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THE ESSENTIAL ROLE OF INTERNATIONAL TRADE ON ECONOMIC GROWTH

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ABSTRACT

Purpose- One of the most fundamental elements of the world economy is international trade. International trade is important in terms of supporting the development and economic growth of countries. In this context, the most important goal of countries is to increase their exports and reduce their imports. However, the impact of foreign trade on economic growth may vary in the short and long run. In addition, determining the quantitative effects of these variables on each other may be important for the development of national economies.
Methodology- In line with these objectives, in this study, growth, export and import figures of G-20 countries for the last 25 years are taken. Co-integration tests are used to examine the long-run relationship between the variables. In addition, Wald Tests were used to investigate the short-run relationship. The mutual causality relations of the variables were analyzed with causality tests.
Findings- According to the findings of the study, the effect of exports and imports on economic growth has been proven. With these results, it is clearly stated by co-integration tests that the export and import development of countries can support their economic growth in the long run. Moreover, in the short run, there is a bi-directional causality relationship between exports and economic growth and between imports and economic growth.
Conclusion- The relationship between economic growth and foreign trade is multifaceted and affected by many factors. However, the importance of foreign trade for the national economy is seen in the short and long run.

Keywords: Economic growth, foreign trade, exports, imports, GDP, co-integration.
JEL Codes: B17, F40, F63

1. INTRODUCTION

Globalization has brought about considerable changes in the international economy in recent years. With the spread of globalization, national economies have become global economies. The transition process towards a single economy has begun worldwide. As a result, countries have become more dependent on each other economically. In this context, each country has been affected by the global crisis to the extent of its fragility. Globalization has increased the world economy and international trade growth due to free trade agreements, technological developments, and international cooperation. However, due to the Covid-19 epidemic in 2020, a severe contraction was observed in the world economy. Fiscal policies taken as measures against the epidemic have significantly increased the default risk of countries (Özparlak et al., 2021a). In 2021 the world economy started to recover, and economic growth accelerated. Economic growth (EG) is the increase in the total production, trade, and business activities in a country's economic activities. This increase is usually measured as GDP (Gross Domestic Production) or GNP (Gross National Production). The EG of a country means the continuous growth of the GDP per capita of that country. EG is of great importance for all countries. EG can be driven by increased productivity in a country's economy, investment in labor and capital, technological advances, trade, and other factors.

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The main objective of EG is to increase the welfare of a country. EG helps to raise a country's production and consumption levels, which in turn helps to increase income and a higher standard of living. In addition, the qualitative development of EG is also essential. The U.N. (2015) report mentions that stable, inclusive, sustainable EG and full and productive employment should be supported (Özparlak, 2022).

As a result, EG is an essential factor that can increase a country's economic well-being. EG is the increase in the ability to produce goods and services. EG is one of the most important goals of countries worldwide. Because EG helps to increase the income levels of the nations, raise the standard of living and improve the welfare of the people.

EG can occur in different ways under the influence of various factors. Therefore, several different types of EG have been described in the economics literature. However, the factors affecting economic development are complex and multifaceted. Each country's conditions, resources, and policies can affect growth differently. Therefore, it is vital to consider the country's unique conditions to make a detailed assessment of the growth analysis. The combination of factors affecting growth determines a country's EG rate. The economy's total output (GDP), and therefore EG, results from combining these factors. The main determinants of growth can be explained as the availability and effective use of resources against supply and demand (Sevcan et al., 2019).

Some types of EG are shared below.

Concentrative Growth: This type of growth is a model in which economic activity is concentrated in a particular sector or a particular region, and this concentration increases the growth rate. For example, rapid industrial development in a region can trigger growth.

Resource Dependence: This type of growth is a type of EG that relies on a particular resource. For example, countries that grow with oil exports can be cited as an example of this type of growth.

Innovation-Based Growth: This growth model is based on developing new technologies, products, or services. Innovation creates new jobs and accelerates EG.

Capital Intensity: This type of growth is a growth model based on capital from the factors of production. Capital intensity can accelerate EG through high-tech manufacturing, construction, and similar investments.

International Trade-Driven Growth: This growth occurs by increasing the country's exports. The international trade-oriented growth model increases the country's foreign trade (FT) volume and can trigger EG.

FT is essential for EG and dramatically influences countries' economic policies. FT increases production diversity, benefits from economies of scale, and facilitates access to foreign markets. It also increases competition and encourages technological transfer.

