which suppliers it will buy from and which markets it will enter. High logistics costs and a low level of logistics service constitute an obstacle to trade, foreign direct investments, and thus economic growth. For these reasons, improving logistics performance has become an important development policy goal. The World Bank developed the logistics performance index (LPI) to help countries develop logistics reform programs to increase their trade capability and competitiveness. Thanks to this index, countries find the opportunity to compare themselves with other countries in terms of international logistics activities, and they see the opportunities and obstacles in front of them.

The study analyzes trade flows between Turkey and OECD countries using the 'gravity model'. The gravity model is divided into three as 'basic gravity model', 'augmented gravity

model', and 'dynamic gravity model'. According to the basic gravity model, which states that the main factors explaining international trade are national income and geographical distance between countries, income is a factor that positively affects foreign trade flows since the volume of imports and exports is related to the economic size of a country. On the other hand, the distance between countries is seen as a factor that negatively affects foreign trade flows since it indicates the cost of transportation. On the other hand, the augmented gravity model has been developed over time by incorporating different parameters such as population size, common language, common border, and economic integrations onto the basic gravity model. It is frequently used in the literature because the gravity model is concise and straightforward, and the model's data can be easily accessed.

In this study, data for the period 2007-2020 and trade flows between Turkey and 37 OECD countries will be tested using panel data analysis with the help of the gravity model. In the study, the foreign trade volume between Turkey and OECD countries has been examined, and it has been analyzed whether the logistics performance index has created a change in Turkey's foreign trade volume. In the study, three different models were established in which the total foreign trade volume, Turkey's exports to OECD countries, and Turkey's imports to OECD countries are dependent variables. The variables used in the models are the gross domestic product of Turkey and OECD countries, R&D investments, population, logistics performance index, and distance between countries. Since the models have autocorrelation, heteroscedasticity, and cross-section dependency problems, the Huber-Eicker-White estimator, which is resistant to these problems, was used. When the literature studies related to the subject are examined in detail, it is seen that the gravity model is used extensively to analyze trade movements between countries. In this respect, it is expected to contribute to the existing literature by using the most up-to-date and wide-ranging data to determine the nature and determinants of trade flows between Turkey and OECD countries and their effects.

The study consists of four parts. In the first chapter, there is an introduction to the scopes that form the basis of the thesis. The introduction includes the concept of foreign trade, the

reasons for foreign trade, the logistics performance index, the general distinction of the gravity model, and Turkey's globalization process.

In the second part, the theoretical and empirical background of the gravity model is detailed. This section mentions the emergence, development and separation of the gravity model, the basic gravity model, augmented gravity model and dynamic gravity model structures. The model structure of the variables added to the gravity model, which has developed with various economic approaches, has been emphasized, and the primary studies based on these approaches have been mentioned. In addition, the methodology, indicators and rankings of OECD countries and Turkey, especially of the selected logistics performance index, are mentioned in the study. Finally, trade potential calculation and various literature studies based on Turkey and logistics performance are included.

In the third chapter, pooled least squares model, fixed-effects model and random-effects model, which are the basis of panel data analysis, are mentioned, and the Hausman test, F test and LM test are cited about which one to use. In addition, Huber, Eicker and White Estimator, which is resistant to autocorrelation, cross-section and heteroscedasticity problems and used as the estimator of the study, is included. Finally, data presentation, established models, descriptive statistics and analyzes are included in this section.

In the last section, the results and evaluations will be included. Besides the main variables evaluated within the scope of the gravity model, the trade flow between Turkey and OECD countries has been shaped based on the logistics performance index.

RESULTS

As a result, the resulting three gravity model equations were obtained in accordance with the signs of the main variables used by Tinbergen in the Gravity Model. The significant variables were added to the model, and the final results were obtained for the models expressed as the augmented gravity model. The gravity model can also analyze data based on goods or sectors. In this way, trade flows can be tested with more detailed

micro-analyses. Apart from the natural trade costs, researchers can easily integrate the trade policy tools that they want to see the effect of into the model and calculate the volume effect of these variables. Some gravity model studies can distinguish between potential-actual trade flows and estimate how far countries move away from potential trade with the model they define. In this way, a specific country can determine which countries they are in a trade loss or gain, thus differentiating policy proposals to promote or prevent the trade from country to country.

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DISCUSSION

The phenomenon of liberalization in the Turkish economy has brought about essential changes in foreign trade policies. The first step towards liberalization and foreign trade in the economy was the decision of January 24, 1980. As a result of the January 24, 1980 decisions, stabilization policies were aimed at making transformation and structural reforms in the Turkish economy. In line with these targets, export-based economic policies were targeted instead of import substitution policies. Thus, it was planned to achieve economic growth by increasing net exports to the economy. In addition, foreign trade has also created the need to improve relations with other countries economically and politically. With the increase in ties, Turkey has searched for new markets.

While international trade transactions consist of a limited number of goods and services, nowadays, with the emergence of new needs and technological development, global communication, and transportation opportunities have increased the scope and size of international trade transactions. International trade aims to provide goods and services that are not available in the domestic market or that are of high cost or low quality. However, foreign trade is available to increase the level of welfare by transferring the surplus goods and services in the domestic market to the foreign market. The purpose and development of international trade has gained an important place for all researchers. Studies in the literature on the determinants of international trade have begun. One of the most important reasons for this has been the gravity model.

