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The Effects of Monetary Policy Determinants on Export in BRICS-T countries: An Empirical Analysis

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Abstract

Monetary policy implementations lead the countries' economic future. Exchange rate increases in recent years have been important in determining monetary policy. Therefore, it was inevitable not to have countries' exports, imports and foreign trade affect from this. In this study, the effect of monetary policy determinants (economic growth, exchange rates, inflation, money supply, interest rate) in Brazil, Russia, India, China, South Africa and Turkey (BRICS-T) on export, is analyzed. In the study, quarter data were used for 1996q1-2018q2 period. According to causality analysis of Dumitrescu and Hurlin (2012), a bi-directional causality is found between economic growth-export, inflation-export, money supply-export and interest rate-export. However, one-way causality was found from exchange rate to exports.

Keywords: *Monetary policy, export, BRICS-T*

1. Introduction

BRIC (Brazil, Russia, India, China) comes to mind as the fastest growing economies as of the beginning of the 2000s. It is called the center of the world's fastest developing markets (Kalaycı, 2011: 90). This abbreviation was first used by O'Neil (2001) from Goldman Sachs institution. Today, South Africa is included in this abbreviation. However, in the study, economic analysis process in Turkey is included with this group of countries. Central banks have raised various policies in order to ensure price stability. Monetary policies vary from country to country according to the socio-economic status of countries and the position of the central bank. While central banks try to achieve price stability in the long term through the monetary policies they implement, they are monitoring interest rates and exchange rates using real variables such as short-term growth and unemployment, and determine their policies. In the economies where inflation has reached a high level, policies for educing inflation can be applied (Acet, Güvenek and Soydal, 2006: 502-503).

In accordance with these explanations, the purpose of this study is to research the effects of the variables identified as monetary policy determinants on exports. Quarterly data were used for the period 1996q1-2018q2. In the first part of the study, after a brief review of the literature, the data used in the second section and the econometric method will be discussed. In the third chapter, empirical results found after econometric methods are given. In the final section, the study will be concluded with a general evaluation.

2. Literature Summary

This study researches the effects of growth, exchange rate, interest rate, inflation and money supply on exports. There is no study in which all variables are combined. However, the studies expressed on the foreign trade of each variable will be discussed and discussed in this section.

Table 1: Literature Summary

Author	Variable- Country- Data Set	Result
Kravis (1970)	55 countries 1835-1966 period Export and growth	A positive relationship between export and growth is determined.
Heller and Porter (1978)	1950-1973 period 41 countries Export and growth	A positive relationship between export and growth is determined.