Export (EXPT) and import (IMPT) activities can stimulate EG, and therefore countries often develop policies to support EXPTs and IMPTs. Exporting means that a country sells its goods and services to foreign markets. The positive impact of EXPTs on EG can take several forms. First, EXPT revenue increases the country's national income and supports employment. Second, EXPTs can increase the competitiveness of local businesses, increasing their productivity and efficiency. Third, EXPTs can trigger production and investment activities with increased foreign demand. When these factors come together, EXPTs seem to stimulate EG. IMPT means that a country brings foreign goods and services to local markets. The impact of IMPTs on EG occurs in many ways, such as meeting local consumer demand and providing the necessary intermediate goods and raw materials in production processes. IMPTs can increase living standards by offering local consumers a more comprehensive range of products and can make local producers more efficient by encouraging competition. In addition, IMPTs can support local production by providing intermediate goods and raw materials to be used by local enterprises in their production processes. For these reasons, the effect of FT on EG is essential. Countries can follow policies to increase EG by encouraging EXPTs and IMPTs.

The importance of FT for the world economy is an indisputable issue for countries. The volume of global trade has expanded enormously in recent years. The growth of FT also affects the growth of the world economy. FT can contribute to EG by increasing the demand for a country's goods and services in international markets. It can increase production and sales, creating employment opportunities and stimulating EG.

Additionally, FT can provide access to new technologies, capital, and raw materials that can help increase productivity and efficiency in local industries. On the other hand, FT can also challenge EG. If a country becomes too dependent on EXPTs, global demand or pricing changes can significantly impact its economy. Similarly, if a country IMPTs more than it EXPTs, it can create a trade deficit that can negatively affect the economy. The relationship between EG and FT is complex and multifaceted. A country's ability to effectively manage its FT relations and balance its IMPTs and EXPTs can be critical in determining its EG trajectory.

EG is defined as the increase in the production volume of an economy over periods. One of the most important indicators of

the increase in the production volume of a country is the changes in the GDP (Turan, 2008). Components of GDP can be mentioned, and the components of GDP are:

$$GDP = C + I + G + (X - M) \quad (1)$$

Consumption (C): Consumption of households
Investment (I): Investments in enterprises
Government expenditures (G): Government expenditures for goods and services
Export (X): The sum of goods and services sold by a country to other countries.
Imports (M): The sum of goods and services bought by a country from other countries.

These components are used in calculating GDP and represent different aspects of economic activity. For example, consumption represents the household aspect of economic activity, while investment; represents the aspect of economic activity done by businesses. EXPT and IMPT, on the other hand, represent trade activities between countries. Therefore, the impact of EXPTs and IMPTs on EG is essential in analyzing issues such as FT deficit or surplus. An increase in EXPTs can lead to an increase in output and indirectly to an increase in GDP.

On the other hand, when IMPTs increase, the costs of inputs used in production increase, resulting in a decrease in GDP. For this reason, the importance of EXPT and IMPT components in GDP is frequently discussed in macroeconomic analyses of national economies. Due to the importance of FT on the economy, researchers must examine it with different methods, examples, and periods.

For this purpose, in this study, the relations between EG and FT indicators were analyzed using the G-20 countries' data from 1997 to 2021. This study is essential in determining the contribution of FT to the country's economy and the numerical value of this contribution. In particular, Turkey's economic policy at the beginning of 2023 is based on the depreciation of the local currency against foreign currencies, the record-breaking of EXPTs, and the closing of the FT deficit. In this respect, this study is also crucial in contributing to the literature and the sector by examining the relationship between FT and EG. This research purposes to define the importance of EXPTs and IMPTs in national economies.

The study universe covers all countries with EXPT and IMPT variables in the EG equation. This wide-ranging universe allows the study results to be more general and far-reaching. However, limitations such as the fact that the study population is so large, some complications in the data collection manner, and the lack of data may be encountered. Therefore, it is crucial to carefully interpret and generalize the methods and results used in the study.

The study sample is the G-20 countries, which have an essential place in the world economy and represent great economic powers. These countries carry out a large part of world trade, and these countries take place in the platforms where many international economic decisions are made. In addition, there are different levels of development and economic structures among the G-20 countries. It can help the study results provide a broader perspective and increase the likelihood that the conclusions drawn will also apply to other countries. However, selecting G-20 countries may exclude some small but economically significant countries. Therefore, the study's results may only be valid for G-20 countries, and different results may be obtained for other countries.

In the study, the growth, EXPT, and IMPT figures of the G-20 countries for the last 25 years were taken. Co-integration tests were used to analyze the long-term relationship between the variables. In addition, Wald Tests were used to examine the short-run relationship. Causality tests were used to analyze the relationship among series.

The limitations of the study are the examining the relationship between EG and FT may be:

Lack of data: Most countries do not have EG and FT data. Therefore, the results of some studies may not be reliable.

Data mismatch: Because different countries use different data collection methods at different time intervals, there may be inconsistencies between EG and FT data. It may affect the reliability of the results of the studies.

