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# The Relationship between Financial Development and Economic Growth in Five Fragile Countries

***Ecem Turgut, PhD Student***
***Okyay Ucan, Professor***
Nigde Omer Halisdemir University, Department of Economics, Turkey

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## Abstract

This study aimed to analyze the causality relationship between financial development and economic growth by using the data of the five fragile countries for the period 1980 to 2018. In this direction, the cross-section dependency is examined, and it is concluded that the cross-section is independent. Then, by performing the Delta homogeneity test, it is aimed to understand whether other countries are affected at the same level without a change occurring in any of the countries considered, and heterogeneity has been reached. Subsequently, the unit root test determines that the variables are stationary at different levels. Dumitrescu and Hurlin panel causality test is performed to test the causality relationship. As a result of the test, while it is seen that there is not a relationship between economic growth and financial development index, the examination with control variables confirmed that there is a causality relationship between economic growth and financial development. These results showed that the demand-leading hypothesis is valid in the five fragile countries. Finally, to understand the causality relationship more clearly in the study, the Hatemi-J asymmetric causality test was performed, and it is understood that the causality relationship between financial development and economic growth may differ according to country.

**Keywords:** Financial Development, Economic Growth, Causality Test, Hatemi-J Asymmetric Causality Test, Dumitrescu-Hurlin Panel Causality Test

## 1. Introduction

One of the issues that have attracted attention lately is financial development's impact on the economic growth process. There is a positive and significant relationship between growth and financial depth, generally expressed as the level of development of financial markets. Therefore, as the development level of the countries increases, it is expected that the financial sectors of the countries will be more developed. Therefore, a financial sector development is expected to positively affect economic growth. As a natural consequence of this, financial development is seen as the main indicator of economic growth (Khan and Senhadji, 2003).

The relationship between financial development and economic growth progresses by mutually supporting each other. In this direction, the supply-leading and demand-leading hypotheses have emerged in the literature. The supply-leading hypothesis suggests a causal relationship between financial development and economic growth. The supply-leading hypothesis argues that creating financial markets and institutions deliberately increases the supply of financial services, thus increasing economic growth (Calderón and Liu, 2002). The demand-leading hypothesis claims that financial development reacts to changes in the real sector. In other words, it is stated that there is a causality relationship between economic growth and financial development. Here, with the increase in real economic growth cases, the demand for financial sector increases, leading to the development of the financial sector. Therefore, financial development responds to an increase in economic growth (Eita and Jordaan, 2007). In addition to these two views, (Apergis, Filippidis, and Economidou, 2007) put forward two different views. The first is the view that economic growth and financial development mutually affect each other. In this view, it is naturally expected that there is a two-way causality between the two variables. The second view is that financial development and economic growth do not affect each other, so there is no causal relationship.

Many factors affect financial development. Progress in human society and continuous improvement in culture, religion, and government policies primarily affect financial instruments in informal capital markets (Ekpo, 2016). Thus, a connection is established with many variables, which are effective in financial development. It also offers many opportunities for new products, services, and innovations in the economy and financial environment (Obeidat, 2016).

After discussing the subject briefly from a theoretical perspective, the studies on this subject are included in the literature, and a general inference has been tried to be made within the scope of the analysis. After that, the empirical application is carried out. Within the scope of the analysis, first cross-section dependency is examined, and then a homogeneity test is performed. After the unit root test is done in line with the results obtained, Dumitrescu and Hurlin causality test is performed, and the causality relationship between variables is generally tested. Finally, to test the causality relationship in terms of countries, the Hatemi-J asymmetric causality test is performed, and the study is completed.

## 2. Literature Review

The main goal of the countries is to increase their economic growth and reach a high rate of welfare. For this purpose, it is becoming more and more important to investigate the factors that impact economic growth. Financial development and economic growth have attracted attention in the literature, especially in recent times, and have been among the most frequently researched topics. When the literature on the subject is examined, it has been observed that panel data analyses stand out, especially. However, it is seen as a result of the literature review that there are studies based on a single country sample. When the empirical studies conducted on this subject in the literature are examined, it has been determined that very different results have been reached.

Nyasha and Odhiambo (2019), used the 1980-2012 period data of the United States, the relationship between financial development and economic growth is analyzed using the Autoregressive Distributed Lag (ARDL) method in their study. Bank-based and market-based financial development indexes represent financial development better to understand the depth and width of financial development. In conclusion, it confirmed that financial development positively affects economic growth in the United States on both bases.

