

The Effect of Openness on Economic Growth for BRIC-T Countries: Panel Data Analysis¹

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Abstract

In this study, the effect of trade openness on economic growth was searched for the most rapidly developing countries (emerging markets; Brazil, Russia, India, China and Turkey, BRIC-T) via panel data analysis by using the annual data of the period from 1989 to 2010. As trade openness variable, the rate of external trade (Export+ Import) to GDP was used. According to empirical evidence derived from the study made with panel data analysis it was found that the effect of openness on economic growth was positive, and statistically significant in line with theoretical expectations.

Keywords: Trade Openness, Economic Growth, BRIC Countries, Turkey.

JEL Code Classification: E41, F43, G53

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1. Introduction

In our globalized world whether there is a relationship between trade openness (openness hereafter) and economic growth and openness is useful for the economy of the countries or not is still a matter in argument. On one hand by trying to decrease the quotas and tariffs through GATT (General Agreement on Tariffs and Trade), UNCTAD (United Nations Conference on Trade and Development) which was established to liberalize the trade between countries and WTO (World Trade Organization) which was established instead of GATT in 1995, increasing the openness of the countries to the world trade is aimed, on the other hand countries impose restrictions in the world trade by increasing the invisible barrier both to protect the domestic industries and to get income.

With non-functioning of the national development thesis through the late 1970s and the collapse of the Eastern Block at the end of 1980s it was again started to argue that openness was necessary for the national economies. In this context some economists expressed that having a certain development level was a precondition for openness policies in order to support the growth while operating the growth models based on openness and export. (Han and Kaya, 2006: 245; Sun and Parikh, 2001: 187-188). There are classical economists on the basis of the view that capital movement liberalization and openness will increase the economic growth and welfare after 1980s. According to Classical and Neoclassical economists, foreign trade makes important contributions to the development and the foreign trade is not only an effective productivity instrument but also it is the engine of the growth. Since the sources are limited in developing countries, the production on the scale of a high and sustainable growth cannot be performed and new sources can be needed for production. With the openness, domestic markets will encounter with the competition, the domestic industries which cannot compete with international prices will transfer their production factor to the other productive factors and the welfare increase will happen as a result of more effective allocation of the sources. So, for this type of economies it will be useful to make production under free trade. The precondition of providing growth under free trade is to apply a foreign trade policy which the national economies may combine with the international structure and to direct the allocation of the sources for production to the sectors determined by the international demand. The natural aim of this type of economy is the industrialization and the availability of the growth and it is suggested that the required dynamism for this will be realized by a structuring coming from external demand rather than domestic demand (Celebi, 1991: 33).

Against the liberal understanding of some classical economists, some economists defended the import substitution and drew attention to the importance of protectionism for industrialization (Bahmani, Oskooee, Niromand, 1999, s.1). The economists who arguing that import substitution suggested that free trade would not contribute to the growth among the countries that their development levels were

different, but it would be useful among the countries that their development levels are the same. For instance, in England where the Industrial Revolution began first and in many of the other countries that were trying to reach England's development level he expressed that free trade is on behalf of England and less developed countries were negatively affected for foreign trade relatively (Chang, 2004: 20).

Openness was modeled with the New Growth Theories suggested in 1980s and it was started to be tested empirically. Internal growth theories suppose that openness will stimulate the new technologies input (Harrison, 1996). No matter how the economy is open, technology input increases, technology usage becomes wide and a more rapid growth realizes as compared to a less open economy (Wu, 2004, s. 1). Internal growth models mentioning the importance of technological diffusion as the source of growth in long period generally suggest the thesis that the countries that are open to the foreign trade will reach higher steady growth rates (Grossman ve Helpman, 1990: 796). So Romer (1986) and Lucas (1988) expressed that the size of the openness in a country was proportional with the ability of adaptation to the new and imported technologies and the ability of the arrangement in production.

Shortly called as BRIC firstly in the early 2000s Brazil, Russia, India and China that have common characters like wide area, big population and rapid economic growth are accepted as the fastest growing "emerging market" in world economy (O'Neill, 2001:1-16). Total area of these countries contains more than 25% of the world area and total population of them contains more than 40% of the world population. It is argued that BRIC group would take G7 group's place and get the leadership of the world economy when the economic indicators are considered (Frank and Frank, 2010:46-54). Goldman Sachs who has studies about BRIC countries estimates that in 2050 China will be the greatest economy in the world, India will be the third, Brazil will be the fourth and Russia will be the sixth biggest economy. Based on these indicators, in our study the effect of openness on economic growth will be searched for BRIC countries and Turkey that is the most developing country after China and has a developing economy.