Short-term effects: The relationship between EG and FT may be variable in the short run. Therefore, using long-term data is essential to counteract the impact of short-term fluctuations.

Causality problem: It may be thought that there is a causal relationship between EG and FT, but it may not be easy to verify this relationship. The influence of other factors should also be taken into account.

Exchange rate and price fluctuations: The relationship between EG and FT can be affected by the exchange rate and price fluctuations. The influence of these factors should also be taken into account during studies.

This research is divided into five parts. The first part is the introductory part. In the second part, studies in the literature are mentioned. The data and methodology are mentioned in the third part. The findings obtained from the research tests are mentioned in the fourth part. In the last part, the results and discussions about the research are shared.

2. LITERATURE REVIEW

In local studies in the literature, the effect of FT on EG has been analyzed with different econometric methods.

Öztürk (2006) used the descriptive analysis method with the data between 1978 and 2005 in his study. In the author's study, the International Energy Agency made predictions about the increase in oil prices. According to this forecast, oil prices are expected to increase by 50% until 2030. According to this study, Öztürk emphasizes the importance of the resumption of FT. Bahar (2006) conducted a study using the Co-integration Test and the VAR Model between 1963 and 2004. According to the findings obtained from this study, it has been determined that tourism positively affects EG. According to the co-integration test results of the study, it is claimed that there is a positive causality relationship between EG and tourism development. Yapraklı (2007) analyzed the Co-integration Test, Granger Causality test, and Vector Error Correction models between 1990 and 2006. As a result, it has been concluded that financial openness in Turkey eliminates the positive effects of trade openness on EG and that the economy is based on money production rather than on producing goods and services. As a result, it shows that the economic structure in Turkey has a growth focused on domestic demand and monetary policy rather than growing outwardly. The study highlights an important issue related to Turkey's EG strategy and policies. In addition, this research indicates that the positive contributions of financial and trade openness to growth are limited, and the economy is more dependent on monetary policy. Turkey needs to focus more on production-based policies to sustain EG. In his study, Yapar Saçık (2009) reveals the relationship between EG and FT, the internal growth model, which is the newest of growth theories, for the period 1980-2006. While this model shows that FT is a means of growth, it states that human capital is also accepted as a source of growth, like physical capital and FT, and emphasizes the importance of the endogenous growth model. The model draws attention to the necessity of human capital investments and FT for EG. It shows that investment in people (education, health) in an economy can increase EG, and FT can also be a growth-supporting factor. In addition, the author emphasizes the significance of FT and human capital investments in Turkey's development strategies and policies. According to the analysis results of the study, promoting FT for EG and increasing investments in human resources can help Turkey reach its sustainable growth and development goals (Yapar Saçık, 2019). Ekinci (2011) summarizes the results of a study conducted for 30 years between 1980 and 2010. The methods used in the research are the ADF unit root test, co-integration analysis, error correction model, and Granger causality test. According to the results, a long-term relationship was found between foreign direct investments and EG. It means that increased foreign direct investment has stimulated EG. In addition, it shows that foreign investments contribute to EG. On the other hand, no relationship could be found between foreign direct investments and employment. It shows that foreign investments have no direct effect on employment. Göçer (2013) summarizes the results of a study conducted using Panel Data Analysis for 16 years between 1996 and 2012. The research includes 11 Asian countries, such as China, S. Korea, Azerbaijan, India, Kazakhstan, Malaysia, Russia, Pakistan, Singapore, Thailand, and Turkey. According to the results, it was determined that a 1% increase in R&D expenditures increased EXPTs of high-technology products by 6.5%, EXPTs of information and communication technologies by 0.6%, and EG by 0.43%. These data indicate that R&D spending has a beneficial impact on economic performance and EXPTs in these nations. The increase in high-tech product EXPTs reflects these countries' competitiveness and technological capabilities. With the increase in R&D expenditures, these countries are seen to gain more competitive advantage in high-tech products and increase their EXPTs. The increase in the EXPTs of information and communication technologies shows that R&D expenditures encourage technological innovations and provide a competitive advantage in this field. As a result of the study, the author concluded that the countries covered in the research realized more EXPTs in the information communication technologies sector and supported the growth in this field. Finally, the impact on EG is also noteworthy. It was found that the increase in R&D expenditures increased EG by 0.43%. It shows that R&D activities play a role in increasing EG potential. Çelik and Direkci (2013) summarize the results of a study conducted in Turkey from 1991-2010. The author's study used the ADF test for co-integration and causality analysis. According to the results, it has been determined that foreign debt in Turkey harms EG. It means the external debt increase negatively affected Turkey's EG performance. The co-integration analysis shows a long-run relationship between external debt and EG. In other words, it has been concluded that foreign debt negatively affects EG in the long run. The causality analysis, on the other hand, shows that there is a relationship that external debt affects EG. This result shows that the increase in external debt reduces EG. Mercan et al. (2013), co-integration and boundary test analysis were performed using Turkish Central Bank data. This study summarizes the results of a study conducted in Turkey. In the study, Pesaran et al. (2001) analysis was carried out with the boundary test approach he developed. According to the study's findings, co-integration was detected between the variables. It means a long-term relationship exists between financial growth and EG. As a result of their studies, the authors concluded that this relationship was positive and statistically significant. This result shows that financial development encourages EG. The development in the financial sector can be associated with the accumulation of capital, increased investments, and the general improvement of economic activity. These findings are based on a study using Central Bank data. However, it should be noted that the interaction of other factors and different periods are not considered. The complexity of the relationship between financial development and EG may require broader analysis and research. As a result, it is supported by the study's findings that financial development has a positive and statistically significant effect on EG. These results show that the focus of economic policies on the development of the

