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FINANCE, DEVELOPMENT AND ECONOMIC GROWTH IN BRICS: A PANEL DATA ANALYSIS

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Abstract

The paper examines the nexus between financial development and economic growth by using panel data vector autoregression. Using five BRICS countries (Brazil, Russia, India, China and South Africa), the study finds bidirectional causality between financial development and economic growth. The policy implication of this study is that the economic policies should recognize the finance-growth nexus in order to maintain sustainable development in the economy.

Keywords: Finance development, growth, BRICS, Vector autoregression

JEL Classification: G10, C23, O43

1. Introduction

Academic research on the finance-growth nexus dates back at least to Schumpeter (1911), who emphasized the positive role of financial development on economic growth. However, the relationship between financial development and economic growth has received considerable attention in recent theoretical and empirical literature, not least because of its implications for development policy (see, for instance, Word Bank, 1989; King and Levine, 1993; Demetriades and Hussein, 1996). The finance-growth nexus starts with a critical question, how finance guides the economic growth (see, for example, Jung 1986). There are couples of ways it can be looked into. For instance, is it definitive that finance is good for growth? Or is it absolutely true with respect to optimum size and growth rate of the financial system? Or, like a person who eats too much, does the financial system become an overstuffed drag on the rest of the economy? (see, for instance, Cecchetti and Kharroubi, 2012). However, this paper starts with the assumption that finance is a key to economic growth and by the way, the countries that we have chosen for empirical investigation are not reached to that extreme. The ultimate scope of this

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paper is to examine the direction of causality between finance and growth. The common questions are accordingly: is it unidirectional? Or is it bidirectional between the two.

Broadly speaking, there are four schools of thoughts in the finance-growth nexus (Greenwood and Smith, 1997): supply-leading hypothesis, where financial development causes economic growth (Hassan et al., 2011; Enisan and Olufisayo, 2009; Jalil and Ma, 2008; Eller et al., 2006; Christopoulos and Tsionas, 2004; Rousseau and Wachtel, 2000; Arestis and Demetriades, 1997); demand-following hypothesis, where economic growth causes finance development (Tekin, 2012; Liang and Teng, 2006; Odhiambo; 2009); third, feedback hypothesis, where financial development and economic growth cause each other (Pradhan, 2011; Bangake and Eggoh, 2011; Wolde-Rufael, 2009; Ang, 2008; Caleron and Liu, 2003; Luintel and Khan, 1999; Levine, 1999; Blackburn and Hung, 1998; Demetriades and Luintel, 1996); and finally, there are some studies arguing that there is no relationship between financial development and economic growth (Eng and Habibullah, 2011; Mukhopadhyay et al., 2011; Stern, 1989; Lucas, 1988).

Despite the great deal of effort devoted empirically in disentangling the impact of financial development on economic growth as accurately as possible, there is still no consensus as the existence, the level, or the direction of such nexus. Cross-country and more recently, panel data studies show evidence of a positive impact of financial development on growth while time series studies, on the other hand, offer contradictory results. In fact, there are a number of concerns with the previous literature (Apergis et al., 2007; Levine, 2003). The study aims in making a contribution to the existing discussion by exhibiting empirical evidence from BRICS countries (Brazil, Russia, India, China and South Africa) during the period 1989-2011. The remaining of the paper is organized into three different sections. Section II describes the methodology. Section III discusses the econometrics results. The final section provides conclusion and policy implications.

2. Relevance and Selection of the Study

In the last decades, among the political, economic and financial turbulences that plagued the world, the five BRICS (Brazil, Russia, India, China and South Africa) appears as pillars of relative political stability and economic prosperity (see, for instance, O' Neill, 2001). These countries project their political stability subject to governments capability to carry out declared programs and able to stay in office. Their economic strengths overshadow their weaknesses, resulting relatively less and reasonable economic risks in the economy. The BRICS also seem to finance their debt obligations, in terms of official, commercial and trade, effectively and hence, representing their relatively moderate financial risks. They are well organized and committed to advance their reform measures in the financial sector and have pledged to work together on "economic-political issues such as energy and food security" and to cooperate to promote the research and development (R & D) activities. The presence or lack of these characteristics has a strong bearing on the BRICS's overall economic performance and the relevant information about this performance is valued by various players like scholars, banks, mutual organizations, importers, foreign exchange traders, rating agencies, portfolio managers, institutional investors and so on (see, for instance, O' Neill, 2005). Moreover, with the BRICs nations reforming their financial regulations and policies to attract foreign portfolio flows and contribute to their stock market development and banking sector development, there has been a fundamental shift in the financial structures of these countries and capital flows from developed nations (Chittedi, 2009).