Škare, Sınković, and Porada-Rochoń (2019) examined the relationship between finance and economic growth in Poland for the period 1990-to 2018 is examined using the time series method. In the study, unlike other studies, the lending structure of the financial sector is also taken into account. As a result of the empirical analysis, it has been shown that financial development plays a vital role in both economic growth and credit growth.

Bist (2018), the relationship between financial development and economic growth has been handled in 16 low-income countries using data from 1995-to 2014. Long-term panel estimates have shown that financial development has a positive and significant effect on economic growth.

Ono (2017) examined the relationship between financial development and economic growth in Russia with the vector autoregression model. Unlike other studies, the analysis was analyzed separately for the 1999-2008 and 2009-2014 periods. As a result, it is understood that there is a causal relationship between growth in money supply and bank lending in the 1999-2008 period, and the demand-leading hypothesis is confirmed for the period. From 2009 through 2014, it is understood that economic growth caused bank leading, whereas there is no causality from money supply to economic growth.

Samargandi and Ghosh (2015) used data from 52 middle-income countries from 1980-to 2008. It has been stated that there is an inverted U-shaped relationship between financial development and economic growth in the long run in a dynamic heterogeneous environment. In addition, it is noted that the effect of financial development may differ between countries due to the heterogeneous structure.

Allegret and Azzabi (2012) tested the relationship between financial development and long-term growth with dynamic panel data techniques for 112 emerging and developing countries from 1975 to 2007. As a result, it partially supported financial development's role in accelerating the convergence of emerging and developing economies towards the world frontier.

Anwar and Nguyen (2009) examined the interaction of financial development and economic growth by using the 1997-2006 period data in the panel data set covering 61 provinces of Vietnam in their study. As a result, it is understood that financial development contributes to economic growth.

## 3. Data Set and Methodology

In this study, which aims to analyze the causality relationship between financial development and economic growth, the data of the five fragile countries (Brazil, India, Indonesia, South Africa, Turkey) from 1980 to 2018 are used. The model is created due to the empirical studies in the literature examining the causality between financial development and economic growth. The model created within the scope of the study is given below:

$$Economic\ Growth = f\ (Financial\ Development) \quad (1)$$

In this study, six different variables are used to represent financial development. The first of these variables is the financial development index used to measure financial development, the control. Other variables used to represent financial development are domestic credit to the private sector by banks, M2 money supply, gross fixed capital formation, life expectancy used to represent labor in the financial sector, and trade. Economic growth is characterized by gross domestic product. Explanations of the variables used in the model are given in Table 1.

**Table 1.** Variables Used in the Model

| Variable | Define of Variable | Source |
|---|---|---|
| GDP | Economic Growth (% of GDP) | World Bank |
| FDI | Financial Development Index | IMF |
| DCPB | Domestic credit to private sector by banks (% of GDP) | World Bank |
| M2Y | Money Supply (% of GDP) | World Bank |
| GCF | Gross fixed capital formation (annual % growth) | World Bank |
| LE | Life Expectancy (Total) | World Bank |
| TRD | Trade (% of GDP) | World Bank |

While the GDP variable used in the model is considered the dependent variable, other variables are used as independent variables in the model. While the financial development index measures financial development, other independent variables are used as control variables in the model.

## 3.1. Cross-Section Dependency

In the standard panel data model, the equation can be created as follows (Hoyos and Sarafidis, 2006):

$$y_{it} = \alpha_i + \beta'_{x_{it}} + u_{it}, \quad i = 1, \dots, N \ \ t = 1, \dots, T \tag{2}$$

In Equation (2), $\alpha_i$ is the individual parameters that do not change with time. $\beta$ is the K x 1 vector of the parameters to be estimated. $x_{it}$ represents the regressor vector K x 1. Under the $H_0$ hypothesis, the $u_{it}$ is assumed to be independent, distributed in the same way between cross-sectional units and throughout periods. From here, the hypothesis is as follows:

$$H_0: \rho_{ij} = \rho_{ji} = cor\left(u_{it}, u_{jt}\right) = 0\,, \ \ i \neq j \tag{3}$$

$$H_1: \rho_{ij} = \rho_{ji} \neq 0, \ \ i \neq j \tag{4}$$

In Equations (3) and (4), $\rho_{ij}$, the product-moment correlation coefficient is obtained as follows:

$$\rho_{ij} = \rho_{ji} = \frac{\sum_{t=1}^{T} u_{it}u_{jt}}{\left(\sum_{t=1}^{T} u^2{}_{it}\right)^{1/2}\left(\sum_{t=1}^{T} u^2{}_{jt}\right)^{1/2}} \tag{5}$$

Accordingly, Breusch and Pagan (1980) proposed an LM test for fixed N under the T → ∞ assumption. This is shown below.