2. Trade Openness

The openness rate of a country is generally calculated as the proportion of foreign trade volume to GDP besides the usage of the proportion of import to GDP (Romer (1993)) and the rate of export increase (Chow, 1987; Kwan and Cotsomitis, 1991; Bahmani-Oskooee and Niromand, 1999; Anoruo and Ahmad, 2000; Dar and Amirkhalkhali, 2003). Openness also indicates the dependence of the country on the foreign trade. The size of openness rates indicates the importance level of the foreign trade for economy of the country. With the openness of the country, an increase can be seen in foreign currency revenues and expenditures at the export and import volume increase results. The share of foreign trade in GDP will increase

with the foreign trade volume increase. In Figure 1 trade openness rates of BRIC-T countries are presented.

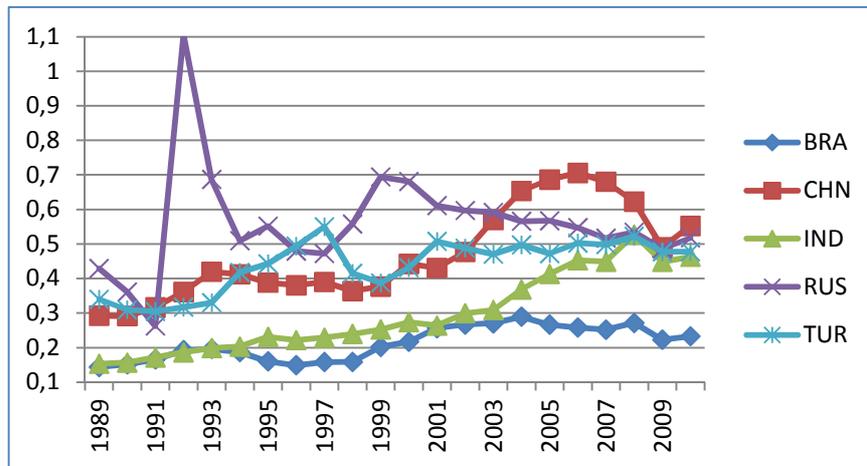


Figure 1: BRIC-T Countries Trade Openness Rates

Source: It was formed by the authors using the World Bank data.

As can be followed from Figure 1, in all BRIC-T countries called as emerging markets since 1990s we have been observing a steady openness rates and the share of foreign trade increases. It has been seen that openness rate is about 0.5 in recent years, so foreign trade volumes of the countries have reached to nearly half of their GDP. Also in Figure 2 the growth rate of BRIC-T countries are presented.

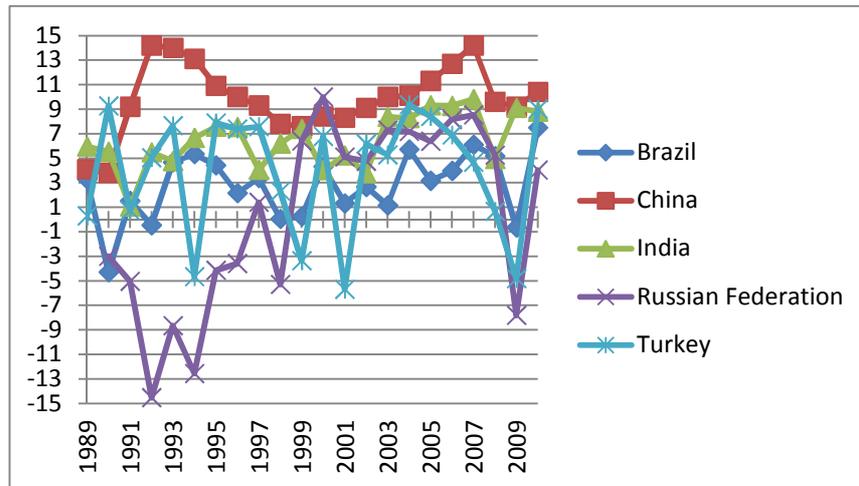


Figure 2: BRIC-T Countries Growth Rates

Source: It was formed by the authors using the World Bank data.

