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Research Article


Financial Development and Economic Growth in BRICS-T Countries: An Econometric Application

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ABSTRACT

In this study, the cointegration and causality relationships between economic growth and financial development were empirically analyzed using the annual data of BRICS-T countries for the period from 1991 to 2017. Access, depth, and effectiveness data, as well as the variables of Gross Fixed Capital Formation, labor force, and economic growth, representing the capital, are among the indicators representing IMF's financial development. In this empirical study, where three different models were used, the long-term relationship of capital, labor force, and one of the three indicators with economic growth was examined. In the results obtained, all of the three models were found to have cointegration relationships, and it was concluded that the variables would act together in the long term. In addition, causality relationships between access, depth and efficiency, and economic growth, which represent financial development, were also investigated in this empirical study. In the findings, it was found that economic growth was the causative of access; and that there was a two-way causality relationship between depth and economic growth, as well as between efficiency and economic growth. In light of these results, it was concluded that there was a two-way causality between financial development and economic growth.

Keywords:

BRICS-T, Dumitrescu and Hurlin Causality Test, Economic Growth, Financial Development



1. Introduction

Financial development is expressed as the increase in the number of financial instruments available in an economy as well as the spread of these instruments to wider areas of use. In brief, financial development is defined as the development of the financial markets. (Erim and Türk, 2005, p. 23). The financial development level is evaluated according to the role it plays in transforming the savings into investments in an efficient manner. Financial development provides investors with the opportunity to diversify their portfolios and enables the resources to be allocated more efficiently. In this way, the improvement in the financial system is measured by transforming scarce resources into efficient and accurate investment projects. A sophisticated financial system provides more diverse products both to the entrepreneurs who invest and to the savers, and enables the distribution of risk and strengthens the flow of information between the borrower and the lender. In this case, the credit system works more efficiently (Güneş, 2013, p. 74).

The relationship between financial development and economic growth has drawn great interest in theoretical and empirical literature due to the effects of countries on development policy. The theoretical foundations of this relationship were laid by Schumpeter and then by McKinnon, Shaw, and their students. In the first studies in this field that contribute to the economic growth process of financial development, economists concentrated on three essential points. (Kar and Tuncer, 1999, p. 21);

- Determination of the effects of financial intermediation systems on countries' economic growth performance,
- Investigation of causality between countries' financial development and their economic growth,
- The empirical analysis of the relationship between financial development and economic growth.

Although financial development is not difficult to define, it is a phenomenon that is difficult to measure, since there is not just one indicator that shows direct financial development. The fact that financial development measurement is controversial also affects the results and methods of studies examining the relationship between economic growth and financial development. When the literature is examined, it is possible to examine the causality relationship between economic growth and financial development under five main headings (Aslan and Korap, 2006, p. 5; Güneş, 2013, p. 75-76);

i. Supply-Leading Approach

This is the approach that suggests that financial development has positive effects on economic growth. Here, it is argued that a strong causality exists from financial development to economic growth. It is stated that this existing causality can be achieved by increasing the rate of savings, and thus the investments, or by increasing the efficiency of capital accumulation.

ii. Demand Leading View

This is the view that argues that developments in financial markets occur in line with the current demands of the sector, and thus, the causality is from economic growth to financial development. Economic growth affects financial development. Furthermore, economic growth increases the need for financial institutions and financial instruments. It is accepted that the financial instruments in the financial system are developing due to the necessity of economic growth.

iii. Development Phase Hypothesis

The development phase hypothesis suggests that any future investments should be directed to efficient and modern sectors instead of outdated projects in order to accelerate financial development. During the period when the degree of economic growth initially begins to increase, the opportunities posed by financial development affect economic growth positively. As a result of the redirection of savings outside the financial system into the financial system due to the diversification of financial instruments in an economy, domestic investments will increase and reveal the supply-leading phase.

iv. Mutual Interaction View

This is the view arguing that there is a mutual interaction contrary to the one-way causality between financial development and economic growth.

v. No Impact View

This is the view arguing that there is no relationship between financial development and economic growth, since the sources of economic growth are physical and human capital.