financial sector can stimulate EG. Vergil and Sinay (2013) summarize the results of a study covering 1989-2009 to understand the effect of knowledge transfers through FT on EG in Turkey. Johansen Co-integration Test and VAR (Vector Auto Regression) methods were used in the study. The Johansen Co-integration Test is a method used to analyze the long-term relationship among data series. At the same time, VAR analysis is a method used to examine the dynamic relationship between variables. According to the study's findings, the effect of knowledge transfers through FT on EG has been determined. However, the statement did not include more specific information about the direction and dimensions of the impact. These results were obtained through analyzes made in Turkey. As a result, this study investigated the effect of knowledge transfers through FT in Turkey on EG and found a general effect. In addition, the following studies by foreign researchers found a positive relationship between EG and FT.

Edwards et al. (1998) discussed the effects of FT on EG and showed that economic openness increases productivity and growth. Frankel et al. (1999) found that FT positively affects EG. Rodriguez et al. (2000) analyzed the effect of FT on EG and trade policies on EG, as well. Dollar et al. (2004) revealed a positive relationship among FT, EG and poverty reduction. Li et al. (2005) examined the effect of China's membership in the World Trade Organization (WTO) on EG and found that FT supports growth.

3. DATA AND METHODOLOGY

3.1. Data

G-20 consists of Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, South Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, and the United States, and the European Union (EU). The E.U. is included in the G-20 not as a country but as a community.

The G-20 comprises countries that come together for global economic cooperation and decision-making. The G-20 (Group of Twenty) is an international organization of the world's largest economies. Member countries represent approximately 90% of the world economy and approximately 80% of the world's population. Two-thirds of the world's population lives in these countries.

Table 1: Variables Used in the Study

Variable	Symbol	Source
Economic Growth	GDP	World Bank
Import	IMPT	World Bank
Export	EXPT	World Bank

The variables and symbols in Table 1 are the sources of the World Bank.

The variables of the research are as follows:
Growth: GDP (Gross Domestic Product) representing EG
Imports: The sum of goods and services that a country purchases from other countries
Export: The sum of goods and services sold by a country to buyers in other countries

The data consists of 25 years between 1997 and 2021 from 19 countries within the G-20 organization. Annual data were used in the study. After obtaining the raw data in the study, logarithmic transformations were made.

The EG variable represents GDP. While the IMPT variable expresses the total of goods and services entering the country, the EXPT variable expresses the sum of the goods and services leaving the country.

3.2. Method

Equation (2) is applied to define the model's validity in the research.

$$GDP = f(IMPT, EXPT) \quad (2)$$

In equation (2), GDP shows the growth in the country's economies, IMPT shows the growth in EXPTs, and EXP shows the growth in EXPTs. GDP is defined as the dependent variable in this equation. In addition, IMPT and EXPT are defined as independent variables in this equation.

The logarithm of all variables has been taken.

$$lnGDP = \alpha + \beta_1 lnIMPT + \beta_2 lnEXP + \varepsilon_{it} \quad (3)$$

in this equation, the constants α and ε are defined as error terms. A 5-step approach is used to estimate the equation (3).

In the first step, cross-sectional dependence (CD) between variables needs to be verified before analyzing the presence of

co-integration between variables. For this purpose, B.-P. LM, P. Scale L.M. and P. CD tests were used.

If there is cross-dependence between data sets, second-generation unit root tests should be chosen. For this, CIPS and CADF analysis were applied. In order to apply co-integration tests, all variables must be stationary at the same level (*I(0)* or *I(1)*).

In the third step, co-integration tests are applied to identify the existence of a long-term equilibrium link between the series. For panel co-integration analyses, Pedroni (1999), Johansen-Fisher (Maddala et al., 1999) and Kao (1999) co-integration tests, which are frequently employed in the literature, are preferred.

