FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH
IN GREECE: AN EMPIRICAL INVESTIGATION WITH
GRANGER CAUSALITY ANALYSIS

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Abstract

This paper examines empirically the causal relationship among the degree of openness of the economy, financial development and economic growth by using a multivariate autoregressive VAR model in Greece for the examined period 1960:I – 2000:IV. The results of cointegration analysis suggest that there is one cointegrated vector among GDP, financial development and the degree of openness of the economy. Granger causality tests based on error correction models show that there is a causal relationship between financial development and economic growth, but also between the degree of openness of the economy and economic growth.

keywords: financial development, economic growth, openness, Granger causality

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1. Introduction

In recent years the relationship between financial development and economic growth has become an issue of extensive analysis. The question is whether financial development precedes or simply follows economic growth. A general proposition states that the development of the financial sector is expected to have a positive impact on economic growth.

The theoretical relationship between financial development and economic growth goes back to the study of Schumpeter (1911) who focuses on the services provided by financial intermediaries and argues that these are essential for innovation and development. The Mckinnon – Shaw school examines the impact of government intervention on the development of the financial system. Their main proposition is that government restrictions on the banking system such as interest rate ceilings and direct credit programs have negative effects on the development of the financial sector and, consequently, reduce economic growth (Mckinnon 1973, Shaw 1973).

The endogenous growth theory has reached similar conclusions by explicitly modeling the services provided by financial intermediaries such as risk-sharing and liquidity provision. This theory also suggests that financial intermediation has a positive effect on steady-state growth and that government intervention in the financial system has a negative effect on economic growth (Ghali 1999).

A theoretical view claims that financial development follows economic growth as a result of increased demand for financial services. This explanation was originally advanced by Robinson (1952). All these views are based on the observation that the ratio of the broad money stock to nominal GDP, which is a
standard measure of financial development used in the literature, is also the inverse of the velocity of circulation of the broad money stock. Hence, a positive correlation between the level of financial development and the real GDP may be due to a downward trend in the velocity of money circulation. If this is true, then the positive relationship between financial development and real GDP may reflect an income elasticity of the demand for money with respect to income, which is greater than one. Consequently, according to this argument the direction of causality will be from real GDP to financial development, and that through the demand for money (Ghali 1999).

The new interest in the determinants of economic development has reignited the debate on openness and growth. In neoclassical growth models developed by Solow (1957) and others, technological change is exogenous variable - unaffected by a country's degree of openness of the economy. Yet the new growth theories suggest that trade policy affects long-run growth through its impact on technological change. In these models, the degree of openness of the economy provides access to imported inputs, which embody new technology (Harrison 1996).

The concept of openness, applied to trade policy, can be synonymous with the idea of neutrality. Neutrality means that incentives are neutral between saving a unit of foreign exchange through import substitution and earning a unit of foreign exchange through exports. Clearly, a highly export oriented economy may not be neutral in this sense, particularly if it shifts incentives in favor of export production through instruments such as exports subsidies. A good measure of trade policy will capture the differences between neutral, inward oriented, and export-promoting regimes. The simplest measures of trade orientation are based on actual trade flows,
such as imports plus exports as a share of GDP or the growth rates of imports and exports (Harrison 1996).

Studies focusing on the theory of trade and growth have shown that there is a positive relationship between trade and economic growth Edwards (1992), while other studies attempting to explain the causal relationship between the degree of openness of the economy and economic growth end up with mixed results (Summers and Heston 1988).

Shan, Morris, and Sun (2001) use a Granger causality procedure to investigate the relationship between financial development and economic growth for nine OECD countries and China by estimating a vector autoregression (VAR) model. The results of their study show that five out of ten countries have a bilateral Granger causality; three of them have reverse causality with economic growth leading to financial development while two countries do not have a causal effect at all.

Arestis, Demetriades and Luintel (2001) examine the relationship among stock market development, credit market development and economic growth, utilizing time series methods and data from five developed countries. The results of their paper suggest that bank-based financial systems may be more able to promote long-run growth than capital-market-based ones.

Sinha and Macri (2001) examine the relationship between financial development and economic growth for eight Asian countries, which are divided in two categories. The first includes seven developing countries while the second one includes only Japan. The aim of their study is to investigate through a multivariate causality test if there are differences between financial development and economic growth for both examined categories. The empirical results are mixed, namely there is a bilateral causal relationship between the examined variables for India, Malaysia,
and Sri Lanka, a unidirectional causal relationship between financial development and economic growth for Japan and Thailand, while they find reverse causality, namely from economic growth to financial development for Korea, Pakistan and Philippines.

