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The effect of foreign trade on economic growth: The case of Turkey

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Abstract. In this study, the causal relationships between export, import and economic growth in Turkey are analysed, using quarterly data from 1987 to 2017. In order to examine these relationships a number of econometric methods are applied, such as the Augmented Dickey-Fuller Unit Root Test, Johansen Cointegration Test and Granger Causality Test based on the Error Correction Model. The results show that all variables are stationary in the first difference. Furthermore, the validity of long-run relationships among variables is found by the Johansen cointegration test. Since the cointegration is observed between series, the Error Correction Model is used to determine the causality. The empirical findings from the causality test suggest that there is short-term bidirectional causality between economic growth and import in Turkey. On the other hand, according to the Error Correction Model, there is a long run unidirectional causality from economic growth to export in Turkey.

Keywords. Export, Import, Economic growth, Cointegration, Causality, Error correction model.
JEL. E40, F32, F36, G15.

1. Introduction

The relationship between foreign trade and economic growth is one of the most widely debated issues in the economic literature. At the centre of this debate is the question of whether export causes growth, or vice versa. The answer of this question is important in terms of the selection and implementation of appropriate development and growth strategies.

The main determinant of economic growth can be defined as an increase in export. It is argued in the hypothesis of export-led growth that at least four approaches can be mentioned in relation to the theoretical logic of this model (Bilgin & Sahbaz, 2009). The first one is related to the Keynesian theory, which derives from the foreign trade approach. In an open economy, where unemployment and unused capacity occur, export can lead to an expansion in output such as consumption, investment and public spending through the foreign trade multiplier.According to the second approach, making the necessary investments for growth and providing intermediate goods to maintain the production depends on the developing countries' import capacities. In the context of the third approach, an increase in the export can enhance the level of productivity, and thus the export sector can contribute to the development of specialization on export commodities. Finally, the fourth approach is related to economies of scale for the capital-intensive manufacturing industries. Export can make it possible for companies in the manufacturing industry to engage in large-

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scale production by incorporating external demand into the process even when the domestic market is limited.

In brief, export development leads to an increase in the efficiency of factor use, provides the adaption of technological innovation and enables the more effective and efficient use of resources. Furthermore, an increase observed in economic growth can be due to the advantages of international competition and the returns from opening the foreign markets. For these reasons, the promotion of export is conceived as a factor in order to maintain the momentum of economic growth.

Contrary to the export-led growth hypothesis, growth rates can lead to an increase in the export. According to Venron's growth-led export hypothesis, growth rates have a positive effect on the export of countries, and lead to a significant expansion of the export rates. In this case, the growth rate in a country can raise the export due to the reasons such as an increase in the international competitiveness of tradable goods, domestic investments, and technological development (Jin, 2002: 64).

An important theoretical background is available for the growth-led export hypothesis. Growth is provided by the dynamics of domestic demand and supply. Neo-classical trade theory suggests that factors other than export have important effects on economic growth, and also supports the hypothesis of growth-led export. According to the neoclassical economists, economic growth raises the level of technical skills plustechnology, and increases the level of productivity. Moreover, this productivity growth generates a comparative advantage in facilitating the export of a country.

In addition, it is possible to mention the two-way relationship between export and economic growth. It is argued that export is able to increase as a result of the emergence of economies of scale. On the other hand, increase in the export leads to a reduction in costs, and thus the profits from production can be raised. Additionally, increasing foreign trade creates more revenue, and this income growth will expand to the volume of international trade.

In this study, the impact of foreign trade on economic growth is analysed for Turkey between 1987 and 2017. One of the main reasons for choosing Turkey in this study is that the country plays a significant role in terms of international trade. The critical geographical position of Turkey in the world has enabled it to be a commercial centre throughout history.The Granger causality test based on error correction model is used to identify the relations between international trade and economic growth for Turkey.

2. Literature review

The relationship between foreign trade and economic growth has been investigated comprehensively in the recent economic literature. In general, these studies have discussed the export-led growth hypothesis. The relationship between export and economic growth, in terms of developed and developing countries, still holds validity in both theoretical and empirical literature. Over the last decades, many empirical studies have examined the impact of the export on economic growth or the export-led growth hypothesis with time series or cross-sectional analyses. Some of these studies will be mentioned in the below.

2.1. Theoretical framework

A wide range of studies analyse the link between trade and economic growth. This relation was first pointed out by Adam Smith in 1776 with his famous theory, named export of surplus. This theory survived in practice until the World War II. As a result of the World War II, inward-oriented and protectionist growth policies had became popular. After the 1960s, due to the failure of these policies and the need for rapid economic growth by trade liberalisation, new theories were introduced into the economic literature by researchers and these theories support the idea that international trade policies play a crucial role in economic growth (Afonso, 2001).