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}^2{}_{ij} \quad (6)$$

In Equation (6), $\hat{\rho}_{ij}$ is an example estimate of the binary correlation of residues. At this point, significant dimensional distortions are likely to occur when N> Y. In his study, Peseran (2004) found a deficiency for case where N → ∞ and proposed an alternative to overcome this deficiency of the LM test. This alternative is shown below.

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij}\right) \quad (7)$$

Equation (7) has exactly zero for fixed values of T and N under a wide class of panel data models, including heterogeneous dynamic models that are subject to multiple breaks in slope coefficients and error variances. In other words, these tests can deviate when the group means zero, but the individual mean different from zero. Pesaran, Ullah, and Yamagata (2008) proposed a cross-section dependency test in which regressors are strongly exogenous, errors normally are distributed, and more suitable for large panels (Pesaran, 2015). Pesaran, Ullah, and Yamagata (2008) make corrections by adding the variance and mean to prevent the deviation; this test is expressed as an adjusted LM test.

$$LM_{adj.} = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \frac{(T-k)\hat{\rho}^2{}_{ij} - \mu_{Tij}}{\upsilon_{Tij}} \sim N(0,1) \quad (8)$$

### 3.2. Homogeneity Test

The homogeneity test, within the scope of panel data analysis, aims to understand whether other countries are affected at the same level by a change that occurs in any of the countries considered. In this context, the economic structures of countries play an important role. If the countries considered in general differ from each other, the coefficients in the model are expected to be heterogeneous. If the countries' economic structures are similar, the coefficients are expected to be homogeneous (Turgut and Uçan, 2019). Regarding panel data analysis, whether the variables are homogeneous or not should be examined. Whether the variables are homogeneous or not changes the format of the unit root tests to be applied. Mohammad developed Delta test. Pesaran and Yamagata (2008) are primarily used in the study.

The Delta test is calculated in two different ways. These are the standard test ($\tilde{\Delta}$) and the adjusted test ($\tilde{\Delta}_{adj.}$). The standard Delta test is determined as follows (Pesaran and Yamagata, 2008):

$$\tilde{\Delta}= \sqrt{N}\left(\frac{N^{-1}\,\tilde{S}-k}{\sqrt{2k}}\right) \qquad (9)$$

The adjusted Delta test is determined as follows:

$$\tilde{\Delta}_{adj}= \sqrt{N}\left(\frac{N^{-1}\,\tilde{S}-E\left(\tilde{Z}_{iT}\right)}{\sqrt{Var\left(\tilde{Z}_{iT}\right)}}\right) \qquad (10)$$

### 3.3. Panel Unit Root Test

Im, Pesaran, and Shin's (2003) panel unit root test is the developed version of the Im, Pesaran, and Shin (1997) test, considering whether the error term is correlated or not, and (T) time series and (N) cross-section data size are finite and infinite. This test is based on the null hypothesis that there is a unit root that assumes that ( $\rho_i$) is equal to 1 for all (i) section data, and it is stated that the random process is valid as follows (Güriş, 2018; Im, Pesaran and Shin, 2003):

$$Y_{it} = \mu_i + \rho_i Y_{i,t-1} + u_{it} \qquad t = 1,\dots T \qquad i = 1,\dots N \qquad (11)$$

During the random process, the autoregressive parameter $\rho_i$ is transformed into the model-Dickey-Fuller type equation form due to the downward deviation of small samples.

$$\Delta Y_{it} = (\mu_i - 1) + (\rho_i - 1)Y_{i,t-1} + u_{it} \qquad (12)$$

$$\Delta Y_{it} = \alpha_i + \delta_i Y_{i,t-1} + \varepsilon_{it} \qquad (13)$$

The basic hypotheses of the test are given below:

$$H_0: \delta_i = 0 \qquad There\ is\ a\ panel\ unit\ root\ for\ the\ entire\ (i)\ section\ unit \qquad (14)$$

$$H_1: \delta_i < 0 \qquad i = 1,2,\dots,N_1 \qquad \delta_i = 0, \qquad i = N_1+1, N_1+2,\dots,N. \qquad (15)$$

is established. This test proposes unit root tests for dynamic heterogeneous panels based on the average of different unit root statistics.