2. Literature Study

Levine et al. (2000), analyzed the data of 74 developed and underdeveloped countries covering the period of 1960-1995, using dynamic panel data and cointegration tests. In the study, loans related to financial services were treated as exogenous variables in legal regulations ranging from country to country, alongside the variables such as other intermediation services. According to the findings obtained, although the financial development has a positive effect on economic growth, the fact that the laws are arranged in a way that protects the rights of the parties, the efficiency of contracts and understandable, efficient, and well-established accounting standards contribute to financial development.

Calderon and Liu (2002), using Granger causality analysis on developing and industrial countries covering the period between 1960-1994, they argue that financial development often leads to economic development, while financial deepening promotes economic growth through both faster capital accumulation and increased productivity. Researchers have suggested that the relative impact of the fact that developing countries have more opportunities in financial and economic developments, lead to the situation that financial intermediaries have a greater impact on emerging economies. Another important finding of the study is that it takes time to see the effects of financial depth on the real sector more clearly.

Hagmayr et al. (2007) examined the relationship between financial development and economic development through panel data analysis using data from macroeconomic and financial indicators identified by Turkey, Croatia, Bulgaria, and Romania for the 1995-2005 period. The researchers obtained the finding that the bond markets and capital stock had an important and positive effect on growth.

Acaravcı et al. (2007) examined the relationship between the financial and economic development of Turkey between 1986-2006 and causality long-term relationship with vector error correction model (VECM) and short-term relationship with the Granger causality test. According to the findings obtained, it was observed that a one-way causality relationship between financial development and economic growth exists. In addition, it has been suggested that the loans provided by a healthy banking system contribute to the development of the economy. Moreover, the study revealed that the supply leading hypothesis is valid in Turkey.

Rault et al. (2009) conducted a study on financial development and economic growth, in order to examine the banking and financial sectors of the last 10 countries that became members of the European Union as of 2009. The researchers made predictions with a dynamic panel data model, using indicator data such as real sector loan utilization rate, stock exchange value, and liquid assets of the financial sector of the countries in question between 1994-2007. The researchers also conducted a Granger causality test to reveal the causality relationship between financial development and economic growth. According to the findings of the research, it was found that the contribution of underdeveloped exchange markets and credit markets, which do not have sufficient depth, to economic growth is limited; whereas an efficient banking sector accelerates the growth. Another important finding of the research is that there is a causality relationship from financial development to economic growth; however, it does not exist in the opposite direction.

In their study in which they analyzed the macroeconomic and financial indicators of 84 countries between 1960-2004, Rousseau and Wachtel (2011) found that financial depth has a strong impact on growth, as long as a country can avoid a financial crisis. Researchers also suggested that excessive financial deepening could lead to both inflation and weakened banking systems and that this would lead to financial crises hampering growth.

In their studies, Rachdi and M'barek (2011) investigated the causality aspect between financial growth and economic growth using the data of 1990-2006 of 4 MENA (The Middle East and North Africa: Egypt, Morocco, Tunisia, and Turkey) and 6 OECD (Spain, Greece, Iceland, Italy, Portugal, and Sweden) countries using the panel data cointegration and GMM analysis method. According to the findings of the study, it was found that there is a strong positive relationship between financial development and real GDP, that this relationship is a two-way causality relationship in OECD countries, and that there is a one-way causality relationship between economic growth and financial development in MENA countries.

In his study, which examined the impact of the development of the financial sector on macroeconomic variables in developing Asian countries covering the period of 1992-2011, Bayar (2014) found that banking and stock markets had a positive effect on economic growth.

Caporale et al. (2015) examined the relationship between financial development and economic growth using a dynamic panel model, using the data of the banking and financial sectors of 10 new member states that joined the European Union later, covering the period between 1994-2007. Researchers have found that insufficient financial depth contributes to economic growth in a positive way, although it is limited, but a more efficient banking sector accelerates growth. In addition, the fact that a better arrangement and supervision have a positive effect on economic growth is another important finding of the research.