In the literature of international trade, the relations between export and growth are defined by export-oriented growth hypotheses. These assumptions explain that there is a positive relation between export and national product, and thus, the export-oriented principles contribute to economic growth.

The theories of international trade examine the flow capacity of international goods and services, and the contribution of these flows in the economy. In addition, these theories explain why countries deal with foreign trade and what the profits and losses from export and import are. A great number of theories have been proposed on behalf of finding answers to these questions.

In mercantile system, the main reason for international trade was seen as increasing the stock of precious metals. In theory, the dominant idea is reducing import as much as possible and promoting export. In parallel with this theory, the state should make regulations with the tools of foreign trade policy (Kuyucuklu, 1982: 20).

Contrary to the mercantilist theory, it is claimed in the theory of absolute advantage that free trade is of benefit to all countries. According to Smith (1776), it is more profitable for countries to engage in international trade than to have a closed economy. David Ricardo, as a member of the same school as Adam Smith, based international trade upon comparative advantage instead of absolute advantage. According to Ricardo, countries do not need to have absolute advantages to engage in foreign trade. He claims the only thing that matters is the degree of superiority (Takim, 2010).

Neoclassical international trade theory accepts the arguments of the comparative advantage approach. The neo-classical economists maintain that export make a major contribution to the economic growth because itaffects economic development positively by increasing rate of investment and achieving technological progress. In addition, export increases the extension of the market and as a result of this the welfare of countries can increase (Kavoussi, 1984).

In the theory of Hecksher-Ohlin, it is argued that developing countries should export products which are used in their areas of abundant of production and import products to use in areas scarcity such as labour and natural sources (Jones, 1956). Although some different models were produced to demonstrate the analytical validity of the Hecksher-Ohlin model, the main role of variables in terms of international trade remained unchanged.

New theories were developed after the 1950s, because it became unrealistic to explain the tradable products with a single theory for more than two hundred countries in the world. In order to test factor endowment theory, the study by Leontief (1951) reached the conclusion that the capital-rich USA should import capital-intensive goods and export labour-intensive goods, in contradiction to the theory (Takim, 2010).

The relationship between export and economic development has been subject to many studies in both theoretical and empirical literature. Michaely (1977), Balassa (1978), Ram (1987) and Frankel & Romer (1996) have revealed the existence of a positive association between export and economic growth.

According to the classical economists, export can be seen as an engine of development. It can be said that export-oriented development has increased gradually since the 1960s and the countries that have adopted this model reached high export revenue. As a result of this, they have increased their growth rates. Moreover, it has been observed that the countries which follow export-oriented growth policies have reached higher growth rates than countries that have applied import substitution policies (Harrison & Revenga, 1995).

On the other hand, a number of researchers argue that export cannot have an effect on economic growth, particularly in developing countries. Therefore, economists claim that it can be necessary to apply import substitution policies rather than export-oriented industrialization policies. According to Nurkse (1953: 145), although export can be defined as an engine of development in the 19th century, it is not valid today.

Bhagwati's Immiserizing Growth Theory is one of the most important studies that showing the negative relationship between export and growth. According to this theory, there is no problem if an increase in real income is greater than the loss resulting from foreign trade rate, while international terms of trade are constant. On the other hand, the process of immiserizing growth has been entered if it is less than the loss; and revenue, generated by the growth, is compensated with this loss (Seyidoglu, 2003: 109).

2.2. Empirical review

Apart from the theoretical analyses, the empirical investigation on the export-led growth hypothesis has a very large place in economic literature. Therefore, in this study, the empirical literature review is restricted to some of the most significant studies.

The empirical literature that considers the export-led growth hypothesis can be divided into three groups in terms of the methods they use. In the first group, the cross-country correlation coefficient is used to test the export-led growth hypothesis. The second group of studies use the typical ordinary least squares (OLS) regression tests obtained from cross-sectional data. The last group of the studies employ various time series methods to analyse the relation between export and economic growth.

Michaely (1977) and Balassa (1978) were two typical studies in the literature that use cross-sectional data. Michaely (1977) preferred to use simple correlation analysis to examine whether the average rate of economic growth has a positive relation with the change in the rate of foreign trade to GDP. He used a sample of 41 developing countries for the period of 1950-1973 and determined a strong positive correlation between international trade and economic growth. As a conclusion of his research, he found that applying protectionist import substitution policies in developing countries was ill-judged. Balassa (1978) used a simple regression test on a sample of 10 countries for the period of 1956-1974 and found that export volume had a positive effect on a country's ratio of economic growth. In addition, he used regression analysis to estimate the size of the quantitative relation.