Arize (1994)	1973Q1-1991Q1 Nine Asian economies Real exchange rate and foreign trade balance	Real exchange rate has a positive and significant effect on foreign trade is found
In and Menon (1996)	7 OECD (Germany, France, Japan, Italy, UK, Canada and USA) Countries real exchange rate-export-import	A causality relationship from foreign trade terms to real currency is found in France, Japan, UK, Canada and the US. Besides, a causal relationship to exchange rate in other words a full reverse causality is found in Germany and Italy.
Shirvani and Wilbratte (1997)	1973: 5-1990: Monthly data in 8 G7 countries (Canada, France, Germany, Italy, Japan, U.K. and U. S.) foreign trade balance and real exchange rate	As a result of the study, it has been determined that exchange rates have a significant effect on foreign trade balance in short term.
Ay, Erdoğan and Mucuk (2003)	1996-2002 Turkey Export and growth	According to Granger causality analysis, they determined bilateral causality between export and growth. .
Bayraktutan and Arslan (2003)	1980-2000 Turkey Foreign exchange, import and inflation	They determined that both the exchange rate and the effect of inflation on imports were negative and meaningful..
Alsu (2006)	Turkey 1985-2005 Real exchange rates, interest rates, inflation rates, foreign trade	It is found that the changes in CPI, interest rate and exchange rates effect foreign trade.
Alptekin (2009)	Turkey 1992:1-2009:1 Real foreign exchange and foreign trade	It is expressed that an improvement in real exchange rate has no effect on foreign trade.
Yapraklı (2010)	Turkey 2001: 3-2009: 6 real budget deficit, real money supply, real exchange rate index real foreign trade deficit	In the long term, it was found that the foreign trade deficit was positively and significantly affected by the budget deficit, negative and meaningful from the money supply, and positively and meaningless affected by the real exchange rate index. In the short term, it was found that the money supply had a positive and meaningful effect on the foreign trade deficit and the real effective exchange rate had a positive and meaningless effect
Sandalcılar (2012)	BRIC (Brazil, Russia, India, China) Countries 1973-2010 Export and growth	A casuality is found from exports to economic growth.
Acet, Erdoğan and Köksal (2016)	Turkey Quarterly data for the period 1998-2013 real GDP, total imports and total exports	They have identified causality from export and import to GDP. In addition, they concluded that the relationship between exports and real GDP was bi-directional.
Gümüş (2017)	BRIC (Brazil, Russia, India, China) countries 1995-2016 Export and growth	In Brazil, Russia and China, there is a positive relationship between exports and growth. On the other hand, there is a negative relationship between export and growth in India
Petek and Çelik (2017)	Turkey 1990-2015 Inflation, exchange rate, export and import	They found a one-way relationship between CPI and exports to imports. In addition, they determined a unilateral causality relationship between exchange rate and import to export.
Barak and Naimoğlu (2018)	Fragile five (Turkey, Argentina, Pakistan, Egypt and Qatar) Countries 2000-2014 Real exchange rate and foreign trade	They determined a negative and significant relationship between foreign trade and real exchange rate in both short and long term. According to the results of Granger causality test, they could not find a causal relationship between real exchange rate and foreign trade..

3. Data and Econometric Method

3.1 Data

The variables used in this study were obtained from the OECD database. However, in order to identify some of the lost data of some countries, the Central Banks of the countries were used.

Quarterly data were used for model estimation for 1996q1-2018q2 period. BRICS (Brazil, Russia, India, China, South Africa) in addition to the group of countries called on Turkey was made in model prediction. In this study, economic growth, interest rate, exchange rate, M1 money supply and inflation were used as determinants of monetary policy. The natural logarithms of the variables used in the study were taken. However, inflation is used without logarithm.

Table 2: Descriptive Statistics

Variable	No of observations	Average	Standard Deviation	Minimum Value	Maximum Value
X	540	78.98112	130.8587	5.597506	650.7717
GDP	540	4.05e+08	9.15e+09	380075.3	542.8975
ER	540	16.69168	19.17137	0.0643172	2.13e+11
INF	540	11.03768	17.17939	-2.06	74.64637
M1	540	49.59007	39.16736	0.2104325	116.8237
R	540	21.8927	26.92844	1.5	166.7048

3.2 Econometric Method

Pesaran (2007) developed a unit root test for horizontal and horizontal cross-sectional dependence and used for heterogeneous panels. Pesaran (2007) model is shown by the following equation:

$$\Delta Y_{it} = a_i + \rho_i^* Y_{it-1} + d_0 \bar{Y}_{t-1} + d_1 \Delta \bar{Y}_t + \varepsilon_{it} \quad (1)$$

$H_o: \rho_i = 0$ (for all i)

$H_1: \rho_i < 0$ (i=1,2,……, N_i), $\rho_i = 0$ (i=$N_{1+1}, N_{1+2}, \ldots, N$)

While the basic hypothesis is the unit root in each of the cross sections, the alternative hypothesis is that some of the cross sections do not contain unit roots.

When the primary differences of both Y_{it} and Y_t, the equation is as follows:

$$\Delta Y_{it} = a_i + \rho_i^* Y_{it-1} + d_0 \bar{Y}_{t-1} + \sum_{j=0}^{N} d_j + 1\Delta \hat{Y}_{t-j} + \sum_{k=1}^{N} C_k \Delta Y_{it-k} + \varepsilon_{it} \quad (2)$$