Shan and Morris (2002) adopt the Toda and Yamamoto’s (1995) model and by using quarterly data for the period 1985:I-1998IV investigate the causal relationship among the following variables: real GDP, ratio of total credit to GDP, spread of borrowing and lending interest rates, productivity, ratio of gross investment to GDP, ratio of total trade to GDP, consumer price index, official interest rate, stock market price index for 19 OECD countries. They conclude that financial development leads to economic growth either directly or indirectly through the remaining examined variables. As far as Greece is concerned, the authors suggest that no causal relationship between financial development and economic growth is found for the examined period.

Evans, Green, and Murinde (2002) evaluate the contribution of human capital and financial development to economic growth in a panel of 82 countries using the translog production function as a framework for estimating the relationships among economic growth and factor inputs such as labour, physical capital, human capital and monetary factor (money or credit). The results of their paper suggest that financial development is as important as human capital in the growth process.

Deidda and Fattouh (2002) present a simple model, which establishes a non-linear relationship between financial development and economic growth, based on a threshold regression model of King and Levine’s study (1993a). The results of their paper suggest that in low-income countries there is no significant relationship
between financial development and economic growth, whereas in high-income countries this relationship is positive and strongly significant.

Nourzad (2002) examines the effect of financial development on productive efficiency using three separate panels of developed and developing countries. The results indicate that the more financially developed economy, the more efficient the production of output. This effect appears to be larger in developed countries relative to the developing ones.

During the last years, the Greek economy has focused on the effort to comply with macroeconomic criteria set by the European Union (EU) for accession to the Economic and Monetary Unification (EMU). The main goal of this effort was the reduction of inflation in the levels of 3%, the reduction of public deficits through the achievement of public discipline, and also the reversion of an upward trend of public debt. In the context of increasing productivity growth and the competitiveness of the economy, important attempts have been made towards the full liberalization of the domestic banking system. The Greek economy has solved the problem of currency stabilization by its accession to the EMU, which had been for many decades an inhibitory factor of economic growth.

Although important steps have been made towards the modernization of the Greek economy there are many crucial problems that need to be solved. This is one of the basic reasons we have chosen Greece as a case study, since only few studies have focused on Greece. Suggestively, we refer to the study of Gursoy and Muslimov (1998) who examine the causal relationship between financial development and economic growth for 20 countries including Greece. The results for Greece support that stock market development causes economic growth. Aras and Muslimov (2003) examine the causal relationship between institutional
investors’ development, stock market liquidity and stock market development in 23 OECD including Greece. The empirical results suggest that there is a bilateral causal relationship between institutional investors and stock market liquidity and also there is a unidirectional causal relationship between institutional investors and stock market development with direction from institutional investors to stock market development for the case of Greece.

Most recent studies refer to the financial development and economic growth issue extensively. The basic difference between the groups of researchers lies as to which variable affects the other. In this paper, a third variable is used, the degree of openness, following the study of Chang (2002), which is regarded as an intermediate variable and as a result in economic growth of Greece. Also, this variable has been included in the study of Siddiki (2002) in conjunction with other variables, such as per capita income, financial liberalisation, human capital, and investments.

Therefore, the purpose of this paper is to test for the direction of causality between the two basic variables, namely financial development and economic growth, and also an intermediate variable, the degree of openness, in a European Union member-state such as Greece, which has recently joined the Economic and Monetary Union.

The remainder of the paper proceeds as follows: Section 2 describes the data that are used in the causal relationship between economic growth, financial development, and degree of openness of the economy in Greece. Section 3 presents the results of the unit root tests. Section 4 summarises the cointegration analysis and Johansen cointegration test. Section 5 analyses the error correction models. Finally, section 6 provides the conclusions of this paper.
2. Data

In order to test the causal relationship between economic growth, financial development and degree of openness of the economy we use the following trivariate VAR model:

\[ GDP = f(FD, OP) \]  \hspace{1cm} (1)

where \( GDP \) is gross domestic product

\( FD \) is financial development

\( OP \) is degree of openness of the economy

Following the empirical studies of Roubini and Sala-i-Martin (1992), King and Levine (1993a) we use gross domestic product as a proxy for economic growth. The existing literature suggests as a proxy for financial development the ratio of money supply (M2) to the level of GDP. This ratio measures the extent of monetization rather than financial deepening. It is possible that this ratio may be increasing due to the monetization process. An alternative hypothesis is to deduct the active currency in circulation from M2 or to use the ratio of domestic bank credit to nominal GDP. Finally, the monetization variable M2/GDP is designed to show the real size of the financial sector (Liu et al. 1997).