The gravity model has long been useful for explaining bilateral trade flows. Its popularity has increased in recent years. One of the reasons for this popularity is that the data used in the gravity models are easily accessible and reliable. Another reason is that various authors have widely discussed and developed the theoretical assumptions of gravity models. The basic idea in the trade gravity model is that trade will increase as the economic capacity of the trading partners increases and the distance between the partners gets shorter. While the national income variable represents financial capacity, market size is represented by the population variable. An increase in national income has a positive effect on trade. On the other hand, population size can affect trade flows sometimes negatively and sometimes

positively. The large distance between the trading partners affects the trade negatively. This is because the distance variable represents transportation costs. The greater the distance, the higher the transport costs.

Gravity models include essential variables such as income, distance, and population, as well as some dummy variables such as regional trade agreements, common language, common border, and common currency. These dummy variables are factors that facilitate bilateral trading. Gravity patterns are usually estimated from cross-sectional data. However, there is a risk of selecting a year not represented in the cross-section estimate, and it is impossible to monitor individual country-specific effects. For this reason, the use of panel data has increased in recent years because panel data allows monitoring of individual unobserved effects and avoids the risk of choosing an unrepresented year.

The study's primary purpose is to analyze the foreign trade between Turkey and OECD countries with the gravity model, taking into account the logistics performance index criterion. For this purpose, the data of Turkey and 37 OECD countries between 2007-2020 were analyzed. Three different models were established in which the total foreign trade volume, Turkey's exports to OECD countries, and Turkey's imports with OECD countries are dependent variables. First, the descriptive statistics of the variables used in the study are included. Then, the LR test was used to choose between the pooled OLS model and the random-fixed effects or two-way model. According to the test results, the H_0 hypothesis was rejected in all three models; the fixed-random effect or two-way effects model will be used. Then, the Breusch Pagan LM Test was used to choose between the random effects model or the pooled OLS model, and according to the result, the H_0 hypothesis was rejected in all three models; that is, the random-effects model was found suitable. Then the Hausman test was applied, which allows us to choose between the fixed effects and random effects model. Since the distance variable is constant with respect to time, it drops out of the fixed-effect model. From this point of view, the random-effects model will be used since the Hausman test also allows the random-effects model. It is essential to investigate the problems of autocorrelation, cross-section dependence, and heteroscedasticity, which are the causes of unreliability in estimations in econometric models. For this purpose,

heteroscedasticity was analyzed with Levene, Brown, and Forsythe heteroskedasticity test, and according to the result, there is a heteroskedasticity problem in all three models. Afterward, the autocorrelation problem was analyzed with Baltagi-Wu LBI and Durbin Watson Autocorrelation Test, and according to the test results, the autocorrelation problem was also found in all three models. Finally, in all three models examined by cross-sectional independence Pesaran's test, the H_0 hypothesis was rejected, that is, there was a correlation between the units. Therefore, the three models created were estimated with the Huber-Eicker-White Estimator, which is resistant to all these problems.

CONCLUSION

According to the first model results, a 1% increase in Turkey's per capita real GDP will increase the foreign trade volume by 1.37%. A 1% increase in OECD country's per capita real GDP will increase Turkey's foreign trade volume by 0.78%. A 1% decrease in R&D expenditures in exporting countries reduces the foreign trade volume by 0.76%. Considering the effect of R&D expenditures made in OECD countries on the trade flow of the exporting country, no statistically significant relationship was found. While a 1% population increase in OECD countries increased Turkey's foreign trade volume by 0.91%, a statistically significant effect of the increase or decrease in Turkey's population on foreign trade volume was not found. A 1% increase in the distances between the countries subject to foreign trade reduces the foreign trade volume of Turkey by 1.03%. A 1% increase in Turkey's logistics performance score leads to a rise of 0.98% in foreign trade volume. The logistics performance index of OECD countries, on the other hand, did not have a statistically significant effect on Turkey's foreign trade volume.

According to the results of the second model, Turkey's per capita real GDP has no statistically significant effects on foreign trade volume. But 1% increase in OECD country's per capita real GDP will increase Turkey's foreign trade volume by 0.66%. When the analysis results of the R&D variable, which is an innovation indicator, are examined, it is seen that there is no statistically significant relationship between Turkey's or OECD country's R&D expenditures and Turkey's foreign trade volume. A 1% population increase

in OECD countries increased Turkey's foreign trade volume by 0.96%, and a statistically significant effect of the increase or decrease in Turkey's population on foreign trade volume was not found. A 1% increase in the distances between the countries subject to foreign trade reduces the foreign trade volume of Turkey by 1.14%. A 1% increase in Turkey's logistics performance score leads to a rise of 2.39% in foreign trade volume. On the other hand, the logistics performance index of OECD countries did not have a statistically significant effect on Turkey's foreign trade volume.

According to the results of the last model, a 1% increase in Turkey's per capita real GDP will increase the foreign trade volume by 1.80%. A 1% increase in OECD country's per capita real GDP will increase Turkey's foreign trade volume by 1.07%. A 1% decrease in R&D expenditures in exporting countries reduces the foreign trade volume by 1.16%. Considering the effect of R&D expenditures made in OECD countries on the trade flow of the exporting country, no statistically significant relationship was found. While a 1% population increase in OECD countries increased Turkey's foreign trade volume by 0.94%, a statistically significant effect of the increase or decrease in Turkey's population on foreign trade volume was not found. According to the panel regression analysis of the distance variable, the 1% increase in the distances between the countries subject to foreign trade reduces the foreign trade volume of Turkey by 1.02%, and Turkey's or OECD country's logistics performance index has no statistically significant effect on Turkey's foreign trade volume.

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