Yıldırım and Gökalp (2015) examined the relationship between the corporate structure and economic growth of 38 developing countries with panel data analysis using data from 2000-2011. According to the findings of the study, it has been determined that a fair legal system has a positive effect on regulations of trade restrictions, restrictions on foreign investment, dismissal, and the degree of utilization of the private sector's banking system and macroeconomic performance. On the other hand, it was found that it has a negative effect on factors such as judicial independence, public expenditures, transfers and subsidies, civil rights, collective agreements, and military tutelage.

Cojocaru et al. (2016) examined the relationship between financial development and economic growth in transition economies of Central and Eastern Europe and the Commonwealth of Independent States. In the study, the transition process after the dissolution of the Soviet Union was examined with panel data analysis using the data between 1990-2008. According to the study, it was found that the financial system had an impact on economic growth. In addition, it is suggested that private sector loans have a positive effect on the economic growth of transition economies, whereas the efficiency and competitiveness of the financial system are more important.

Borlea et al. (2016) examined the relationship between financial development and economic growth using Granger causality analysis in the study, which covers 10 economic regions worldwide consisting of developed and developing countries, where data from 1998 to 2011 were used. Researchers have found that market capitalization, which represents the total market value of securities in six out of 10 economic regions, has a causality relationship with economic development in the long term. However, no causality relationship between economic development and market capitalization has been found. Furthermore, another finding from the study is that when stock exchanges are considered, it is observed that financial development causes economic growth in some regions, while economic growth causes financial development in some other regions.

Using 1986-2010 data of 21 Sub-Saharan African countries, Ekpeno (2016) examined the impact of financial development on economic development with the GMM model. According to the findings obtained from the study, it was found that financial development in 21 Sub-Saharan African countries did not contribute to their economic development, but corporate development and financial development had a statistically insignificant and positive effect on economic growth. Researchers attribute this to the undeveloped corporate infrastructure of these countries.

Ofori-Abebrese et al. (2017) examined the relationship between financial development and economic growth using Ghana's data for the period 1970-2013

with ARDL and Granger causality test. Researchers have found that private sector loans had a positive and significant relationship with economic growth in the short and long term, while there was a statistically significant relationship to the contrary between deposits and economic growth. They also found that there was a two-way relationship between financial growth and economic growth, in other words, mutual interaction.

Demetriades et al. (2017) examined the effects of vulnerability on the finance-growth relationship using the financial vulnerability indicator data of 124 countries between the periods 1998-2012. According to the findings of the study, it was found that financial vulnerability and private sector loans affected growth negatively, and financial vulnerability also had a negative effect on growth, even if a banking crisis was avoided.

In his study in which he utilized VAR and VEC based Granger Causality Test using the data of MENA (The Middle East and North Africa) countries for the period 1988-2012, Puryan determined that there was a one-way relationship from the banking sector to economic growth, and there was a mutual causality relationship between the development in the stock market and economic development.

Kacho and Damardeh (2017) examined the impact of 27 OECD countries' financial development and corporate quality (accountability, political stability, government effectiveness, quality of legal regulations, the effectiveness of laws, audit factors) on economic growth for the period between 2002-2014. According to the findings obtained, it was found that financial development and corporate quality had a positive and significant effect on economic growth.

Helhel (2018) analyzed the relationship between bank loans and economic growth in the period 2002-2016 in Brazil, India, Indonesia, South Africa, and Turkey, known as the Fragile Five, using VECM, DOLS and FMOLS tests. In the study, the researcher found that there was a causality relationship from economic growth to financial development; in other words, the demand-following hypothesis is valid.

Şahin and Durmuş (2018) analyzed the relationship between banking sector loans and economic growth in Turkey between the periods 2006:01 and 2017:06 using the Gregory-Hansen cointegration test with structural break. As a result of the analysis, the researchers found that an increase of 1% in the banking sector increased the economic growth by 0.37%. It was also found in the study that there was a one-way causality relationship from the loans extended in the banking sector to economic growth, using the Fourier Toda-Yamamoto causality test.