CIPS statistics is expressed as the average of CADF statistics. It is shown as follows:

$$CIPS = \frac{1}{N} \sum_{i=1}^{N} CADF_i \quad (3)$$

The cointegration test used Westerlund and Edgerton (2008) cointegration test. Westerlund and Edgerton (2008) made a regression estimate based on the Fully Modified Least Squares Estimator (FMOLS) proposed by Pedroni. Estimates using LM statistics. The equation is as follows:

$$Y_{it} = a_i + \beta_i + X_{it} + Z_{it} \quad (4)$$

If z_{it}, it is equal to the total of v_{it}+v_{it}. The model by adding LM is as follows:

$$LM_N^* = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{t=1}^{T} w_i^2 s_{it}^2 \sim N(O, var, LM_N^*) \quad (5)$$

In equation, s_{it}^2 partial total method expresses the long term variance of w_i^2 u_i. While the main hypothesis of cointegration $H_o: a_i^2 = 0$ is as available in terms of cointegration for all i, $H_1: a_i^2 > 0$ is as does not have cointergration for some i.

If the assumption of heterogeneity is made, variables are not stationary, and if there are co-integration relationships between variables, they are done by the Common Correlated Effects Mean Group (CCEMG) method developed by Pesaran (2006). Dumitrescu and Hurlin (2012) developed Granger causality testing for heterogeneous panels. The illustration of the equation is as follows:

$$Y_{it} = a_i + \sum_{k=1}^{K} \gamma_i^{(k)} Y_{it-k} + \sum_{k=1}^{K} \beta_i^{(k)} X_{it-k} + \varepsilon_{it} \quad (6)$$

The main and alternative hypothesis is as follows:

$H_o: \beta_i = 0$ i=1,……,N

The main hypothesis expresses that there is no casuality from X to Y for all panels.

$H_o: \beta_i = 0$ i=1,……,N_1

$H_o: \beta_i \neq 0$ i=$N_{1+1}, N_{1+2}, \ldots, N$

Alternative hypothesis expresses that there is no causality relations in some units.

4. Empirical Results

In order to determine the stability of the variables, the unit root test was performed and reported in table 2. Pesaran's CADF test results are shown. All of the variables that we use in the unit root test results contain unit roots in the level values. That is, the variables we use are not static at the level values. However, when the first differences of the variables are taken, the variables become stationary.

Table 3: CIPS Unit Root Test Results (Level)

Variables	Constant		Constaant+Trend	
	Statistics	P-value	Statistics	P-value
lnGDP	0.791	0.785	0.854	0.804
lnER	-0.962	0.168	-2.337	0.010
INF	-5.223	0.000	-3.859	0.000
lnM1	-0.606	0.272	-1.068	0.143
lnR	-1.823	0.034	-2.640	0.004
lnX	-1.311	0.095	-0.093	0.463

Table 4: CIPS Unit Root Test Results (First Difference)

Variables	Stable		Stable+Trend	
	Statistics	P-value		Statistics
lnGDP	-9.391	0.000	-9.182	0.000
lnER	-8.548	0.000	-7.910	0.000
INF	-10.139	0.000	-9.459	0.000
lnM1	-8.230	0.000	-6.984	0.000
lnR	-9.664	0.000	-9.383	0.000
lnX	-10.342	0.000	-10.133	0.000

In order to see some unit root tests, heterogeneity or homogeneity of variables, it would be useful to look at the homogeneity test of Pesaran and Yamagata (2008). This test will take place when the time dimension (T) is greater than the observation number (N). Our analysis is valid because it provides this condition.

The current hypothesis of this test is based on the assumption that all parameters are the same, ie equal to zero.

The alternative hypothesis is that the cross-section units are different from each other..

$$LNX = LNGDP + LER + INF + LNM1 + LNR + \varepsilon_{it} \quad (7)$$

Table 5: Homogeneity Test Results

Homogeneity Test	Statistics	P value
$\tilde{\Delta}$	5.611	0.000
$\tilde{\Delta}_{adj}$	5.773	0.000

Homogeneity test results, homogeneity of the variables will be rejected. The panel cross-section coefficients are heterogeneous.

Pesaran (2004) proposed to determine whether there is a correlation between the units. The proposed model determines the cross-sectional dependence between variables.