### 3.4. Panel Causality Test

Causality analysis, first developed by Granger (1969), helps investigate whether variables other than that variable provide useful information in predicting the future value of a variable. The main reason for Granger causality testing within the panel data is to make utilization of the advantages of the panel data models structure. It provides significantly more flexibility in modeling the behavior of cross-sectional units by extending the Granger causality method to be applied to panel data. In addition, panel size allows for analytical analysis of significantly more observations than time series (Hood, Kidd, and Morris, 2006). At this point, one of the most important panels causality tests is the causality test developed by Dumitrescu and Hurlin.

Dumitrescu and Hurlin Panel Causality Test are tested with the alternative hypothesis that there is at least one cross-section relationship against the null hypothesis under the absence of a homogeneous causality relationship. In Dumitrescu and Hurlin causality test, when X and Y express two stationary processes observed during the T period for N number of units, they consider the following linear heterogeneous model for each unit (i) at time t (Bozoklu and Yılancı, 2013):

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (16)$$

In equation (16) $\beta_i = (\beta_i^{(1)}, \beta_i^{(2)}, \beta_i^{(3)}, \dots, \beta_i^{(k)})$. While assuming that $(\alpha_i)$ individual effects are constant, the assumption that $(\gamma_i^{(k)})$ lag parameters and $\left(\beta_i^{(k)}\right)$ regression slope coefficients vary between units is valid. Accordingly, the fixed effects model is established in the causality test. The hypotheses obtained by using Equation (16) are given below.

$$H_0 = \beta_i = 0 \ \forall i = 1, \dots, N \quad (17)$$

$$H_1 = \beta_i = 0 \ \forall i = 1, \dots, N_1$$
$$\beta_i \neq 0 \ \forall i = N_1 + 1, \dots N \quad (18)$$

In equation (18) $0 \leq N_1 / N < 1$, the test statistic used to test the basic hypothesis is the simple average of individual Wald statistics.

$$W_{N,T}^{Hnc} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T} \quad (19)$$

For small values of T, it is suggested to use standardized test statistics since individual Wald statistics do not converge to the same chi-square distribution.

$$Z_{N,T}^{Hnc} = \frac{\sqrt{N}\left[W_{N,T}^{Hnc} - \sum_{i=1}^{N} E(\underline{W}_{i,T})\right]}{\sqrt{\sum_{i=1}^{N} Var(\underline{W}_{i,T})}} \quad (20)$$

In equation (20), the variance and mean T ≥ 6 + 2K are calculated as follows.

$$E(\underline{W}_{i,T}) = N^{-1}\sum_{i=1}^{N} E(W_{i,T}) = Kx\frac{(T-2K-1)}{(T-2K-3)} \quad (21)$$

$$Var(\underline{W}_{i,T}) = N^{-1}\sum_{i=1}^{N} Var(W_{i,T}) = 2Kx\frac{(T-2K-1)^2\,x\,(T-K-3)}{(T-2K-3)^2\,x\,(T-2K-5)} \quad (22)$$

One advantage of the Dumitrescu and Hurlin (2012) causality test is that it can also be applied for unbalanced panels and panels where units have heterogeneous lag lengths. In this case, instead of the equation (20), the following equation should be used.

$$Z_{N,T}^{Hnc} = \frac{\sqrt{N}\left[W_{N,T}^{Hnc} - N^{-1}\sum_{i=1}^{N} E(\underline{W}_{i,T})\right]}{\sqrt{N^{-1}\sum_{i=1}^{N} Var(\underline{W}_{i,T})}} = \frac{\sqrt{N}\left[W_{N,T}^{Hnc} - N^{-1}\sum_{i=1}^{N} K_i\,x\,\frac{(T_i-2K_i-1)}{(T_i-2K_i-3)}\right]}{\sqrt{N^{-1}\sum_{i=1}^{N} 2K_i\,x\,\frac{(T_i-2K_i-1)^2 x (T_i-K_i-3)}{(T_i-2K_i-3)^2\,x\,(T_i-2K_i-5)}}} \quad (23)$$

## 4. Empirical Findings

The most important problem in panel data studies is whether the series contain cross-section dependence. Because, in line with the result obtained here, first or second-generation unit root tests should be applied to the series. However, this part is directly neglected in many studies, thus preventing accurate results. Unlike other studies, the empirical analysis is first started in this study by testing the cross-sectional dependence. The results of the cross-section dependence test results are given in Table 2.