After the 1980s, some studies examining the causal relationship between export and growth rate reached the conclusion that this impact is from foreign trade to income. Some others have claimed that the causality effect can be from income to international trade. In addition, while some researches undertaken by Bahmani-Oskooee & Alse (1993) and Chow (1987) suggested a positive association between export and growth, Jung & Marshall (1985), Afxentiou & Serletis (1991) and Bahmani-Oskooee *et al.,* (1991) claimed that there is no causality relation between export and economic development. On the other hand, Kugler (1991) and Crespo & Woerz (2005) explored the relationship between GDP and export activities with time-series analysis and demonstrated that export have a positive impact on growth in the developed countries.

2.3. The case of Turkey

It can be said that there is an important literature in Turkey examining the relationship between export and economic growth. The selected studies about Turkey are as follows:

Bahmani-Oskooee & Domac (1995) have found a two-way relationship between export and economic growth for Turkey between the years of 1923 and 1990, by using a cointegration test and error correction model.

Yigidim & Kose (1997) have used two different methods in their study that covering the years 1980-1996. Firstly, they used changes in the percentage of the variables and they did not found causality between export and growth. Secondly, they identified unidirectional causality from growth to export when they considered the logarithmic differences of the variables.

Ozmen & Furtun (1998) used time series analysis for the period of 1970 to 1995 and they tested the export-led growth hypothesis for Turkey. They concluded that there is no correlation between these two parameters.

Taban & Aktar (2008) have analysed the period of 1980 and 2007 with quarterly time series data. They found that there is a strong relation between export and economic growth. In addition, an export-led growth model is applied and as a result of this the presence of a bidirectional causality relationship was detected between export and economic growth.

Some of the studies in the literature focusedonly on Turkey as a case study. On the other hand, some other studies considered Turkey's case among various groups of countries. For example, Dutt & Ghosh (1994) found a long-run relationship between export and growth for Turkey between the period 1953-1991 by utilising annual data. Amirkhalkhali & Dar (1995) and Ram (1987) could not find statistically significant effects of export on growth for Turkey in their studies using annual data between the periods of 1961-1990 and 1960-1981, respectively.

The above-mentioned studies about Turkey did not consider the causality relationship. They just identified the relationship between export and economic growth. The studies, in order to determine causality between export and growth in Turkey, are only based on Turkey or consider Turkey among groups of countries. For instance, Sharma & Dhakal (1994) used annual data during 1960-1988 in Turkey and concluded that there is no causal relationship between export and growth for this period. Pomponio (1996) examined 66 countries, including Turkey, by using annual data from 1965 to 1985. He determined one-way causality from export and investment to economic growth in his analysis. Dodaro (1993) investigated 87 countries' causality relationships between export and growth and found one-way causality from growth to export for Turkey between 1967 and 1986.

Another study that analyses export-led growth theory for Turkey is conducted by Bilgin & Sahbaz (2009). Monthly data for the period of 1987-2007 were used to show the relationship between export and economic growth. Their findings indicated that export-led growth theory is valid for the given period in Turkey. Demirhan (2005) found similar results to Bilgin & Sahbaz (2009). He examined the causal relation between growth and export for the period of 1987 to 2004 and concluded that there is a long-term relation between variables.

When the studies in the literature are reviewed as a whole it can be said that different results were obtained in the researches examining the relationship between export and growth. Therefore, offering a certain suggestion under the guidance of export-led growth hypothesis should be avoided.

3. Methodology and data

One of the most significant data in econometric analysis is time series. Because of the fact that these data sets include trend, when they are added into the regression without any conversion, the regression results may be spurious or do not reflect the reality. Therefore, the variables used in the models should be stationary. The stationarity test of time series data is usually done using unit root tests. After determining the stationarity of a series, cointegration tests can be implemented, and the last process used to analyse the relationship between variables is the Granger causality test based on error correction model.

3.1. Stationarity in time series

The stationarity test analyses the series to see whether they contain a unit root or not by using unit root tests. The basic model for defining unit root tests is as follows:

$$Y_t = \rho Y_{t-1} + u_t \qquad -1 \leq \rho \leq 1 \tag{1}$$

where u_t is a white noise error term. The model expressed in Equation (1) is a regression model that created Y in t period with respect to $t-1$ period. If the coefficient of $Y_{t-1}(\rho)$ is equal to 1, then it is faced with a unit root problem or non-stationarity stochastic process. Therefore, Y_t is regressed on its one lagged value Y_{t-1} and ρ is tested whether it is equal to 1. If it is equal to 1 then it can be concluded that I_t is non-stationary. This can be accepted as a general idea behind the unit root test of stationarity (Gujarati, 2003: 814).