Demez et al. (2018) examined the relationship between financial development and economic growth in Turkey during the period of 2016-2018 with Hacker and Hatemi-J Bootstrap causality analysis. According to the findings of the research, it was found that there was a one-way causality relationship from domestic loans to economic growth and that the supply-leading hypothesis is valid in Turkey's economy.

Polat (2019) investigated whether or not financial development has any determining ramifications on the effect of the trade deficit on economic growth. To this end, he examined the data of 41 developing countries between 1995-2014 with dynamic

panel data analysis. According to the research findings, it was suggested that trade deficit and financial development did not have a direct impact on economic growth.

In their study, Yağlı and Topçu (2019) examined the causality relationship between financial growth and economic growth of G7 countries in the period of 2005-2015 with the panel vector error correction model. According to the findings of the research, it was found that there was no causality relationship between financial depth and economic growth in the short term, and that there was a one-way causality relationship from financial depth to economic growth in the long term. According to another finding of the study, it was found that there was a two-way causality relationship between financial development and economic growth, and in the long term, there was a one-way causality relationship from financial development to economic growth. In addition, it was found that there was no causality relationship between legal regulations and economic developments, and also that there was a one-way causality relationship from legal regulations to economic growth in the long term.

Erataş-Sönmez and Sağlam (2019) conducted a study involving the financial development and per capita real GDP data of Brazil, China, Mexico, Indonesia, Turkey, Egypt, and India covering the period 1980-2016. Findings from the research support the supply-leading hypothesis that there is a one-way causality relationship from financial development to growth for countries, and in this context, financial development positively affects growth.

In another study, Helhel (2019) analyzed the relationship between stock market development and economic growth in Fragile Five, in the period of 2002-2016 with panel co-integration and causality tests. According to the findings from the study, it was revealed that there was a causality relationship from stock market development to economic growth, and the supply-leading hypothesis is valid in these countries.

3. Data, Methodology and Empirical Analysis

3.1. Data

In this empirical study, annual data covering the period from 1991 to 2017 for Brazil, Russia, India, China, South Africa-Turkey that are BRICS-T countries was used. As a representative of economic growth, Gross Domestic Product (GDP), Gross Fixed Capital Formation (K), labor force (L), and access (A), depth (D), efficiency (E) data that constitute the financial development index were used. Access refers to bank branches per 100,000 adults and the number of ATMs per 100,000 adults. The depth covers bank loans to the private sector, pension fund assets, investment fund assets, and insurance premiums. Efficiency data is comprised of the collection of data on the banking sector's net interest margin, the spread of lending deposits, the ratio of non-interest income to total income, the ratio of overhead expenses to overhead expenses, the return on assets, and return on equity.

GDP, K, and L data were taken from the World Bank database and A, D, E data from the IMF database. In the study, three models were taken and analyzed. These models are:

$$\text{Model 1: } GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}A_{it} + \varepsilon_{it} \quad (1)$$

$$\text{Model 2: } GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}D_{it} + \varepsilon_{it} \quad (2)$$

$$\text{Model 3: } GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}E_{it} + \varepsilon_{it} \quad (3)$$

Here $i = 1, 2, \dots, N$ refers to the number of sections in the panel, $t = 1, 2, \dots, T$ refers to the time dimension.

3.2. Methodology and Empirical Analysis

3.2.1. Cross-Sectional Dependence Analysis

Cross-sectional dependencies of variables must first be tested for the selection of the unit root test to be used in panel data studies. For the findings, the cs should be used in case of cross-sectional dependence in variables. Tests that will be used without determining the cross-sectional dependence of the variables can lead to erroneous results. cross-sectional dependence tests used in the study are Breusch-Pagan (1980) CD_{LM} test and Pesaran (2004) CD_{LM} tests. The zero hypothesis of both tests is that "variable does not have a cross-sectional dependence", and the alternative hypothesis is "variable has a cross-sectional dependence". The reason for choosing these tests is that both tests give good results when the time dimension is larger than the cross-section dimension ($T > N$).