The concept of openness applied to trade policy, could be synonymous with the idea of neutrality. Neutrality means that incentives are neutral between saving a unit of foreign exchange through import substitution and earning a unit of foreign exchange through exports. A good measure of trade policy would capture differences between neutral, inward oriented and export promoting regimes Harrison (1996).
The simplest measure of trade orientation is based on actual trade flows, such as imports plus exports. This measure shows a positive relation with economic growth, after controlling for other factors such as capital and labour. This is the main reason this variable is used in the model, which is regarded as an intermediate variable between financial development and economic growth.

The data that have been used in this analysis are quarterly, covering the period from 1960:I to 2000:IV and come from the database of OECD (Business Sector Data Base). All time series data are expressed in logarithms in order to capture multiplicative time series effect and also to achieve stationarity in their variance Granger and Newbold (1986).

These time series data are symbolized with the letter $L$ preceding each variable name. If these variables share a common stochastic trend and their first differences are stationary, then they can be cointegrated. Economic theory scarcely provides some guidance as to which variables appear to have a stochastic trend and when these trends are common among the examined variables. For the analysis of the multivariate time series that include stochastic trends, the Augmented Dickey-Fuller (ADF) (1979) and Kwiatkowski et al. (KPSS) (1992) unit root tests are used for the estimation of individual time series, with intention to provide evidence about when the variables are integrated.

3. Unit root tests

The cointegration test between the examined variables requires initially a test for the existence of a unit root for each individual time series and especially for financial development, economic growth and the degree of openness. Thus, the
integration order of variables will be verified, since the causality tests are valid, whether the variables have the same integration order.

Many macroeconomic time series contain unit roots dominated by stochastic trends as developed by Nelson and Plosser (1982). Unit roots are important in examining the stationarity of a time series because a non-stationary regressor invalidates many standard empirical results. The presence of a stochastic trend is determined by testing the presence of unit roots in time series data. A unit root test is performed using Augmented Dickey-Fuller (ADF) (1979), and Kwiatkowski et al. (1992).

3.1 Augmented Dickey-Fuller (ADF) test

The Augmented Dickey-Fuller (ADF) (1979) test refers to the t-statistic of $\delta_2$ coefficient on the following regression:

$$\Delta X_t = \delta_0 + \delta_1 t + \delta_2 X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + u_t$$

The ADF regression tests for the existence of unit root of $X_t$, namely in the logarithm of all model variables at time $t$. The variable $\Delta X_{t,i}$ expresses the first differences with $k$ lags and finally, $u_t$ is the variable that adjusts the errors of autocorrelation. The coefficients $\delta_0$, $\delta_1$, $\delta_2$, and $\alpha_i$ are being estimated. The null and the alternative hypothesis for the existence of unit root in variable $X_t$ is:

$$H_0 : \delta_2 = 0 \quad H_a : \delta_2 < 0$$
This paper follows Engle and Yoo (1987) by using the Akaike information
criterion (AIC) (1974), to determine the optimal specification of Equation (2). The
appropriate order of the model is determined by computing Equation (2) over a
selected grid of values of the number of lags \( k \) and finding that value of \( k \) at which
the AIC attains its minimum. The distribution of the ADF statistic is non-standard
and the critical values tabulated by Mackinnon (1991) are used.

3.2 Kwiatkowski, Phillips, Schmidt, and Shin’s (KPSS) test

Since the null hypothesis in the Augmented Dickey-Fuller test is that a time
series contains a unit root, this hypothesis is accepted unless there is strong evidence
against it. However, this approach may have low power against stationary near unit
root processes. Kwiatkowski et al (1992) present a test where the null hypothesis
states that the series is stationary. The KPSS test complements the Augmented
Dickey-Fuller test in that concerns regarding the power of either test can be
addressed by comparing the significance of statistics from both tests. A stationary
series has significant Augmented Dickey-Fuller statistics and insignificant KPSS\(^1\)
statistics.