Table 6: Pesaran (2004) Cross Sectional Dependency Test Results

	LNX	
CD Test	**Value**	**p-value**
LM(Breusch&Pagan,1980)	854.376	0.000
CD LM(Pesaran,2004)	153.248	0.000
CD (Pesaran,2004)	28.570	0.000
Bias-adjusted CD	4.482	0.000

The null hypothesis of this test was rejected. So there is a cross-sectional dependence between variables.

According to the cross-sectional dependency test developed by Pesaran (2004), a cointegration test will be performed considering the cross-sectional dependence after the cross-section is found.

Table 7: Westerlund and Edgerton (2008) Cointegration test result (1)

Constant		
Statistics	$p-değer^a$	$p-değer^b$
6.617	0.437	0.000

Table 8: Westerlund and Edgerton (2008) Cointegration Test Results (2)

Constant+Trend		
Statistics	$p-değer^a$	$p-değer^b$
13.755	0.001	0.000

In order to perform the Westerlund and Edgerton(2008) co-integration test, the variables need not be stationary.

According to Westerlund and Edgerton (2008) cointegration test, the cointegration relationship between the variables of export and monetary policy determinants was determined in both constant and constant and trend models. The main determinant of the cointegration test was the boostrap value of the LM test.

Estimation of the coefficients of the cointegration test will be made through the proposed CCEGM method for heterogeneous panels.

Table 9: Estimation of coefficient through CCEGM Estimation

All Panel	**GDP**	**ER**	**INF**	**M1**	**R**
Coefficient	-0.526*	0.032*	-0.001	0.057*	0.044**
Standard Deviation	0.124	0.039	0.000	0.060	0.016
t value	-0.42	0.82	-2.49	0.96	2.72

*%1 and %5 shows significancy level.
** %5 shows significancy level.

According to the results in Table 9, long-term regression coefficients between exports and independent variables are expressed. According to the results of the whole panel, the effect of economic growth on exports is found to be negative in the estimation of the long-term relationship, while the exchange rate, M1 money supply and interest rate effect on exports are positive. Nevertheless, the effect of inflation on exports seems insignificant.

The causality test developed by Dumitrescu and Hurlin (2012) for heterogeneous panels will be used in this study. AIC information criterion was chosen as the delay length. In the table below, the results of the causality analysis of Dumitrescu and Hurlin (2012) were reported. According to the results, a positive and bidirectional relationship was found between economic growth and exports. Between exchange rates and exports, a one-way relationship between exchange rate and exports was determined. Inflation, M1 money supply and interest rate and exports were found to be positive and bidirectional.

Table 9: Dumitrescu and Hurlin (2012) Panel Casuality Test Results

lag		X>GDP	GDP>X	X>ER	ER>X
AIC	W-stat	59.1675	48.1819	60.0355	33.4449
	P-value	0.0000**	0.0000**	0.0000**	0.0747
AIC		X>INF	INF>X	X>M1	M1>X
	W-Stat	110.5590	364.0189	76.2755	78.8476
	P-value	0.0000**	0.0000**	0.0000**	0.0000**
AIC	W-Stat	X>R	R>X		
		39.7937	42.0557		
	P-value	0.0001**	0.0000**		

** The rejection of the current hypothesis was realized as 1% and 5%..

5. Results

In this study, for the period of 1996q1-2018q2 the effects of monetary policy determinants (economic growth, exchange rates, inflation, money supply, interest rate) on the export are analyzed in Brazil, Russia, India, China, South Africa and Turkey (BRICS-T). In this direction, it is resulted that it is heterogeneous panel in homogeneity test and our econometric analysis has been shaped in this direction. According to the results of cross-sectional dependence, the cross-sectional dependence between the variables was determined. Westerlund and Edgerton (2008) showed that the co-integration test results revealed that the variables were co-integrated; In other words, it was determined that the variables act together in the long term. According to Dumitrescu and Hurlin (2012) causality analysis, a positive and bi-directional relationship was found between economic growth and exports. Between exchange rates and exports, a one-way relationship between exchange rate and exports was found. Inflation, M1 money supply and interest rate and exports were found to be positive and bidirectional. Therefore, monetary policy makers should consider the export factor. Monetary policy makers must ensure an environmental condition where all segments make production.

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