VARIABLES	GDP	GFC	L	A	D	E
CDLM (BP, 1980)	347.353 (0.000)	324.033 (0.000)	260.007 (0.000)	294.409 (0.000)	253.236 (0.000)	115.090 (0.000)
CDLM (Pesaran, 2004)	59.583 (0.000)	55.326 (0.000)	43.636 (0.000)	49.917 (0.000)	42.400 (0.000)	17.178 (0.000)

Note: Probability values are shown in parentheses.

Table 1. Results of Cross-Sectional Dependence Tests

Breusch-Pagan (1980) $CDLM_1$ and Pesaran et al. (2004) $CDLM_2$ test results are reported in Table 1. According to CDLM (BP, 1980) test results, test statistics of GDP, GFC, L, A, D and E variables were found to be 347,353; 324,033; 260,007; 294,409; 253,236 and 115,090 respectively. CDLM (Pesaran, 2004) test results, test statistics of GDP, GFC, L, A, D and E variables were found to be 59,583; 55,326; 43,636; 49,917; 42,400 and 17,178 respectively. According to these findings, the null hypothesis was rejected according to both test statistics, and the alternative hypothesis was accepted. In this manner, the shocks that may occur in any variable in one country may affect the variable in the other country as there are close economic nexuses.

3.2.2. Unit Root Test Analysis

Since cross-sectional dependence was found in the variables (Table 1), Bai and Ng (2004) unit root test, among the second generation panel unit root tests, was used in the study. Bai and Ng (2004) unit root test, which separately tests stationarity in residual and general items, addresses the following dynamic factor model:

$$Y_{it} = \beta_i + \lambda_i f_i + \rho_i Y_{it-1}^0 + \varepsilon_{it} \quad (4)$$

Consistent estimation of the factors can be made regardless of whether the residues are unit-rooted or not, since the stationarities of the factors and residual elements are tested separately. These two terms may have different dynamic properties; for example, one may be stationary while the other is not stationary or is integrated into different orders. Bai and NG (2004) unit root test statistics:

$$P_{\hat{\epsilon}}^c = \frac{-2 \sum_{i=1}^N \log P_{\hat{\epsilon}}^c(i) - 2N}{2\sqrt{N}} \xrightarrow{d} N(0,1) \quad (5)$$

Where, $P_{\hat{\epsilon}}^c(i)$ is the p-value of ADF tests of residual shocks estimated for the section (Tatoğlu, 2013).

	LEVEL		1ST DIFFERENCES	
	Statistic	p-value	Statistic	p-value
GDP				
$Z_{\hat{\epsilon}}^c$	-2.0891	0.9817	3.0230	0.0013
$P_{\hat{\epsilon}}^c$	1.7654	0.9997	26.8096	0.0082
K				
$Z_{\hat{\epsilon}}^c$	-0.8088	0.7907	3.6050	0.0002
$P_{\hat{\epsilon}}^c$	8.0376	0.7822	29.6606	0.0031
L				
$Z_{\hat{\epsilon}}^c$	-1.4018	0.9195	2.1678	0.0151
$P_{\hat{\epsilon}}^c$	5.1328	0.9534	22.6200	0.0311
A				
$Z_{\hat{\epsilon}}^c$	-1.4396	0.9250	2.1801	0.0146
$P_{\hat{\epsilon}}^c$	4.9475	0.9597	22.6801	0.0306
D				
$Z_{\hat{\epsilon}}^c$	-2.2277	0.9870	6.2297	0.0000
$P_{\hat{\epsilon}}^c$	1.0866	1.0000	42.5193	0.0000
E				
$Z_{\hat{\epsilon}}^c$	-0.8862	0.8123	7.3485	0.0000
$P_{\hat{\epsilon}}^c$	7.6583	0.8112	48.0000	0.0000

Note: The maximum number of common factors is taken as 2.