In the fourth step, DOLS test was implied to define the long-term coefficients of the series. DOLS outperforms FMOLS in terms of performance (Kao et al., 2001).

$$\ln E_t = \beta_{0i} + \beta_{1i}\ln BS_{it} + \beta_{2i}\ln WOB_{it} + \sum_{k=-K_i}^{K_i} \delta_k \Delta \ln BS_{it-k} + \sum_{k=-K_i}^{K_i} \delta_k \Delta \ln WOB_{it-k} + \varepsilon_{it} \quad (4)$$

The endogenous feedback effect is regulated by $\hat{\beta}^*_{D,i}$. Equation (4) displays how it is explained. Ki and -Ki present leading and lagging ranks in equation (4).

$$\hat{\beta}^*_{GD} = N^{-1} \sum_{i=1}^{N} \hat{\beta}^*_{D,i} \quad (5)$$

The panel DOLS estimator might be determined as Equation (5).

$$t_{\hat{\beta}^*_{GD}} = N^{-1/2} \sum_{i=1}^{N} t_{\hat{\beta}^*_{D,i}} \quad (6)$$

$\hat{\beta}^*_{D,i}$ indicates the traditional DOLS estimator and represents the *i* $_{th}$ member in equation (6).

$$t_{\hat{\beta}^*_{GD}} = N^{-1/2} \sum_{i=1}^{N} t_{\hat{\beta}^*_{D,i}} \quad (7)$$

As a result, equation (7) may be used to represent the equivalent t-ratio.

Finally, the corresponding t-ratio can be explained by equation (7).

In the fifth step, Vector Error Correction Model (V.E.C.M.) was applied to analyze the robustness of the DOLS test results. The long-term co-integration relationship between the series can be explained by the error correction term (ECT_{t-1}) coefficient of VECM (Özparlak et al., 2023). If ECT_{t-1} has a statistically significant negative coefficient, it can be said that there is a constant and long-term relationship among the variables (Ampofo et al., 2021).

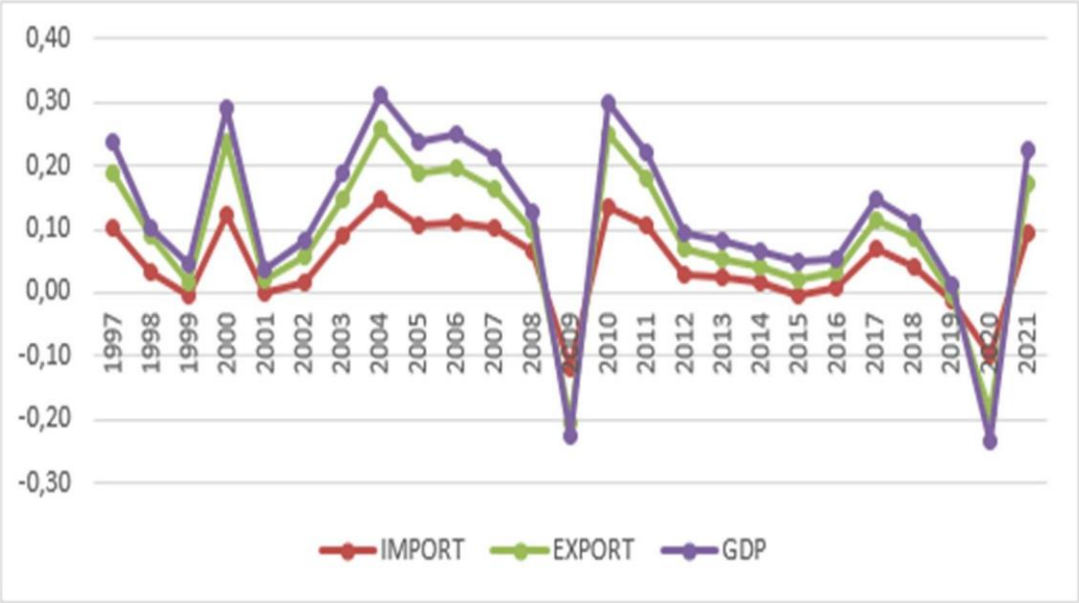
In addition, causality relationships between the variables in the research equation were analyzed with Wald Tests. The Wald test determined short-term causality according to whether each lag of the study's variables was significant.