As can be followed from Figure 2, we see that the growth rates of the related countries are close to each other and the countries were negatively affected from the global economic crisis in 2008 and the Asia crisis in 1997. The important point in Figure 2 is China and India's positive growth throughout the whole periods. Additionally, we see that Russia and Turkey are the most affected countries from the global crisis in 2008. In Table 1 economic size of BRIC-T countries are presented.

Table 1. Economic Sizes of the Selected Countries (Billion \$)

	BRA	CHN	IND	RUS	TUR	BRIC-T	WORLD	OECD	EU
2000	645	1.198	460	260	267	2.830	32.240	26.162	8.477
2001	554	1.325	478	307	196	2.859	32.046	25.917	8.579
2002	504	1.454	507	345	233	3.043	33.305	27.085	9.362
2003	552	1.641	599	430	303	3.526	37.466	30.422	11.409
2004	664	1.932	722	591	392	4.300	42.229	33.873	13.172
2005	882	2.257	834	764	483	5.220	45.658	35.749	13.749
2006	1.089	2.713	951	990	531	6.274	49.506	37.744	14.665
2007	1.366	3.494	1.242	1.300	647	8.049	55.849	41.346	16.957
2008	1.653	4.522	1.216	1.661	730	9.782	61.305	43.816	18.252
2009	1.594	4.991	1.377	1.222	615	9.800	58.088	41.036	16.310
2010	2.088	5.927	1.727	1.480	734	11.956	63.124	42.809	16.223

Source: It was formed by the authors using the World Bank data.

As can be followed from Table 1, the GDP of the studied five countries in 2010 is totally 11,956 Billion\$. This value corresponds to the 71% of European Unity GDP, 28% of OECD countries GDP and 19% of world countries total GDP. In 2000 while BRIC-T countries total GDP corresponds to 8% of world countries total GDP, the increase of this rate to 19% in 2010 is a significant evidence to be noticed.

3. Trade Openness and Economic Growth: Literature Review

In the studies so far about the effect of the trade openness on economic growth it is difficult to say that there is a consensus. Besides Romer (1986) and Lucas (1988) in the context of internal growth theories, Dollar (1992), Barro and Sala-i Martin (1995), Sachs and Warner (1995), Sinha and Sinha (1996), Edwards (1992, 1998) asserted that the effect of the openness on economic growth was positive, Levine and Renelt (1992), Harrison (1996), Rodriguez and Rodrik (1999) claimed the opposite of this idea.

The studies regarding the relationship between openness and economic growth, country groups, the used methods and results are presented in Table 2. As can be followed from Table 2 the view that openness affects the economic growth positively is generally supported in the studies and the importance of growth based on export is emphasized.

Table 2: Abstract of Empirical Studies Regarding the Openness and Growth Relationship

Authors	Sampling and Used Econometric Method	Basic Findings
Edwards (1998)	93 countries study Method of Least Squares	He found that total factor productivity increased more rapidly in the country that is more open.
Bahmani et al. (1999)	For 59 countries 1960-92 Period Johansen cointegration method	They found that there was a positive relationship between openness and growth in 19 countries that have cointegration relations.
Ahmad and Anoruo (2000)	For 5 countries 1960-97 period Johansen cointegration method	They indicated that openness and growth variables were cointegrated, and also they expressed that there was a two-sided causality relationship between openness and growth in error correction model.
Sun and Parikh (2001)	29 region of China (1985-1995) Panel Data Analysis	They expressed that export and foreign capital inputs have significant and positive effects on economic growth.
Vamvakidis (2002)	Regression predicted for various periods	He identified that free trade has had no positive effect on the growth since 1870, even this effect was positive in 1930s and he expressed that this could be explained by the changing world trade regime.
Jin (2003)	North Korea 1953- 1999 Granger causality test	He supports the hypothesis that free trade arouses the economic growth.
Wu (2004)	APEC (Asian-Pacific Economic Cooperation) countries.	He identified that openness not only provided an effective change in country's economy, but also it changed the structure of production technology.
Kaplan (2004)	General Equilibrium Model	He identified that the changes of economic policy affected the sectors in economy and production factors in different ways.
Utkulu and Kahyaoglu (2005)	Turkey (1990-2004) Non-linear Time Series and Markow Modelling	They found that trade openness in Turkey affected the growth positively.
Yaprakli (2007)	Turkey (1990-2006) Johansen Cointegration Method	He identified that economic growth was affected positively from trade openness and there was a mutual causality between openness and economic growth in short term.
Kurt and Berber (2008)	Turkey (1989-2003) VAR analysis	They expressed that the hypothesis that openness claimed by endogeneous growth theories would increase the growth was applicable for Turkish economy.
Yang (2008)	30 countries (OECD and Asia) between 1958 and 2004 Panel Data Analysis	In the economies where the export growth is more rapid than the economic growth it was identified that foreign exchange policy helped in this situation.
Omisakin et al. (2009)	Nigeria (1970-2006) Toda-Yamamoto causality and ARDL Method	There is a positive relationship between openness and growth and a 10% increase in openness rate increases the growth nearly with the rate of 7%.