Table 2. PANIC Panel Unit Root Test Results

Table 2 presents Bai and Ng (2004) PANIC panel unit root test results. According to $P_{\hat{\epsilon}}^c$ and $Z_{\hat{\epsilon}}^c$ test statistics, and as per the test statistics of GDP, K, L, A, D, and E variables according to a level of 5% significance, the null hypothesis of “the variable is unit rooted”, **could not be** rejected. By taking the difference of the variables, the null hypothesis was rejected and the alternative hypothesis “variable is stationary” was accepted. For this reason, it was assumed that the variables are stationary in first order I (1).

3.3.3. Homogeneity Test Analysis

Pesaran and Yamagata (2008) have developed two Tests to detect homogeneity in the panel:

$$\text{For large samples: } \tilde{\Delta} = \sqrt{N} \frac{N^{-1}\tilde{S}-k}{\sqrt{2k}} \quad (6)$$

$$\text{For small samples: } \tilde{\Delta}_{adj} = \sqrt{N} \frac{N^{-1}\tilde{S}-k}{\sqrt{\text{Var}(t,k)}} \quad (7)$$

Where N; refers to the number of sections, S; refers to Swamy test statistics, k; refers to the number of explanatory variables and Var(t, k) refers to the standard error. The null hypothesis of the tests is “cointegration coefficients are homogeneous”, and alternative hypothesis is “cointegration coefficients are heterogeneous”.

MODEL 1		
$GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}A_{it} + \varepsilon_{it}$	Statistic	p-value
Cross-section dependency tests:		
CDLM (BP,1980)	43.809	0.000
CDLM (Pesaran, 2004)	4.164	0.000
Homogeneity tests:		
$\tilde{\Delta}$	8.598	0.000
$\tilde{\Delta}_{adj}$	9.487	0.000
MODEL 2		
$GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}D_{it} + \varepsilon_{it}$	Statistic	p-value
Cross-section dependency tests:		
CDLM (BP,1980)	38.862	0.000
CDLM (Pesaran, 2004)	3.261	0.001
Homogeneity tests:		
$\tilde{\Delta}$	7.836	0.000
$\tilde{\Delta}_{adj}$	8.645	0.000
MODEL 3		
$GDP_{it} = \gamma_2 + \beta_{3i}K_{it} + \beta_{4i}L_{it} + \beta_{3i}E_{it} + \varepsilon_{it}$	Statistic	p-value
Cross-section dependency tests:		
CDLM (BP,1980)	43.471	0.000
CDLM (Pesaran, 2004)	4.102	0.000
Homogeneity tests:		
$\tilde{\Delta}$	6.529	0.000
$\tilde{\Delta}_{adj}$	7.204	0.000

Table 3. Cross-sectional Dependence and Homogeneity Tests

In order to choose the cointegration test, first of all, cross-sectional dependence analysis should be conducted in 3 models. cross-sectional dependence and homogeneity results of three models are given in Table 3. According to the findings obtained, the class hypothesis that “the panel does not have a cross-sectional dependence”, has been rejected. Thus, all three models have cross-sectional dependence. Homogeneity test results are also given in Table 3. In three models, the null hypothesis “slope coefficients are homogeneous in the panel” has been rejected and it was found that the slope coefficients are heterogeneous in the panel.

3.3.4. Cointegration Test Analysis

It was found that the slope coefficients in the cross-sectional dependence and cointegration equations are heterogeneous in the panel. (Table 3). Therefore, the panel cointegration test to be used must comply with these requirements. Westerlund and Edgerton (2007) panel cointegration test used in the study is estimated as follows:

$$LM_N^+ = \frac{1}{NT^2} \sum_{i=1}^N \sum_{i=1}^T \hat{\omega}_i^{-2} S_{it}^2 \quad (8)$$

Where, S_{it} , is the partial sum of \hat{z}_{it} and the item $\hat{\omega}_i^2, \Delta x_{it}$ is conditional u_{it} 'nin long term variance estimate. The null hypothesis of this test is “there is a cointegration relationship between variables”, and the alternative hypothesis is “there is no cointegration between variables”.