4. FINDINGS AND DISCUSSIONS

4.1. Trend Analysis

Figure 1 shows the fluctuations of average IMP, EXPT, and GDP values between 1997 and 2021. The graph shows sharp decreases were experienced in IMP, EXPT, and GDP values due to the economic crises and epidemics in 2009 and 2020. In general, changes in average import (IMPT), export (EXPT), and EG (GDP) values among G-20 countries show how dynamic the economic activities and trade between countries are. Increasing these values is usually a positive sign of EG because more goods and services are produced and consumed. However, a sustainable EG strategy is required for this growth to be permanent and lead to economic development. Evaluating the sustainable development performances of the G-20 countries is a current issue for the world (Özparlak, 2021b). EG strategies may vary depending on countries' domestic and international trade and investment policies. It is the main factor causing the decrease in the IMP, EXPT, and GDP values of the G-20 countries in the 2020-2021 period. The pandemic has caused a worldwide decline in demand, and the economic activities of many countries, including their trade and tourism sectors, have been severely affected. Therefore, the IMPT and EXPT values of the countries decreased, and thus, the GDP decreased. In addition, the quarantine measures implemented due to the epidemic caused the limitation of production activities and led to a decline in economic activities. It caused a decrease in the IMP, EXPT, and GDP values of the G-20 countries. However, many countries took economic stimulus measures to contain the epidemic and made efforts to revive economic activity. Therefore, as of the end of 2021, some countries started to see a recovery in IMP, EXPT, and GDP values.

Figure 1: Average IMPT, EXPT, and GDP Values of G-20 Countries between 1997 and 2021



4.2. Descriptive Statistics and Correlation Analysis

Table 2 includes the descriptive statistics of the data of the study.

Table 2: Descriptive Statistics

	*ln*GDP	*ln*IMPT	*ln*EXPT
Mean	-0.81	-0.27	-0.46
Median	-0.8	-0.26	-0.45
Max	-0.56	-0.04	-0.23
Min	-3.14	-2.85	-3.02
Stand. Dev.	0.16	0.15	0.15
Skewness	-7.08	-11.24	-10.67
Kurtosis	91.98	189.28	177.38
Jarque-Bera	160665.8	696765.2	610836.9
Prob.	0.0000	0.0000	0.0000
Total	-385.15	-130.12	-216.39
Tot. Stand. Dev.	12.59	10.57	10.80
Number of Obs.	475	475	475

Table 3 demonstrates the correlation relationship between the variables in the study. Accordingly, a positive, moderately statistically significant correlation exists between *ln*GDP and *ln*IMPT. In addition, there is a positive, weak-grade statistically significant relationship between *ln*GDP and *ln*EXPT. In addition, there is a positive, moderate, and statistically significant relationship between *ln*IMPT and ln *ln*EXPT. Correlation test findings are consistent with previous research.

Table 3: Correlation Table

	*ln*GDP	*ln*IMPT	*ln*EXPT
***ln*GDP**	1		
***ln*IMPT**	.48***	1	
***ln*EXPT**	.26***	.40***	1

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.3. Breusch Pagan Lagrange Multiplier Test (LOAD-POP)

Table 4 displays the results of the B.-P. LM, P.Scale L.M. & P. CD tests. This test will support the acceptance of the existence of cross-sectional dependence between the series. As shown in Table 4, all tests accept the existence of CD among the variables.

Table 4: Cross-Sectional Dependence Tests

Test	Stat.		d.f.
B.-P. LM	1081.68		0.000
P. Scaled LM	49.24	171	0.000
P. CD	27.76		0.000

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.4. Unit Root Tests

The results of CIPS and CADF second generation unit root tests are given in Table 5. In order to apply co-integration analysis, the variables should be stationary at either the *I(0)* or *I(1)* level. According to the unit root test results of the research, all variables are stationary at *I(0)* or *I(1)* level.

Table 5: Unit Root Tests

	CIPS		CADF	
	Level	**Δ**	**Level**	**Δ**
***ln*GDP**	-5.69***	-6.96***	-1.63	-3.11***
***ln*IMPT**	-3.60***	-5.41***	-6,44***	-4.83***
***ln*EXPT**	-3.57***	-5.09***	-6.35***	-5.82***

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.5. Co-integration Tests

Co-integration refers to situations where the behavior of two or more related time series depends on each other, but they cannot be considered random walking alone. Co-integration tests are used to detect and analyze the existence of such relationships.

4.5.1. Pedroni Co-integration Test

In Table 6, the results obtained from the Pedroni co-integration test are shared.

Table 6: Pedroni Co-integration Test Results

	Stat.	Prob.	Weight Stat.	Prob.
Panel v- Statistic	-2.76741	0.9972	-2.19493	0.9859
Panel rho- Statistic	-6.89256	0.0000	-7.55589	0.0000***
Panel PP- Statistic	-9.52775	0.0000	-12.2364	0.0000***
Panel ADF- Statistic	-9.39894	0.0000	-11.3304	0.0000***
	Stat.	**Prob.**		
Group rho-Statistic	-7.13476	0.0000***		
Group PP- Statistic	-15.9642	0.0000***		
Group ADF- Statistic	-13.8785	0.0000***		

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively. Trend assumption: linear deterministic trend. User-defined lag length: 1

All of the panel and group tests are significant at the 1% level, with the exception of Panel v-Statistic. Overall, the table shows that six of the seven tests included in this test confirm the existence of a co-integration link between the variables. These results rejected the H_0 hypothesis (H_0: There is no co-integration between the variables).