The above model can be denoted as follows:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + u_t \\ = (\rho - 1)Y_{t-1} + u_t \tag{2}$$

and which can be written as;

$$\Delta Y_t = \delta Y_{t-1} + u_t \tag{3}$$

where $\delta = (\rho - 1)$,Δ is the first difference operator and t is the trend variable.

Instead of estimating model (1), model (3) can be estimated and the null hypothesis that $\delta=0$ is tested. If δ is found as 0 and $\rho=1$ then it can be said that we have a unit root. Alternatively, if $\delta<0$, this means that the Y_t series is stationary (Gujarati, 2003; Verbeek, 2004).

Verbeek (2004) states that a time series which becomes stationary after first differencing is defined as integrated in order one, and specified as I(1). Likewise, if the time series is stationary after taking differences twice (the first differences of first order differences), then it is said that this series is stable in the second order [I(2)]. As a rule, if a series is differenced d times before it becomes stationary, then it is said to be integrated in order d.

To understand the stationarity of a time series,the following hypothesis can be applied.

H_0: $\delta=0$ Y_t is non-stationary.
H_1: $\delta<0$ Y_t is stationary.

Dickey and Fuller have defined that the estimated t value of the coefficient of Y_{t-1} in Equation (3) follows the τ (tau) statistics, under the null hypothesis that δ=0. They have calculated the critical values of the *tau statistic* with regards to the Monte Carlo simulation method. The *tau test* is known as the Dickey-Fuller test in the economic literature (Enders, 2010).

Dickey & Fuller (1979) state that using the Monte Carlo simulation method, the three equations can be obtained, as follows:

$$\Delta Y_t = \rho Y_{t-1} + u_t \tag{4}$$
$$\Delta Y_t = \beta_1 + \rho Y_{t-1} + u_t \tag{5}$$
$$\Delta Y_t = \beta_1 + \beta_2 t + \rho Y_{t-1} + u_t \tag{6}$$

In Equation (4), Y_t is a random walk which means the subsequent year's value equals the current year's value plus a stochastic error term. Y_t is a random walk with drift in the Equation (5), and in Equation (6) $Y_t$is a random walk withdrift around a stochastic trend. In each of these cases, the null hypothesis of δ=0 is tested against the alternative one (Gujarati, 2003: 815).

One of the weaknesses of the Dickey-Fuller test is that it does not take into account the autocorrelation of error terms, or it assumes that the error term u_t is uncorrelated. As a solution Dickey and Fuller have developed a method called the *Augmented Dickey-Fuller (ADF)* test.The lagged value of dependent variable is added in the model to the approximate autocorrelation. For these reasons the ADF test is the most widely used in the unit root tests (MacKinnon, 2002: 625). The ADF test of equation is as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (7)$$

where ε_i is a white noise error term, $\Delta Y_{t-1}=(Y_{t-1}-Y_{t-2})$, $\Delta Y_{t-2}=(Y_{t-2}-Y_{t-3})$, etc. To eliminate the correlation between the error terms in Equation (4), sufficient terms should be added into the model. In ADF test the null hypothesisof $\delta=0$ is tested as in Dickey-Fuller test. If the null hypothesis is rejected, ΔY_t is said to be stationary. In addition, the ADF test uses the same asymptotic distribution as DF statistics (Enders, 2010: 215).

3.2. Cointegration test

As mentioned before, using a non-stationary time series in econometric analyses might cause some problems. As a result, spurious regression results can be obtained from the time series, which include stochastic or deterministic time trends, and thus, the test statistics might become invalid.

Engle & Granger (1987) suggest a solution to this problem. Thanks to the cointegration analyses the result of regressions does not cause spurious correlations, and therefore non-stationary variables can be included into the regression analysis.Although this method is simple, the Johansen test is more suitable than the Engle-Granger test for analysing the cointegration relations among variables. Therefore, the Johansen test is used in this study.

Johansen (1988), and Johansen & Juselius (1990), have developed a maximum likelihood testing method on cointegrating vectors, which include analysing techniques for linear restrictions on the cointegrating parameters for any set of variables. Johansen's method adopts all variables as endogenous, and thus the problem of normalising the cointegrating vector on one of the variables cannot appear. This method analyses the non-stationary time series as a vector autoregression (VAR), as follows:

$$\Delta Y_t = \mu + \Pi_0 + \Pi_1 \Delta Y_{t-1} + \cdots + \Pi_{p-1} \Delta Y_{t-p+1} + u_t \quad (8)$$

where Δ is the first difference term, Y_t is a $px1$ random vector in I(1) order, μ is the $px1$ vector of constant terms, Π is pxp coefficient matrix, and u_t is $px1$ vector of error term coefficients; independently and identically distributed (*iid*) with zero mean and constant variance.