	Statistic	bootstap p-value
MODEL 1		
LM_N^+	1.086	0.941
MODEL 2		
LM_N^+	1.599	0.807
MODEL 3		
LM_N^+	1.397	0.889

Table 4. Cointegration Test Results

Westerlund and Edgerton (2007) panel cointegration test results are presented in Table 4. Since the p-value of test statistics is greater than 0.05%, the null hypothesis “there is no cointegration relationship between the variables” has been rejected. Therefore, it was concluded that there is a long-term relationship between the variables in the model, and the variables will act together in the long term.

3.3.5. Causality Test Analysis

The causality test developed by Dumitrescu and Hurlin (2012) was used in the panel causality test analysis.

$$W_{N,T}^{Hnc} = \frac{1}{N} \sum_{i=1}^N W_{i,T} \quad (9)$$

where, $W_{i,T}$ shows the Wald test statistics to estimate the causality of Granger in i^{th} cross-section.

$$\tilde{Z}_{N,T}^{Hnc} = \frac{\sqrt{N}[W_{N,T}^{Hnc} - \sum_{i=1}^N E(\tilde{W}_{i,T})]}{\sqrt{\sum_{i=1}^N \text{Var}(\tilde{W}_{i,T})}} \quad (10)$$

where, the average and variance including $T \geq 6 + 2K$:

$$E(\tilde{W}_{i,T}) = N^{-1} \sum_{i=1}^N E(W_{i,T}) = K \times \frac{(T-2K-1)}{(T-2K-3)} \quad (11)$$

$$\text{Var}(\tilde{W}_{i,T}) = N^{-1} \sum_{i=1}^N \text{Var}(W_{i,T}) = 2K \times \frac{(T-2K-1)^2 \times (T-K-3)}{(T-2K-3)^2 \times (T-2K-5)} \quad (12)$$

$\tilde{Z}_{N,T}^{Hnc}$ test statistics can give good results even when the sections are low. The following statistics are used instead of the equation (10) when the panels are unbalanced, and sections have a non-homogeneous lag length. (Bozoklu and Yilanci, 2013).

$$\tilde{Z}_{N,T}^{Hnc} = \frac{\sqrt{N}[W_{N,T}^{Hnc} - N^{-1} \sum_{i=1}^N E(\tilde{W}_{i,T})]}{\sqrt{N^{-1} \sum_{i=1}^N \text{Var}(\tilde{W}_{i,T})}} \quad (13)$$

Dumitrescu and Hurlin (2012) panel causality test was tested for four or five lag lengths. This is because it increases the reliability of the test results.

Lags	A \rightarrow GDP			GDP \rightarrow A		
	W- Statistics	Zbar- Statistics	p-value	W- Statistics	Zbar- Statistics	p-value
1	2.165	1.573	0.116	7.800	9.853	0.000
2	2.108	-0.112	0.911	8.071	5.767	0.000
3	5.849	1.836	0.066	11.284	5.912	0.000
4	5.962	0.760	0.447	13.512	5.191	0.000

Table 5. Dumitrescu and Hurlin Panel Causality Results

The results of the causality relationship between access and economic growth are presented in Table 5. According to the empirical analysis results for four lag lengths, the null hypothesis "Access was not the causative of economic growth" could not be rejected in three tests. The hypothesis "Access is not the causative of economic growth" has been rejected in all four lag lengths, and it has been determined that access was the causative of economic growth.

Lags	D \rightarrow GDP			GDP \rightarrow D		
	W- Statistics	Zbar- Statistics	p-value	W- Statistics	Zbar- Statistics	p-value
1	6.318	7.675	0.000	1.614	0.763	0.446
2	5.102	2.839	0.005	3.934	1.687	0.092
3	6.927	2.645	0.008	5.705	1.728	0.084
4	17.695	7.646	0.000	7.543	1.688	0.091

Table 6. Dumitrescu and Hurlin Panel Causality Results

The results of the causality relationship between depth and economic growth are reported in Table 6. It is seen in Table 6 that the null hypothesis "Depth is not the causative of economic growth" has been rejected in all four lag lengths. The null hypothesis "Economic growth is not the causative of the depth" is rejected in 2, 3, and 4 lag lengths. For this reason, it was concluded that there was a two-way causality between depth and economic growth.