4.5.2. Johansen-Fisher Panel Co-integration Test

The results of the Johansen Fisher panel cointegration test are shown in Table 7. The results in Table 7 confirm the existence of a cointegration relationship between the series. Hence, the null hypothesis H_0 is rejected (H_0: There is no cointegration between the variables).

Table 7: Johansen-Fisher Panel Co-integration Test Results

Hypothesized **No. of C.E. (s)**	Fisher Statics* **(from trace test)** **Prob.**		Fisher Statistic* **(from max-eigen test)** **Prob.**	
r≤0	231.5	0.000***	171.9	0.000***

r≤1	115	0.000 ***	80.77	0.000 ***
r≤2	103.3	0.000 ***	103.3	0.000 ***

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.5.3. Kao Co-integration Test

The results in Table 8 figure out that there is co-integration between the variables. Therefore, the null hypothesis H_0 (H_0: There is no co-integration between variables) is rejected.

Table 8: Kao Co-integration Test

	t-Statistic	Prob.
A.D.F.	-3.33	0.0004***
Resd. Var.	0.04	
HAC Var.	0.00	

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.6. DOLS Test

The findings obtained from the DOLS analysis are given in Table 9. The findings from the DOLS test are consistent and statistically significant. The test results displayed that a 1% increase in IMPT implies an approximately 0.45% increase in a country's GDP score. Similarly, a 1% increase in EXPT is explained by an approximately 0.52% increase in a country's GDP score. Moreover, the results of the test are consistent with previous studies in the literature (Frankel et al., 1999; Rodriguez et al., 2000; Dollar et al., 2004; Li et al., 2005; Edwards, 1998).

Table 9: DOLS Co-integration Test Results

Panel DOLS	Coeff.	Stdn. Er.	t-stat.	Prob.
***ln*IMPT**	0.446693	0.059073	7.561692	0.0000 ***
***ln*EXPT**	0.516095	0.095561	5.400687	0.0000 ***

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

4.7. V.E.C.M. Test

According to the results in Table 10, ECT_{t-1}[1] is equal to "-0.04879". This value is negative and statistically significant. The robustness test results of the study confirmed the co-integration between the variables. Therefore, it is possible to state there is a long-term causality from the *ln*IMPT and *ln*EXPT variables. According to these results, the *ln*IMPT and *ln*EXPT variables affect the *ln*GDP variable.

Table 10: V.E.C.M. Test Results

	Coeff.	Stdn. Er.	t-stat.	Prob.
C(I)	-0.04879	0.0073	-6.6430	0.0000
C(II)	-0.54789	0.0551	-9.9513	0.0000
C(III)	-0.19050	0.0628	-3.0311	0.0026
C(IV)	-0.05555	0.0426	-1.3053	0.1925
C(V)	-0.07947	0.0441	-1.8009	0.0725
C(VI)	0.19517	0.0744	2.6245	0.0090
C(VII)	0.03068	0.0449	0.6833	0.4948
C(VIII)	-0.00004	0.0064	-0.0056	0.9956

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively. The optimum delay length selection according to AIC, L.R., FPE, SC, and H.Q. criteria is 8 delays.

[1] C(I)

4.8. WALD Test

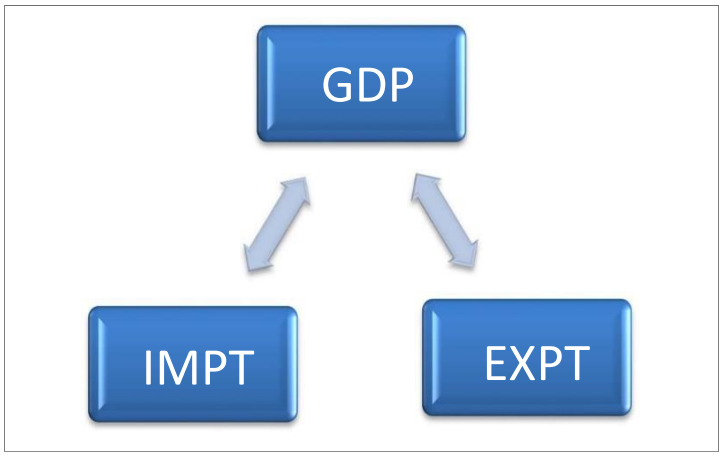
The short-term causality relationship between the series was analyzed with the Wald Test. According to the results in Table 11, it can be said that there is no significant bilateral causality relationship between *ln*IMPT and *ln*GDP in the short term. In addition, it is claimed that there is no significant causal link between *ln*EXPT and *ln*GDP. However, there is no significant relationship between *ln*EXPT and *ln*IMPT in the short term.