Π includes information about long-run relationships between Y_t variables, and can be shown in the following form:

$$\Pi = \alpha x \beta' \quad (9)$$

where α and β are nxr matrices. β is called the cointegrating matrix and α is represented as the adjustment matrix. The direct estimations of cointegrating vectors are provided by the Johansen test. In addition, this method can enable to test for the rank (r) of cointegration. In the procedure of determining the cointegration rank, the Johansen test uses two test statistics. The first is known as the trace statistic:

$$\lambda\, trace = -T \sum_{i=r+1}^{n} ln(1-\lambda_i) \qquad r = 0,1,2,3,\ldots,n-1 \quad (10)$$

where T is the total number of observations, n is the number of variables, λ_i is n-r smallest squared correlations between $Y_{t-k}(Y_{t-1}, Y_{t-2},\ldots\ldots, Y_{t-p+1})$ and ΔY_t. The trace test analyses the cointegration between the variables under the null hypothesis tests, finding that there are maximum r cointegrating vectors.

In every case the null hypothesis is tested against the alternative one. The critical values were calculated with the simulation method by Johansen & Juselius (1990). According to their results, if the test statistic is greater than the critical value, the null hypothesis should be rejected.

The second test statistic is the maximal eigenvalue:

$$\lambda\, max = -T\, ln(1 - \lambda_{r+1}) \tag{11}$$

In this test, the null hypothesis of *r* cointegrating vectors is tested against the alternative hypothesis of *r+1* cointegrating vectors. The null and alternative hypotheses are:

H_0: r cointegrating vectors.
H_1: r+1 cointegrating vectors.

The null hypothesis $r=0$ is tested against the alternative $r=1$, and if the null is rejected then the null of $r=1$ is tested against $r=2$.In Johansen method, choosing an optimal lag length is very important in terms of the performance of cointegration tests. In this study, Akaike's Information Criterion (AIC) is used to select the number of lags required in the cointegration test.

3.3. Error Correction Model (ECM)

After determining the long-run relationship between series via the Johansen cointegration test, the next step is to specify the causal relationship and the direction of this causality. Granger (1988) suggests applying the ECM to analyse the causality relationship among the variables. If the variables are found to be cointegrated, the ECM links short-term and long-term effects together. In Equations (12) and (13), the error correction models are defined as:

$$\Delta Y_t = \alpha_1 + \textstyle\sum_{i=1}^{m} \beta_{1i}\, \Delta Y_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\, \Delta X_{t-i} + \sum_{i=1}^{r} \delta_{1i}\, ECT_{t-1} + e_{1t} \tag{12}$$
$$\Delta Y_t = \alpha_2 + \textstyle\sum_{i=1}^{m} \beta_{2i}\, \Delta X_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, \Delta Y_{t-i} + \sum_{i=1}^{r} \delta_{2i}\, ECT_{t-1} + e_{2t} \tag{13}$$

where Δ represents the first difference of the variables, *ECT* is the error correction term, δ_{1i} and δ_{2i} are the coefficients of error terms. Y_{t-i} and X_{t-i} indicate that the short-run dynamics of the system and the coefficients of these terms are β_{1i}, β_{2i}, γ_{1i} and γ_{2i}.

The cointegrating regressions regard only the long-run relations in the model. On the other hand, a substantial time series model contains both short and long-run dynamics (Enders, 2010: 366). Therefore, ECM is used in this study to determine short-term relations among the variables in addition to the long-term.

3.4. Causality

The concept of causality was first defined by Granger (1969). In a bivariate system, the variable X_{1t} is said to cause the variable X_{2t} in the Granger sense if the prediction for X_{2t} improves when lagged variables for X_{1t} are considered in the equation. Granger causality tests were performed in a strictly bivariate framework, but if the other relevant variables are omitted from the model, regression results could lead to a spurious causality (Granger, 1969: 429).

The Granger causality test assumes the information related to the prediction of the respective variables, *Y* and *X*, are included only in the time series data on these variables (Gujarati, 2003: 817). The standard Granger test estimates both of the following regressions:

$$Y_t = \textstyle\sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{i=1}^{n} \beta_j Y_{t-j} + u_{1t} \tag{14}$$
$$X_t = \textstyle\sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{i=1}^{n} \delta_j Y_{t-j} + u_{2t} \tag{15}$$

where α, β, λ and δ are lag coefficients, n represents the lag level for all variables. It is assumed in the Granger causality theorem that the disturbances u_{1t} and u_{2t} are uncorrelated (Granger, 1969: 431). According to regressions, the current value of Y is related to the past value of X in Equation (14); and the current value of X is related to the past values of Y in (15). The hypothesis of the Granger causality test is as follows:

$H_0: \sum \alpha_i = 0$: X is not Granger cause of Y.
$H_1: \sum \alpha_i \neq 0$: X is Granger cause of Y.