Lags	E \rightarrow GDP			GDP \rightarrow E		
	W- Statistics	Zbar- Statistics	p-value	W- Statistics	Zbar- Statistics	p-value
1	2.343	1.833	0.067	5.660	6.709	0.000
2	7.210	4.917	0.000	3.356	1.118	0.264
3	8.866	4.098	0.000	4.504	0.828	0.408
4	11.163	3.812	0.000	7.903	1.899	0.058
5	14.951	3.962	0.000	9.921	1.707	0.088

Table 7. Dumitrescu and Hurlin Panel Causality Results

The causality relationship between efficiency and economic growth are given in Table 7. According to the empirical results obtained, the null hypothesis "efficiency is not the causative of economic growth" was rejected in all five lag lengths. The null hypothesis "Economic growth is not the causative of the efficiency" is rejected in 1, 4, and 5 lag lengths. Thus, a two-way causality relationship between efficiency and economic growth has been determined.

4. Conclusion

In order to achieve financial development in a country, the conditions for the smooth functioning of the financial system must be determined within the financial integration process, and the ground for the formation of these conditions must be established. In this way, its effectiveness can be increased in the process of collecting savings from the components that make up the financial system and converting those savings collected into investments. Financial development has an impact on economic growth thanks to capital accumulation and hence its positive effect on investments.

The relationship between economic growth and financial development has been investigated both empirically and theoretically for a long time. In general, it is

accepted that financial development leads to economic growth. According to this view, it is argued that the economic growth will be achieved by transforming the accumulation of funds, gained due to the developments in the financial market; thus, increasing the savings accumulation into investments. Although there are approaches that argue that the relationship between economic growth and financial development is a mutual or opposite relationship, there also exists those that argue that there is no relationship between these two concepts.

In this study, the relationship between economic growth and financial development was investigated with panel data analysis for BRICS-T countries for the period between 1991 and 2017. Access, depth, and efficiency variables were used to represent financial development. Within the framework of empirical analysis, first of all, it was found that there was a cross-sectional dependence in variables. Therefore, the variables are found to be stationary in I (1) using the second generation panel unit root test. By determining the cross-sectional dependence and slope coefficients are heterogeneous in the panel, the cointegration relationship was determined in the models by making the appropriate cointegration test analysis. Thus, the variables will act together in the long term.

On the other hand, in the last part of the empirical analysis, the causality relationship between economic growth and access, depth, and efficiency variables were investigated. In the findings, one-way causality was found from economic growth to access. While this finding differs from Erataş-Sönmez and Sağlam (2019) and Helhel (2019), it is similar to the findings of Helhel (2019). Economic growth directly affects bank branches and the number of ATMs. A two-way causality relationship was found between economic growth and depth. Thus, just as the economic growth affects investment fund assets and insurance premiums, investment fund assets and insurance premiums also affect economic growth. Bidirectional causality relationship between economic growth and depth Rachdi and M'barek (2011), Ofori-Abebrese et al. (2017) is consistent with the findings of Yagli and Topçu (2019). However, Rault (2009), Borlea et al. (2016), Ekpeno (2016), Puryan (2017), Helhel (2018), Şahin and Durmuş (2018), Demez et al. (2018) differ from the findings of Erataş-Sönmez and Sağlam (2019) and Helhel (2019). A two-way causality relationship between efficiency and economic growth has been determined. On the other hand, the more effective functioning and profitability of banks affect economic growth, while economic growth affects the profitability of banks as well. These findings obtained by Calderon and Liu (2002), Bayar (2004), Rault (2009), Cojocararu et al. (2016), Kacho and Damardeh (2017) and Şahin and Durmuş (2018) are similar to the findings obtained from the studies.

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