Source: Authors' studies.

4. Empirical Analysis

4.1. Data Set and Model

In this study, the effect of openness on economic growth was searched for the most rapidly developing countries (emerging markets; Brazil, Russia, India, China and Turkey, BRIC-T) via panel data analysis by using the annual data of the period from 1989 to 2010. From the variables used in the analysis y and $open$ represent the real GDP (constant 2000 US\$) and trade openness (export+import/GDP) respectively. The data was obtained from World Bank (www.worldbank.org).

For analysis, Stata 11.0 and Eviews 7 econometric analysis programmes were used and for model choice and correction tests codes were used.

4.2. Method

Panel data analysis was used to search the data from different countries together (Baltagi, 2001; Gujarati, 1999).

$$Y_{it} = \alpha + X'_{it}\beta + u_{it} \quad (1)$$

This model is based on decomposing the error term (u_{it}) to its components in terms of its individual and time effects. In the model i indicate the countries, t indicates the time. When the error term is decomposed:

$$u_{it} = \mu_i + \lambda_t + \vartheta_{it} \quad (2)$$

is obtained. This final equation is called error component model. Here μ_i indicates the individual effects, λ_t indicates the time effects. It is supposed μ_i , λ_t and $\vartheta_{it} \sim IID(0, \sigma^2)$ (Independent Identically Distributed), in other words the average of error terms is zero, its variance is stationary and it is distributed normally (having white noise process). In the Panel data analysis the stationary of the series are searched through panel unit root tests firstly. Then the type of individual and time effects should be identified. An endogeneity test should be conducted among the variables when there is a variable which is considered to have a close relation with the given variable, therefore it is suspected for its endogeneity. After that a model should be estimated and the problems of heteroskedasticity and autocorrelation in the model should be tested.

4.3. Panel Unit Root Analysis

It is accepted that the panel unit root tests which regard the information about both time and cross section dimension of the data are statistically stronger than the time series unit root tests which regard the information only about the time dimension (Im, Pesaran ve Shin, 1997; Maddala ve Wu, 1999; Taylor ve Sarno, 1998; Levin, Lin ve Chu, 2002; Hadri, 2000; Pesaran, 2006) because the variability in the data increases when the cross section dimension is included to the analysis.

The first problem in panel unit root test is whether the cross sections building the panel are independent or not. At that point panel unit root tests are classified as the first generation and the second generation. The first generation tests are also classified as homogeneous and heterogeneous. Levin, Lin and Chu (2002), Breitung (2000) and Hadri (2000) are based on homogeneous model hypothesis, whereas Im, Pesaran and Shin (2003), Maddala and Wu (1999), Choi (2001) are based on heterogeneous model hypothesis. On the other hand, the main second generation unit root tests are MADF (Taylor and Sarno, 1998), SURADF (Breuer, Mcknown and Wallace, 2002), Bai and Ng (2004) and CADF (Pesaran, 2006).

Im, Pesaran and Shin (IPS) and Levin, Lin and Chu (LLC) unit root tests will use in this study. These tests:

$$\Delta Y_{it} = \alpha_i Y_{it-1} + \sum_{j=1}^{P_j} \beta_{ij} \Delta Y_{it-j} + X'_{it} \delta + \varepsilon_{it} \tag{3}$$

is based on the model above. Here α_i ; is error correction term and when $|\alpha_i| < 1$ happens, we understand that the series is trend stationary, on the other hand when $|\alpha_i| \geq 1$ happens, it has unit root, thus it is nonstationary. The tests enable the α_i to differentiate for the cross section units, in other words heterogeneous panel structure. Tests hypotheses:

H0: $\alpha_i = 1$ for all the cross section units, so the series is nonstationary.