Table 11: WALD Test Results

Null Hypothesis	Observation	Value	Prob.
*ln*IMPT → *ln*GDP	437	5.89267***	0.003
*ln*GDP → *ln*IMPT		11.6445***	0.000
*ln*EXPT → *ln*GDP	437	3.96599**	0.020
*ln*GDP → *ln*EXPT		98.4847***	0.000
*ln*EXPT → *ln*IMPT	437	0.64149	0.527
*ln*IMPT → *ln*EXPT		0.89167	0.411

Note: ***, **, and * denotes significance level of 1%, 5% and 10% respectively.

Figure 2: Causality Established According to Wald Test Results



As seen in Figure 2, the growth in GDP in the short run causes EXPT and IMPT to grow as well. However, in the short run, the growth in IMPT and EXPT causes GDP to grow.

5. CONCLUSION AND IMPLICATIONS

The relationship between EG and FT is a subject that researchers, economists, and politicians have been working on for many years. FT refers to the trade goods and services between countries, while EG refers to the increase in a country's economic activities. Many factors influence the relationship between these two concepts. The contribution of FT to EG has an essential role in the economic development of countries. In particular, increased EXPTs and IMPTs can significantly contribute to countries' EG. In addition, thanks to FT, countries can also benefit from other countries' technological and innovative developments. It can be beneficial for countries' economic development. The relationship between EG and FT is also influenced by factors such as trade policies between countries and international trade agreements. In particular, free trade agreements can increase FT and, thus, EG by removing trade barriers between countries. However, the contribution of FT to EG may not always be positive. In particular, the increase in FT surplus in some countries may cause EXPTs to decrease domestic prices. In this case, the competitiveness of domestic producers may decrease, and EG in the country may slow down. In addition, imbalances in FT may adversely affect EG.

EXPT and IMPT variables are economic indicators that reflect the FT activities of countries. An increase in these variables indicates that a country's EXPTs and IMPTs are increasing, while their decreases indicate that these activities are decreasing. GDP is an indicator that measures the economic size of a country. An increase in this variable indicates that a country's economy is growing and producing more goods and services. In contrast, a decrease indicates that the economy is contracting and producing fewer goods and services. The analysis can be used to identify trends in the economic performance of these countries, and this information can be considered by policymakers and investors in their future decisions.

As a result, the relationship between EG and FT is multifaceted and influenced by many factors. The contribution of FT to EG is also affected by factors such as trade policies between countries and international trade agreements. Therefore, due to the importance of FT on the economy, researchers must examine it with different methods, examples, and periods.

In this context, in this study, an analysis was made with the annual data of the G-20 countries between 1997 and 2021. Co-integration tests were used as a method. The study aims to see the long-term and short-term effects of EXPTs and IMPTs on EG. The study aims to support the contribution of EXPT and IMPT variables to the EG of the country's economies. According to the findings obtained from the study, the effect of EXPTs and IMPTs on EG has been proven. With these results, it has been clearly expressed by co-integration tests that countries can improve their EXPTs and IMPTs and support their EG rates in the long run. Although the net EXPT (Net EXPT=EXPT-IMPT) variable is included in the EG (GDP) equation, the effects of EXPTs and IMPTs, which are complementary to it, on EG are demonstrated by co-integration tests.

In addition, it has been seen that there is a causality relationship between EXPTs and EG and between IMPTs and EG with short-term tests. According to the results, the increase in EXPTs and IMPTs in the short term supports EG. Because the increase in EXPTs causes the country's foreign markets to increase and the demand for production in the country to increase. As a result, the increasing demand at domestic and abroad causes an increase in domestic supply. Thus, countries create more investment, more production, and more employment.

Moreover, from the study's results, it has been concluded that the increase in EG values in the short run also causes an increase in EXPTs and IMPTs. The increase in EG can explain because of increases in the volume of supply and demand. As economies grow, they create more production, investment, and employment. It is just that the production capacities and productivity of the countries are also developing more. It means that only the economies of developing countries can reach the capacity to EXPT and IMPT more.

These results clearly indicate the importance of FT for national economies. In this direction, it is of great importance for policymakers to increase the country's FT volume to increase their countries' welfare. In addition, this study can be done with more countries and different methods over a more extended period. In this way, it can be ensured that the information obtained from the research results is more inclusive and valid.

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