For the null hypothesis, the F test is applied as follows:

$$F = \frac{(RSS_R - RSS_{UR})/m}{(RSS_{UR})/(n-k)} \tag{16}$$

where RSS_R is the restricted residual sum of squares, obtained running regression including all Ys without including X; RSS_{UR} is the unrestricted residual sum of squares (including X), m is the number of restrictions, n is the number of observations and k is the number of parameters in the unrestricted regression.

The F value is used to make decisions on causality, thereby enabling a comparison of the captured F value with the critical F value. If the captured F value is greater than the critical F value at a significance level (1%, 5%, 10%), then one rejects the null hypothesis (H_0). This means that there is a causal relationship between variables.

The standard Granger test had been used for testing causal relations between two variables until the development of the error correction model. Granger states that the advantages of using a standard cointegration test are overridden if there is a cointegration between variables (Bahmani-Oskooee & Alse, 1993). Therefore, if a cointegration relation is seen in the model, the error correction terms should be included into the standard Granger test to obtain reliable results. Otherwise, the standard Granger test may yield spurious results. The Granger error correction model can be formulated as follows:

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} \Delta Y_{t-i} + \sum_{j=1}^{n} \lambda_{1i} \Delta X_{t-j} + \delta_1 ECT_{t-1} + \varepsilon_{1t} \tag{17}$$
$$\Delta X_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} \Delta X_{t-i} + \sum_{j=1}^{n} \lambda_{2i} \Delta Y_{t-j} + \delta_2 ECT_{t-1} + \varepsilon_{2t} \tag{18}$$

where ECT_{t-1} is stationary error term-which is called error correction term- and, Δ shows the first difference of the variables.

To obtain more reliable results in the Granger test, lag length selection is very significant. Akaike and Schwartz's Information Criterions are useful for choosing an optimal lag length (Gujarati, 2003: 537). Therefore, in this study, Akaike's Information Criterion is used for the lag selection process of the model and then the causal relations between industrial production index (IPI), real export and real import are found by using the Granger causality test.

3.5. Data

The data set used in this study are quarterly and seasonally adjusted Turkish observations for the period of 1987:1 and 2017:4 (T=124).All variables are used in natural logarithm forms and real termsbased on the year 2005=100. The variables utilised in this research are industrial production index (IPI), real export of goods and services, and real import of goods and services.

The industrial production index is used in this study due to the difficulty of finding quarterly GDP data for Turkey. The IPI has been used in several previous studies such as; Rashid (1995), Jin & Yu (1995, 1996), Karunaratne (1996), Bilgin & Sahbaz (2009) and Tastan (2010) to represent the general economic condition because of the presence of a high correlation between IPI and GDP. Export and import are millions of US dollars, deflated by export and import price indices, respectively. All data are collected from International Financial Statistics published by the International Monetary Fund and the Turkish Statistical Institute. The statistical analyses for all data are performed using Gretl 1.9.9 econometric software.

4. Empirical analysis and results

4.1. Unit root test

As mentioned before, variables used in a regression analysis are tested for their stationarity by the unit root tests. In line with this objective, an ADF test is used in this study to reveal the order of integration for each variable. Firstly, the levels of variables are tested and then the first differences are examined.

Before testing stationarity with unit root tests, it is essential to determine the lag length. There is no general rule in selecting the maximum lag length. In the literature, the lag length is specified as 12 or 24 for monthly series and 4, 8, or 12 for seasonal series. Akaike Information Criterion is used in this study to select the optimal lag length. The maximum lag length is decided as 12 and decreased to find the appropriate length and this was found to be 5 with VAR lag selection criteria.The ADF test results are presented in Table 1.

Table 1. *Unit-root test results*

Variable in logarithms		Constant		Constant and Trend		None	
		Level	1st difference	Level	1st difference	Level	1st difference
logIPI	Test Statistic	-0.467358	-4.9178*	-3.09072	-4.88598*	1.81911	-4.15789*
	Critical value (5%)	−2.8621		−3.4126		−1.9393	
logREXP	Test Statistic	-0.059184	-4.88818*	-2.57596	-4.84845*	3.33138	-2.68081*
	Critical value (5%)	−2.8621		−3.4126		−1.9393	
logRIMP	Test Statistic	-0.963266	-5.97443*	-3.12859	-5.94121*	1.83935	-5.14681*
	Critical value (5%)	−2.8621		−3.4126		−1.9393	

Notes: 1. (*) Significant at 5% MacKinnon (1991) critical value. 2. logIPI, logREXP and logRIMP are natural logs of the industrial production index, real export and real import, respectively.