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\(^1\) According to Kwiatkowski et al (1992), the test of KPSS assumes that a time series can be composed into three
components, a deterministic time trend, a random walk and a stationary error:

\[ y_t = \delta t + r_t + \epsilon_t \]

where \( r_t \) is a random walk: \( r_t = r_{t-1} + u_t \). The \( u_t \) is iid \((0, \sigma_u^2)\).

The stationarity hypothesis implies that \( \sigma_u^2 = 0 \).

Under the null, \( y_t \), is stationary around a constant (\( \delta = 0 \)) or trend-stationary (\( \delta \neq 0 \)). In practice, one simply runs a
regression of \( y_t \) over a constant (in the case of level-stationarity) or a constant plus a time trend (in the case of
trend-stationary). Using the residuals, \( \epsilon_t \), from this regression, one computes the LM statistic

\[ LM = T^{-2} \sum_{t=1}^{T} S_t^2 / S_{n}^2 \]
4. Cointegration test

Following the maximum likelihood procedure of Johansen and Juselious (1990), a p-dimensional (p×1) vector autoregressive model with Gaussian errors can be expressed by its first-differenced error correction form as:

\[ \Delta Y_t = \mu + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots + \Gamma_{p-1} \Delta Y_{t-p+1} + \Pi Y_{t-1} + u_t \]  

(3)

where:

- \( Y_t \) is a p×1 vector containing the variables.
- \( \mu \) is the p×1 vector of constant terms.
- \( \Gamma_i \) = -1 + A_1 + A_2 + \ldots + A_i \quad (i = 1, 2, \ldots, p-1) \) is the p×p matrix of coefficients.
- \( \Pi = 1 - A_1 - A_2 - \ldots - A_p \) is the p×p matrix of coefficients.
- \( u_t \) is the p×1 vector of the disturbance terms coefficients.

The \( \Pi \) matrix conveys information about the long-run relationship between \( Y_t \) variables and the rank of \( \Pi \) is the number of linearly independent and stationary

where \( S_{\nu}^2 \) is the estimate of variance of \( \varepsilon_t \)

\[ S_{\nu}^2 = \sum_{i=1}^{l} e_i, \quad t = 1, 2, \ldots, T \]

The distribution of LM is non-standard: the test is an upper tail test and limiting values are provided by Kwiatkowski et al (1992), via Monte Carlo simulation. To allow weaker assumptions about the behaviour of \( \varepsilon_t \), one can rely, following Phillips (1987) on the Newey and West (1987) estimate of the long-run variance of \( \varepsilon_t \) which is defined as:

\[ S^2(l) = T^{-1} \sum_{i=1}^{T} e_i^2 + 2T^{-1} \sum_{s=1}^{l} w(s,l) \sum_{r=s+1}^{T} e_r e_{r-k} \]

where \( w(s,l) = 1 - s / (l+1) \). In this case the test becomes

\[ \nu = T^{-2} \sum_{i=1}^{T} S_{\nu}^2 / S^2(l) \]

which is the one considered here. Obviously the value of the test will depend upon the choice of the 'lag truncation parameter', \( l \). Here we use the sample autocorrelation function of \( \Delta e_t \) to determine the maximum value of the lag length \( l \).
linear combinations of variables studied. Thus, testing for cointegration involves testing for the rank of \( \Pi \) matrix \( r \) by examining whether the eigenvalues of \( \Pi \) are significantly different from zero. Johansen and Juselious (1990) propose two test statistics for testing the number of cointegrated vectors (or the rank of \( \Pi \)) in the VAR model. These are the trace (\( Tr \)) test and the maximum eigenvalue (\( L\text{-max} \)) test.

The likelihood ratio statistic for the trace test is:

\[
-2 \ln Q = -T \sum_{i=r+1}^{p} \ln(1 - \hat{\lambda}_i)
\]  

(4)

where \( \hat{\lambda}_{r+1}, \ldots, \hat{\lambda}_{p} \) are the estimated \( p - r \) smallest eigenvalues. The null hypothesis to be tested is that there are at most \( r \) cointegrated vectors. That is, the number of cointegrated vectors is less than or equal to \( r \), where \( r \) is 0, 1, or 2, and so forth. In each case, the null hypothesis is tested against the general alternative.