**Table 2.** Cross Section Dependency Test Results

| Test | Statistics | P-value |
|---|---|---|
| LM | 13.89 | 0.178 |
| LM adj* | 1.905 | 0.056 |
| LM CD* | 1.747 | 0.080 |

When looking at the cross-section dependency as a model in Table 2, it is seen that the null hypothesis that there is cross-section independence at the 5% significance level is accepted at the end of all three tests. The absence of cross-section dependence indicates that first-generation unit root tests should be performed on the variables. However, a problem with first-generation unit root tests is the assumptions of heterogeneity and homogeneity. Therefore, before performing the first generation unit root tests, it is necessary to make a homogeneity test and decide which of the first generation unit root tests is suitable for the analysis. The results of the Delta homogeneity test performed within the scope of the study are given in Table 3.

**Table 3.** Delta Test Results

| Test | Delta | p-value |
|---|---|---|
| $\Delta$ | 2.247 | 0.025 |
| $\Delta_{adj.}$ | 2.520 | 0.012 |

$H_0$: slope coefficients are homogenous

Delta homogeneity test developed by Pesaran and Yamagata (2008) allows analysis in cases where both N> T and T> N. When Table 3 is examined, it is seen that the null hypothesis is rejected because the probability values are less than 5% significance level. Hence, heterogeneity has been concluded. Therefore, applying a unit root test that accepts the heterogeneity assumption is deemed appropriate. Im, Pesaran, and Shin unit root test results are given in Table 4.

**Table 4.** Im, Pesaran, and Shin Unit Root Test Results

| Variables | Level | | First Difference | | Result |
|---|---|---|---|---|---|
| | **Statistics** | **Probability** | **Statistics** | **Probability** | |
| GDP | -5,690 | 0.000 | - | - | I(0) |
| FDI | -1,682 | 0.046 | - | - | I(0) |
| DCPB | -0.046 | 0.481 | -6.327 | 0.000 | I(1) |
| M2Y | -0.730 | 0.232 | -5.619 | 0.000 | I(1) |
| GCF | -0.607 | 0.271 | -5.073 | 0.000 | I(1) |
| LE | -5.926 | 0.000 | - | - | I(0) |
| TRD | -1.655 | 0.049 | - | - | I(0) |

When Table 4 is examined, it is seen that the dependent variable GDP and independent variables FDI, LE, and TRD variables are stationary at the level, while the first difference of DCPB, M2Y, and GCF variables are stationary. Therefore, it is understood that the variables are stationary at different levels.

To apply the Dumitrescu and Hurlin Causality Test to the variables, all variables must be stationary at the level. Therefore, Dumitrescu and Hurlin Causality tests are performed by taking the differences of DCPB, M2Y, and GCF variables which are stationary in the first difference. Dumitrescu and Hurlin Causality Test results applied within the scope of the study are given in Table 5.

**Table 5.** Dumitrescu and Hurlin Causality Test Results

| Null Hypothesis | W-Statistic | Zbar-Statistic | Probability | Result |
|---|---|---|---|---|
| FDI --/--> GDP | 2.314 | 0.177 | 0.859 | Accept |
| GDP --/--> FDI | 2.323 | 0.186 | 0.852 | Accept |
| ΔDCPB --/--> GDP | 1.985 | -0.148 | 0.881 | Accept |
| GDP --/--> ΔDCPB | 17.859 | 15.346 | 0.000 | Reject |
| ΔM2Y --/--> GDP | 2.131 | -0.006 | 0.995 | Accept |
| GDP --/--> ΔM2Y | 4.942 | 2.737 | 0.006 | Reject |
| ΔGCF --/--> GDP | 2.036 | -0.099 | 0.920 | Accept |
| GDP --/--> ΔGCF | 10.046 | 7.719 | 0.000 | Reject |
| LE --/--> GDP | 5.283 | 3.088 | 0.002 | Reject |
| GDP --/--> LE | 0.470 | -1.630 | 0.102 | Accept |
| TRD --/--> GDP | 1.465 | -0.654 | 0.512 | Accept |
| GDP --/--> TRD | 4.826 | 2.640 | 0.008 | Reject |