H1: $\alpha_i < 1$ for at least one cross section unit, so the series is stationary.

When the probability value obtained from the test results is smaller than 0.05, H0 is rejected and it is decided that the series are stationary. IPS and LLC panel unit root test results are on Table 4.

Table 4: IPS and LLC Panel Unit Root Test Results

variables	IPS		LLC	
	statistic value	p-value	statistic value	p-value
y	-0,74	0,77	0.19	0.57
Δy	-2,64	0,00	-5.57	0.00
open	3,66	0,99	-0.10	0.45
$\Delta open$	-3,79	0.00	-8.88	0.00

Note: In Panel unit root test Schwarz criterion is used and lag length is regarded as 1. Δ symbol indicates that the first differences of the variables were taken. As a test style at level value for series trend and intercept regression equation has been used.

When we study on the results on Table 4, it is observed that y and open series aren't stationary in level value and series became stationary in the first difference. In other words, in the studied period it is found out that macroeconomic variables are nonstationary and the shock effects on these variables do not disappear after a while. So we can say that the last economic crisis was destabilized the countries' economies considerably.

4.4. Breush-Pagan Lagrange Multiplier (LM) Test

In this stage of the analysis the LM test was performed in order to determine the type of time effect and individual effects (random or fixed). Because the selected countries aren't in a certain economic group, it was expected that individual effects would be random and also the time effects of financial development on the growth would be random for the countries in the studied period. Whether or not the effects are really random can be determined with the LM test (Baltagi, 2001:15).

The LM test is classified as LM1 and LM2. LM=LM1+LM2. LM1; tests the individual effects are random and LM2 tests the time effects are random. In LM1 test; $H_0: \sigma_{\mu}^2 = 0$ (no random individual effects) hypothesis is tested through LM1 statistics. LM1 statistics are calculated with the formula below.

$$LM_1 = \frac{N.T}{2.(T-1)} \left[\frac{\sum_{t=1}^T (\sum_{i=1}^N \hat{u}_{it})^2}{\sum_{i=1}^N \sum_{t=1}^T \hat{u}_{it}^2} - 1 \right]^2 \quad (4)$$

Here, μ_i indicates the individual effects in the equation (2), N; indicates the cross section (country) number, T; indicates the time dimension, \hat{u}_i indicates the prediction for the error terms in the equation (1). When the probability value obtained from the test results is smaller than 0.01, H_0 is rejected and it is decided that individual effects are random.

In LM2 test; $H_0: \sigma_{\lambda}^2 = 0$ (No random time effect) hypothesis is tested by LM2 statistics. LM2 statistics are calculated with the formula below.

$$LM_2 = \frac{N.T}{2.(N-1)} \left[\frac{\sum_{t=1}^T (\sum_{n=1}^N \hat{u}_{it})^2}{\sum_{i=1}^N \sum_{t=1}^T \hat{u}_{it}^2} - 1 \right]^2 \quad (5)$$

Here, μ_i indicates the individual effects in the equation (2), N; indicates the cross section (country) number, T; indicates the time dimension, \hat{u}_i indicates the predictions for the error terms in the equation (1). When the probability value obtained from the test results is smaller than 0.01, H_0 is rejected and it is decided that the time effects are random.

In LM=LM1+LM2 test;

$H_0: \sigma_{\mu}^2 = \sigma_{\lambda}^2 = 0$ (no random individual and time effects)

H_1 : At least one $\sigma_{\mu}^2 \neq 0$ and at least one $\sigma_{\lambda}^2 \neq 0$ (random effects both).

When the probability value obtained from the test results is smaller than 0.01, H_0 is rejected and it is decided that both of the effects are random. In this case a estimation is made through the two-way random effect model. If H_0 is accepted, model estimation is made through the two-way fixed effect model. The LM tests results are presented in Table 5.

Table 5: LM Test Results

Test	p-value	Decision
LM ₁	0,243	Individual Effects aren't Random.
LM ₂	0,052	Time Effects aren't Random.
LM	0.032	Individual and Time Effects aren't Random.