Alternatively, the \( L\text{-max} \) statistic is:

\[
-2 \ln Q = -T \ln(1 - \hat{\lambda}_{r+1})
\]  

(5)

In this test, the null hypothesis of \( r \) cointegrated vectors is tested against the alternative hypothesis of \( r+1 \) cointegrated vectors. Thus, the null hypothesis \( r = 0 \) is tested against the alternative that \( r = 1 \), \( r = 1 \) against the alternative \( r = 2 \), and so forth. It is well known the cointegration tests are very sensitive to the choice of lag length. The Schwartz Criterion (SC) and the likelihood ratio test are used to select the number of lags required in the cointegration test.
The results that appear in Table 2 suggest that the number of statistically significant normalized cointegration vectors is equal to 1 and are the following:

\[
LGDP = 26.0303 + 1.4930LFD + 2.0225LOP
\]  

(6)

From the above cointegrated vector we can infer that in the long-run financial development has a positive effect on economic growth, there is a positive relationship between degree of openness of the economy and economic growth as well. According to the signs of the vector cointegration components and based on the basis of economic theory the above relationships can be used as an error correction mechanism in a VAR model.

5. A VAR model with an error correction mechanism

After determining that the logarithms of the model variables are cointegrated, we must estimate then a VAR model in which we shall include a mechanism of error correction model (MEC). The error-correction model, derived from the long-run cointegration relationship, has the following form:

\[
\Delta LGDP_t = \text{lagged}(\Delta LGDP_t, \Delta LFD_t, \Delta LOP_t) + \lambda u_{t-1} + V_t
\]  

(7)

where \( \Delta \) is reported to all variables first differences  
\( u_{t-1} \) are the estimated residuals from the cointegrated regression (long-run relationship) and represents the deviation from the equilibrium in time period \( t \).
-1<λ<0 short-run parameter which represents the response of dependent variable in each period starts from equilibrium point.

\( V_t \) is a 3X1 vector of white noise errors.

Granger (1988) supported that there are two channels of causality, channel 1 is through lagged variables \((\Delta LFD, \Delta LOP)\), when the coefficients of these variables are all statistically significant \((F\text{-statistic})\), and channel 2 if the coefficient \(\lambda\) of variable \(u_{t-1}\) is statistically significant \((t\text{-statistic})\). If \(\lambda\) is statistically significant in equation (7), then financial development and degree of openness of the economy effects on economic growth.

**INSERT TABLE 3**

The error correction model (Equation 7) is used to investigate the causal relationships among the variables of the model. Such analysis provides the short-run dynamic adjustment towards the long-run equilibrium. The significance levels of the \(F\text{-statistics}\) test for the Granger causality and that of \(t\text{-statistics}\) test for the coefficient \(u_{t-1}\). The numbers in parentheses are the lag lengths determined by using the Akaike criterion.

As referred earlier there are two channels of causality. These are called channel 1 and channel 2. If lagged values of a variable (except the lagged value of the dependent variable) are jointly significant then this is channel 1. On the other hand, if the lagged value of the error correction term is significant, then this is channel 2. The results of Table 4 denote the causality through these channels. For convenience in discussing the results, let us call the relationships, a ‘strong causal relationship’ if it is through both channel 1 and channel 2 and simply a ‘causal relationship’ if it is through either channel 1 or channel 2.
From the results of Table 4 we can infer that there is Granger causality between financial development and economic growth, but also between the degree of openness of the economy and economic growth.

More specifically, there is a bilateral «dynamic» causal relationship between financial development and economic growth according to the study of Gursoy and Muslumov (1998) for high-income countries, while the same applies according to the study of Shan, Morris and Sun (2001) for the five out of ten OECD countries. A bilateral «dynamic» causal relationship exists also between the degree of openness and economic growth according to the study of Chang (2002) for mainland China.

6. Conclusions

In this paper we examine the relationship between the degree of openness of the economy, financial development, and economic growth for Greece, through the analysis of multivariate causality based on an error correction model. For the empirical testing of these variables, we use the Johansen cointegration test and Granger causality tests based on a vector error correction model.

The results of the cointegration analysis suggest the existence of cointegration relationship between the three variables. This indicates the presence of common trend or long-run relationships among these variables.
The results of the causality analysis denote that there exists a bilateral (strong) causal relationship between financial development and economic growth and between the degree of openness and economic growth.