According to the ADF test results, there are unit roots in the level form of the variables. Therefore, the null hypothesis of non-stationary cannot be rejected at the levels of variables. On the other hand, when taking the first differences of logIPI, logREXP and logRIMP, the null hypothesis is rejected at the 5% significance level. This means that the series are stationary in their first difference or integrated of order one, I(1). Therefore, the long-run relationship between variables can be analysed by using the Johansen cointegration test.

4.2. Johansen cointegration test

In applying the Johansen test procedure, the optimum lag length is determined as 5 by Akaike Information Criterion (see Table 2 for the details). The lag selection process is significant sincechoosing an appropriate lag length can generate the best model with uncorrelated residuals. When testing cointegrated vectors in a model, first the optimum lag is determined and then the trace and the maximum eigenvalue tests are used to specify the number of cointegrated vectors in the non-stationary time series.

Table 2. *VAR lag order selection criteria*

Lag	Log Likelihood	p (LR)	AIC	BIC	HQC
1	224.92553	-	-5.058446	-4.621307	-4.882828
2	246.65586	0.00000	-5.365201	-4.665778	-5.084212
3	286.26448	0.00000	-6.102759	-5.141051	-5.716398
4	306.77808	0.00000	-6.380195	-5.156203*	-5.888463*
5	320.11072	0.00159	-6.484596*	-4.998320	-5.887493
6	327.14774	0.11972	-6.437295	-4.688736	-5.734822
7	332.50174	0.29626	-6.349440	-4.338596	-5.541595
8	339.47546	0.12421	-6.300614	-4.027486	-5.387398
9	346.36514	0.13039	-6.249762	-3.714351	-5.231176
10	357.04889	0.01111	-6.290335	-3.492640	-5.166377
11	366.29333	0.02991	-6.296225	-3.236246	-5.066896
12	370.93378	0.41176	-6.191175	-2.868912	-4.856476

Notes: 1) (*) indicates lag order selected by the criterion; 2) AIC: Akaike information criterion; 3) BIC: Schwartz Bayesian criterion; 4) HQC: Hannan-Quinn information criterion

All variables are tested to determine the cointegrating relationship. The results from Table 3 indicate that the null hypothesis of $r=0$ is rejected at 5% significance level, because the trace test value of 36.185 is greater than the critical value (29.68). Besides, the statistic obtained from the maximum eigenvalue test is also greater than the critical value. On the other hand, the null hypotheses of $r=1$ cannot be rejected for both trace and maximum eigenvalue tests because the test statistics are smaller than the critical values. Therefore, it can be said that there is at most one cointegrating vector among the variables, and as a result of the cointegration test a long-run relationship is found between industrial production, export and import for Turkey.

Table 3. *Johansen cointegration test*

Unrestricted Cointegration Test	Trace statistic			Maximum eigen statistic		
Number of Cointegrating Vectors	0	At most 1	At most 2	0	At most 1	At most 2
Critical Values (%5)	29.68	15.41	3.76	20.97	14.07	3.76
Test statistic [probability]	36.18*	8.71	0.48	27.47*	8.22	0.48

Notes: 1. If the test statistic is greater than the critical value, we reject the null; 2. (*) indicates rejection of the null hypothesis at the 95% confidence level; 3. The r denotes the maximum number of cointegrating vectors; 4. The optimum lag length is selected as 5 by using the Akaike Information Criterion; 5. Critical values are obtained from Osterwald-Lenum (1992).

The cointegration relation among series shows that there may be a causality relationship between variables. Therefore, the Granger causality test based on the error correction model is presented in the next part of this study.

4.3. Error correction model and Granger causality test results

In this study, the Vector Error Correction Model (VECM) is used to determine the causality. On one hand, the vector autoregressive model (VAR) is utilized to find the causality for the time series which are not stationary and not cointegrated. On the other hand, VECM is used to specify the causality between variables which are non-stationary but cointegrated. In addition, the VAR model can only show the short-run relationships. However, VECM can identify the causality relations for both the short and long-term, which cannot be determined by the standard Granger causality test. For these reasons, VECM is used in this study.In addition, VAR model results can also be seen from the table below to compare the results in the short and the long term.