As a result of the causality test, it is understood that there is a one-way causality relationship from GDP to ΔDCPB, ΔM2Y, ΔGCF, and TRD, while a one-way causality relationship from LE to GDP is understood. While these results show no relationship between growth and financial development index, the analysis with control variables confirmed a causality relationship between growth and financial development. These results show that the demand-leading hypothesis is valid in the five fragile countries.

## Conclusion

The relationship between financial development and economic growth has recently been among the most studied topics, increasing interest in the financial sector. This study examined the causality relationship between financial development and economic growth in a sample of five fragile countries. The data of the relevant variables and countries for the period 1980-

2018 are used in the study. While economic growth is considered as the dependent variable in the study, six different variables are used to represent financial development, which is considered as an independent variable. The financial development index, domestic credit to the private sector by banks, M2 money supply, gross fixed capital formation, life expectancy, and trade.
The most important problem in panel data analysis is whether there is cross-section dependency or not. Because, according to the cross-section dependency situation, the unit root test should be done for the variables. Therefore, the cross cross-section dependency test is first performed in this study and the independence result is reached. This result showed that first-generation unit root tests should be applied to the variables. However, in this case, according to the result obtained by performing the homogeneity test, the most appropriate test should be selected from the first generation unit root tests. Therefore, after the cross-section dependency test is performed, the Delta homogeneity test is performed and the heterogeneity result is obtained. Therefore, Im, Pesaran, and Shin (2003) a unit root test, which accepted the heterogeneity assumption, performed, and it was found that the variables are stationary at different levels. Within the scope of the causality test planned, within the scope of the study, Dumitrescu and Hurlin causality tests are performed first. The causality relationship between the variables is aimed to be seen in general. As a result of the analysis, it is seen that there is no relationship between growth and financial development index. Still, as a result of the examination with control variables, it is understood that there is a causality relationship between growth and financial development. These results show that the demand-leading hypothesis is valid in the five fragile countries. This result is found to be suitable for the study of Ono (2017). In addition, as a result of the Hatemi-J asymmetric causality test, it is understood that the causality relationship between financial development and economic growth may vary by country. Hatemi-J asymmetric causality test results are given in the Appendix. More variables representing financial development can be determined in future studies, and a different econometric method can be examined.

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## Appendix: Hatemi-J Asymmetric Causality Test

**Table 1.** Results for panel causality (FD indicator: FDI)

| Countries | $H_0$: from GDP to FDI does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 0.125 | 0.724 | 0.790 | 0.374 |
| India | 0.600 | 0.438 | 0.255 | 0.614 |
| Indonesia | 11.417 | 0.010* | 0.549 | 0.459 |
| South Africa | 0.025 | 0.875 | 1.272 | 0.259 |
| Turkey | 20.562 | 0.000* | 0.293 | 0.588 |
| Countries | **$H_0$: from FDI to GDP does not causality** | | | |
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 2.334 | 0.127 | 0.360 | 0.548 |
| India | 1.044 | 0.307 | 0.017 | 0.897 |
| Indonesia | 6.112 | 0.106 | 0.319 | 0.572 |
| South Africa | 0.229 | 0.632 | 9.663 | 0.002* |
| Turkey | 2.029 | 0.363 | 1.045 | 0.307 |

(*) show that it is rejected at the 5% level.

**Table 2.** Results for panel causality (FD indicator: DCPB)

| Countries | $H_0$: from GDP to DCPB does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 0.000 | 0.998 | 1.129 | 0.288 |
| India | 4.746 | 0.029* | 1.210 | 0.271 |
| Indonesia | 0.594 | 0.441 | 5.297 | 0.021* |
| South Africa | 1.764 | 0.184 | 7.897 | 0.048* |
| Turkey | 0.782 | 0.854 | 0.137 | 0.711 |
| Countries | **$H_0$: from DCPB to GDP does not causality** | | | |
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 2.250 | 0.134 | 0.002 | 0.964 |
| India | 0.461 | 0.497 | 0.626 | 0.429 |
| Indonesia | 0.716 | 0.397 | 0.227 | 0.634 |
| South Africa | 0.000 | 0.985 | 1.268 | 0.737 |
| Turkey | 6.441 | 0.092** | 0.432 | 0.511 |

(*) and (**) respectively show that it is rejected at the 5% and 10% levels.