Note: 1% significance level was taken.

When we look the results in Table 5, we can see that individual effects, time effects and individual and time effects aren't random. According to LM test result the estimation was made using the two-way fixed effect model.

4.5. Hausman Endogeneity Test

In this stage of the study, whether there was a relationship between the individual effects and the explanatory variables or not was tested by Hausman method after model estimated with two way random effect model. Test hypotheses:

H0: $Cov(\mu_i, x_{it}) = 0$ No endogeneity problem.

H1: $Cov(\mu_i, x_{it}) \neq 0$ An endogeneity problem.

Here μ_i indicates the individual effects in the equation (4), but X_{it} indicates the explanatory variables in the equation (3). When the probability value of χ^2 (Chi2) obtained from the analysis is smaller than 0.05, H0 is rejected and it is decided that there is an endogeneity problem in the model. In this case fixed effects model is used (Greene, 2003). However, when H0 is accepted, random effects model is used. This prediction is effective, non-deviated and consistent. Hausman test is not an alternative for LM test. But it functions to check the decision by LM test.

Hausman test was conducted and $\chi^2=14.62$ ve χ^2 probability value =0.028 was obtained and since this value was smaller than 0.05, H0 hypothesis was rejected and it was decided that there was an endogeneity problem in the model. In this case, it is necessary to do the analysis with the fixed effects model and this result supports the LM test results.

4.6. Two-way Fixed Effects Model Estimations

Panel data analysis is estimated by the two-way fixed effect model and the result are on the Table 6.

When we look to the weighted test statistics in Table 6, we can see that model is reliable as statistically. Since there are no heteroskedasticity and autocorrelation problems in the model, the estimation results are reliable and interpretable. As can be seen from the Table 6, openness affects the economic growth positively in line with the theoretical expectations. A 1% increase in trade openness level will increase the growth with the rate of 0.27%. So this affected Turkey mostly in terms of the decrease in export depending on the decrease in external demand as a result of 2008 global economic crisis (Somel, 2009).

Table 6: Analysis Results

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t-Statistics</i>	<i>p-value</i>
OPEN	0,271	0,078	3,442	0,000
C	0,056	0,014	3,791	0.000
<i>Diagnosis Tests</i>				
Weighted R ² =0,39		DW=1,93	F _{ist} = 3,66	Root MSE=0.035
Lagrange Multiplier (LM) Heteroscedasticity Test: prob:0.230				
Decision: No Heteroscedasticity.				
Autocorrelation Test: prob:0.622				
Decision: No Autocorrelation.				

Conclusion

In this study the effect of trade openness level on economic growth was searched via panel data analysis method in the sample of five developing countries which have an important place in the world economy (emerging markets; Brazil, Russia, India, China and Turkey-BRIC-T). In the study, annual data between 1989 and 2010 periods was used. At the panel unit root analysis result it was found out that series were nonstationary and the effects of shocks on the series did not disappear after a while and therefore it was determined that macroeconomic shocks affected the economy of the countries significantly.

At the LM tests result conducted to define the applicable panel data analysis method, it was found out that individual and time effects weren't random, for that reason an analysis with the two-way fixed effect model was carried out. At the diagnosis tests result it was found out that there was no heteroskedasticity and autocorrelation problems in the model. In this regard, the estimated model is reliable.

According to the analysis results, it was determined that 1% increase in openness level increased the the growth at the rate of 0.27%. In other words, openness of economy affects the economic growth positively. The analysis results support the hypothesis that openness will increase the economic growth which is put forward by endogeneous growth theories. When the role of openness in leading new technological developments by more efficient production methods and the role of the increase in total factor productivity by contributing to an optimal allocation of resources are considered, the importance of policies to increase the openness clearly comes out in terms of both achieving integration in global economy and providing a strong and sustainable economic growth (Turedi and Berber, 2010). Therefore, as a result of policies to be implemented in this way, the increase in openness especially in exports will support economic growth by increasing the economic performance of countries. In fact, because of the contractions in demand, the effect of 2008 global economic crisis on the economic growth of countries through export channel supports the analysis result.

As a conclusion, in the study the effect of trade openness were searched and it was found that openness positive affected the economic growth. If the sustainable growth is considered as one of the most significant macroeconomic variables of the growth for the countries, the increase in foreign trade especially in export are very important.

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