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References


Table 1. Tests of unit roots hypothesis

<table>
<thead>
<tr>
<th></th>
<th>Augmented Dickey-Fuller</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\tau_\mu$</td>
<td>$\tau_t$</td>
</tr>
<tr>
<td>LGDP</td>
<td>-0.80372</td>
<td>-1.01766</td>
</tr>
<tr>
<td>LFD</td>
<td>-0.60660</td>
<td>-0.78621</td>
</tr>
<tr>
<td>LOP</td>
<td>-1.49920</td>
<td>-1.56783</td>
</tr>
<tr>
<td>$\Delta$ LGDP</td>
<td>-4.253***</td>
<td>-5.85***</td>
</tr>
<tr>
<td>$\Delta$ LFD</td>
<td>-3.976***</td>
<td>-4.57***</td>
</tr>
<tr>
<td>$\Delta$ LOP</td>
<td>-6.132***</td>
<td>-6.32***</td>
</tr>
</tbody>
</table>

Notes: $\tau_\mu$ is the t-statistic for testing the significance of $\delta_2$ when a time trend is not included in equation 2 and $\tau_t$ is the t-statistic for testing the significance of $\delta_2$ when a time trend is included in equation 2. The calculated statistics are those reported in Dickey-Fuller (1981). The critical values at 1%, 5% and 10% are -3.61, -2.94 and -2.60 for $\tau_\mu$ and -4.21, -3.53 and -3.19 for $\tau_t$, respectively.

The lag-length structure of $a_t$ of the dependent variable $x_t$ is determined using the recursive procedure in the light of a Langrange multiplier (LM) autocorrelation test (for orders up to four), which is asymptotically distributed as chi-squared distribution and the value t-statistic of the coefficient associated with the last lag in the estimated autoregression.

$\eta_\eta$ and $\eta_\tau$ are the KPSS statistics for testing the null hypothesis that the series are I(0) when the residuals are computed from a regression equation with only an intercept and intercept and time trend, respectively. The critical values at 1%, 5% and 10% are 0.739, 0.463 and 0.347 for $\eta_\eta$ and 0.216, 0.146 and 0.119 for $\eta_\tau$, respectively (Kwiatkowski et al, 1992, table 1).

Since the value of the test will depend upon the choice of the ‘lag truncation parameter’, $l$. Here we use the sample autocorrelation function of $\Delta e_t$ to determine the maximum value of the lag length $l$.

***, **, * indicate significance at the 1, 5 and 10 percentage levels.
Table 2. Cointegration tests based on the Johansen and Johansen and Juselius approach (LGDP, LFD, LOP, VAR lag = 5)

<table>
<thead>
<tr>
<th>H0: r = 0</th>
<th>Trace test</th>
<th>5% critical value</th>
<th>10% critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: r ≤ 1</td>
<td>36.8648</td>
<td>31.5400</td>
<td>28.7800</td>
</tr>
<tr>
<td>H0: r ≤ 2</td>
<td>9.8453</td>
<td>17.8600</td>
<td>15.7500</td>
</tr>
<tr>
<td></td>
<td>1.6720</td>
<td>8.0700</td>
<td>6.5000</td>
</tr>
</tbody>
</table>

Notes:
- Critical values are taken from Osterwald – Lenum (1992).
- r denote the number of cointegrated vectors.
- Schwarz Criteria (SC) was used to select the number of lags required in the cointegration test. The computed Ljung – Box Q – statistics indicate that the residuals are white noise.

Table 3 – Causality test results based on vector error – correction modeling

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>F – significance level</th>
<th>t – statistic</th>
<th>$u_{t-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆LGDP</td>
<td>0.000**(3)</td>
<td>0.002***(2)</td>
<td>-3.7875***</td>
</tr>
<tr>
<td>∆LFD</td>
<td>0.123 (3)</td>
<td>0.334 (3)</td>
<td>-1.3807</td>
</tr>
<tr>
<td>∆LOP</td>
<td>0.235 (2)</td>
<td>0.119 (1)</td>
<td>-1.2847</td>
</tr>
</tbody>
</table>

Notes: *, **, and *** indicate 10%, 5%, and 1% levels of significance. Number in parentheses are lag lengths.

Table 4 – Summary of causal relations

<table>
<thead>
<tr>
<th>GDP → FD</th>
<th>GDP → OP</th>
<th>FD → GDP</th>
<th>FD → OP</th>
<th>OP → GDP</th>
<th>OP → FD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td></td>
<td></td>
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