Beginning with the short-run results, Table 4 reports that the null hypothesis of no causal relationship between export and economic growth cannot be rejected because the test statistic (1.7207) is less than the critical value of the F-test. Therefore, the causal relationship from export to economic growth is not valid for Turkey. On the other hand, as a result of the rejection of the null hypothesis, a causal relation can be mentioned from import to industrial production for Turkey.

The test statistics in Table 4 indicate that although there is no causality from economic growth to export, the null hypothesis that import does not Granger cause of export was rejected, and thus a causality from import to export can be observed for Turkey. In addition, while a causal relation from economic growth to export was found, the causality from export to import was not established. These pieces of evidence show that, on one hand, the export-led growth hypothesis is not valid for Turkey. On the other hand, there is an unidirectional causal relationship from import to export. Moreover, bidirectional causality between economic growth and import was found for Turkey in the short term.

The causal relationship in the long run is usually determined by the t-value, and the t-statistics of the coefficients of error correction terms give information about causality (Taban & Aktar, 2005: 1547). It can be seen from Table 4 that there is a long-run causal relation from industrial growth and import to export at a significance level of 5%. Furthermore, a causality running from industrial production (economic growth) and export to import exists in Turkey at a 1% significance level.

Table 4. *Granger causality test*

		F-statistics			t-statistics
Dependent Variable	Lag Orders	ΣΔLIPI	ΣΔLEXP	ΣΔLIMP	ECT_{t-1}
ΔLIPI	m=1, n=5	-	1.7207	2.6856**	1.076
ΔLEXP	m=1, n=5	0.2659	-	2.0085*	-2.605**
ΔLIMP	m=3, n=5	2.2424*	1.7899	-	3.894***

Notes: 1. Lag orders are selected based on the Akaike criterion, *m* = lag length of dependent variable, *n*= lag length of “causal variable”; 2. Δ indicates the first difference of the variables; 3. ECT indicates error correction term; 4. The critical values for F statistics at 10%, 5% and 1% are 1.92, 2.34 and 3.27, respectively; 5. The critical values for t statistics at 10%, 5% and 1% are 1.29, 1.66 and 2.36, respectively; 6. (*), (**) and (***) indicate significance levels at 10%, 5% and 1%, respectively.

The results of this study revealthat export-led growth theory was not valid for Turkey between the periods of 1987 and 2017since the direction of the causal relationship is not from export to economic growth, but from growth to export in the long run. Contrary to the assumption of the theory, concerning the validity of long-term equilibrium between export and economic growth, there is no argument for a causal relation from export to industrial production in the short and long-term. Moreover, the results show that there is a long-run causality from growth to export. Therefore, the Growth-led Export hypothesis is valid for Turkey, rather than the Export-led Growth theory, for the period of 1987-2017.

5. Conclusion

The main objective of this study is to examine the relationship between foreign trade (export and import) and economic growth by using quarterly time series data for Turkey between 1987 and 2017. To determine this relationship, ADF unit root test, Johansen cointegration method and Granger Causality test were used.

The results of the ADF unit root test show that all variables are stationary in their first differences. After determining the stationarity of the variables, Johansen cointegration test was employed to find a long-run relationship between variables, and in consequence of the Johansen test, at most one cointegrated vector was found among industrial production, export and import. The cointegration relation between series shows that there may be a causal relationship among variables. Therefore, Granger Causality Test based on the error correction model was applied to determine causal relations between the variables. As a result of the causality tests, no evidence has been found for the short-term and long-term causality running from export to economic growth. Contrary to this, the results present a long-run causality from growth to export. Therefore, it can be said that, instead of Export-led Growth, a Growth-led Export process was valid for Turkey between 1987 and 2017.

In addition, bidirectional causality between economic growth and import was found for Turkey in the short-term. Moreover, there is a unidirectional causal relationship from import to economic growth for both the short-term and long-term. As a result of the econometric analyses used in this study, import seems to have relatively the highest impact on economic growth. When considered from this point of view, an Import-led Growth process can be said to be valid for Turkey for the period 1987-2017.

The results obtained from this research show similarities to previous studies, such as Dodaro (1993), Amirkhalkhali & Dar (1995), Yigidim & Kose (1997), Ozmen & Furtun (2005). Although the results from this study indicate that export does not cause economic growth for Turkey, there is a causal relation from import to growth. This finding confirms that import had a significant impact on economic growth in the examined period.

The finding that there is no causality relation from export to growth should not be interpreted as meaning that export have a low importance in terms of a country's economy. In this context, export promotion activities should be implemented, and economic policies should be developed with respect to these activities. The contribution of export on economic growth can be made possible by productivity growth and obtaining new technologies since export can enable a country to sell new technologies on the international market.

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