**Table 3.** Results for panel causality (FD indicator: M2Y)

| Countries | $H_0$: from GDP to M2Y does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 0.089 | 0.766 | 1.030 | 0.310 |
| India | 0.665 | 0.415 | 0.001 | 0.974 |
| Indonesia | 0.772 | 0.380 | 0.171 | 0.680 |
| South Africa | 0.412 | 0.521 | 7.245 | 0.007* |
| Turkey | 11.290 | 0.001* | 0.234 | 0.628 |
| Countries | **$H_0$: from M2Y to GDP does not causality** | | | |
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 1.308 | 0.253 | 0.136 | 0.712 |
| India | 0.515 | 0.473 | 0.002 | 0.965 |
| Indonesia | 0.004 | 0.950 | 0.036 | 0.850 |
| South Africa | 0.449 | 0.503 | 1.278 | 0.258 |
| Turkey | 2.502 | 0.114 | 13.851 | 0.000* |

(*) show that it is rejected at the 5% level.

**Table 4.** Results for panel causality (FD indicator: GCF)

| Countries | $H_0$: from GDP to GCF does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 0.489 | 0.783 | 4.202 | 0.122 |
| India | 0.484 | 0.487 | 14.327 | 0.001* |
| Indonesia | 2.913 | 0.405 | 12.327 | 0.006* |
| South Africa | 2.019 | 0.155 | 30.028 | 0.000* |
| Turkey | 1.335 | 0.248 | 3.524 | 0.060** |
| Countries | **H0: from GCF to GDP does not causality** | | | |

| | Positive Shock | | Negative Shock | |
|---|---|---|---|---|
| | MWald | P-value | MWald | P-value |
| Brazil | 2.649 | 0.266 | 1.497 | 0.473 |
| India | 0.121 | 0.728 | 1.545 | 0.462 |
| Indonesia | 0.530 | 0.088 | 6.424 | 0.093** |
| South Africa | 0.451 | 0.502 | 0.194 | 0.650 |
| Turkey | 0.747 | 0.387 | 0.146 | 0.702 |

(*) and (**) respectively show that it is rejected at the 5% and 10% levels.

**Table 5.** Results for panel causality (FD indicator: LE)

| Countries | $H_0$: from GDP to LE does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 8.105 | 0.044* | - | - |
| India | 1.925 | 0.588 | - | - |
| Indonesia | 2.013 | 0.570 | - | - |
| South Africa | 0.379 | 0.945 | - | - |
| Turkey | 7.466 | 0.058** | - | - |
| Countries | **$H_0$: from LE to GDP does not causality** | | | |
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 10.256 | 0.017* | - | - |
| India | 8.661 | 0.034* | - | - |
| Indonesia | 3.728 | 0.292 | - | - |
| South Africa | 44.960 | 0.000* | - | - |
| Turkey | 77.912 | 0.000* | - | - |

(*) and (**) respectively show that it is rejected at the 5% and 10% level.

**Table 6.** Results for panel causality (FD indicator: TRD)

| Countries | $H_0$: from GDP to TRD does not causality | | | |
|---|---|---|---|---|
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 17.956 | 0.000* | 0.165 | 0.685 |
| India | 6.913 | 0.009* | 0.351 | 0.554 |
| Indonesia | 0.073 | 0.786 | 0.001 | 0.974 |
| South Africa | 2.825 | 0.093** | 1.429 | 0.489 |
| Turkey | 2.251 | 0.134 | 0.061 | 0.805 |
| Countries | **$H_0$: from TRD to GDP does not causality** | | | |
| | Positive Shock | | Negative Shock | |
| | MWald | P-value | MWald | P-value |
| Brazil | 13.196 | 0.001* | 5.254 | 0.022* |
| India | 0.731 | 0.392 | 0.196 | 0.658 |
| Indonesia | 0.012 | 0.914 | 0.000 | 0.992 |
| South Africa | 0.064 | 0.801 | 2.100 | 0.350 |
| Turkey | 0.095 | 0.758 | 0.005 | 0.945 |

(*) and (**) respectively show that it is rejected at the 5% and 10% levels.