At present, five BRICS has the following features: they together account for more than a quarter of the world's land area, over 40% of the world's population and around 15% of the global GDP. These five countries are deemed to be at a similar stage of newly advanced economic development. For instance, Goldman Sachs predicts China and India, respectively, to be the dominant global suppliers of manufactured goods and services while Brazil and Russia would become similarly dominant as suppliers of raw materials. Cooperation is thus hypothesized to be a logical next step among the BRICs because Brazil and Russia together would form the commodity suppliers to India and China. Thus, the BRICs have the potential to form a powerful economic bloc to the exclusion of the modern-day G7 status (see, for instance, Cheng et al., 2007). It is expected that the BRICS' total nominal GDP (excluding South Africa) to be $128 trillion in 2050, compared to $66 trillion for the G7 countries together at the same time. It also expects the four BRICS countries (excluding South Africa) to account for 41% of the world's market capitalization by 2030. In fact, China will possibly overtake the United States in equity market capitalization terms by 2030 and turn to be the largest equity market in the world economy. The combined share of global trade of BRICS is about 16%. The intra-BRICS trading has escalated to 8% of their total trade. BRICS have more than 30% of the world reserves, and have witnessed a three times increase in their foreign direct investment within themselves. Moreover with increasing productivity, their currency values will appreciate and that will enhance their economic growth (see, for instance, Ahya et al., 2006; King and Henry, 2006). In brief, the BRICS is a symbol of the shift in global economic power away from the developed G7 economies towards the developing world (see, for instance, Hammoudeh et al., 2012; Wilson and Purushothaman, 2003; O' Neill, 2001)

With this above background, we have chosen the five BRICS nation for our empirical investigation and to recognize and predict the direction of the world economy in the future. The idea is that these countries have been interested in fostering their financial development, for example, by reducing governmental intervention in national financial sectors, privatizing banks, enhancing market capitalization and so on. Such policies have been expected to promote growth through, inter alia, a higher mobilization of savings or a rise in domestic and foreign investments (Gries et al., 2008). However, the effectiveness of such policies requires a convenient causal relationship between financial sector development and economic growth. Hence, in this study, the contribution is assessed whether financial sector development has actually swayed economic growth in a sample of five BRICS countries and whether a policy focus on financial sector development is appropriate for fostering economic growth. Since financial sector will not automatically grow, this study simultaneously examines the impact of economic growth on financial development.

3. Methodology

The investigation on finance- growth nexus is executed in four steps: First, apply of principal component analysis to construct the composite index of financial development (FSD); Second, the use of panel unit root test to know the stationarity of variables (FSD and GDP); Third, use of panel cointegration test to know the existence of long run relationships FSD and GDP and estimate long run equation by using fully modified ordinary least squares (FMOLS); and Fourth, use of panel VAR (vector autoregressive) model to know the direction of causality between FSD and GDP. The detail descriptions of these steps are as follows.

3.1. Principal Component Analysis

Principal Component Analysis (PCA) is a special case of more general method of factor analysis. The PCA transforms original set of variables into smaller set of linear combinations that account for most of the variance of the original set. The aim of PCA is to construct out of a set of variables, X_j's (j = 1, 2, .., k) new variables (P_i) called ' Principal Components', which are linear combinations of X's.

The first principal component (P_1) is determined as the linear combination of X_1, X_2,....,X_m provided that the variance contribution is maximum. The second principal component (P_2), independent from the first principal component, is determined as to provide a maximum contribution to total variance left after the variance explained by the first principal component, then the third and the other principal components are determined as to provide the maximum contribution to the remaining variance and independent from each other. The aim here is to determine a_{ij} coefficients providing the linear combinations of variables based on the specified conditions. The following formula is used to have financial sector development index:

$$FSD = \sum_{i=1}^{8} a_i \frac{X_{ij}}{Sd(X_i)} \quad \text{... (1)}$$

where FSD = Composite index of finance sector development; Sd = Standard Deviation; X_{ij} = i^{th} items in j^{th} year; $a_{i,}$ = Factor loadings as derived by PCA.

The composite index of finance development is the sum total of banking sector development (BSD) indicators and stock market development (SMD) indicators. The BSD includes claims on the private sector of the economy (CLM), domestic credits by banks (DCB), domestic credits to private sector (DCP), total reserves (RES) and liquid liability ratio (LIQ), while SMD includes turn over ratio (TUR), value traded ratio (TRA) and market capitalization ratio (MAC). We use two-step procedure to have the composite indices (BSD, SMD and FSD): first, the deployment of PCA; and second, the use of formula in (Eq. 1). The idea behind the use of PCA is to get the factor loadings for all individual indicators under stock market development and banking sector development separately. The factor loadings are simply the weight of the particular factor on the aggregation procedure. Finally, on the basis of these loadings, we developed BSD, SMD and FSD for five BRICS countries during the time period 1989-2011. The data used in this study, for these above nine indicators including GDP, are obtained from World Development Indicators, World Bank, Washington. The trends and status of these three composite indices (BSD, SMD and FSD) are presented in Table 1. Interestingly, the trends of all these three indicators are increasing over the years and that is true for all these five BRICS countries. This clarifies that these countries have not reached the optimal ceiling for financial development, particularly up to the year 2011.

3. 2 Panel Unit Root Test

The unit root test is usually used to check the stationarity of variables. The study applies LLC (Levin et al., 2002) and IPS (Im et al., 2003) panel unit root tests for the same. The LLC allows for heterogeneity of the intercepts across members of the panel, while IPS allows for heterogeneity in intercepts as well as in the slope coefficients. The test starts with the estimation of followings:

Table 1. The Status of Financial Development among the BRICS Countries

Countries	Year	BSD	SMD	FSD
	1989	2.182	2.857	5.038
	1999	2.801	3.429	6.231
Brazil	2009	3.618	3.748	7.366
	2011	3.787	3.645	7.433
	1994	2.098	0.724	2.822
	1999	2.331	3.283	5.615
Russia	2009	3.883	3.800	7.683
	2011	3.937	3.719	7.656
	1989	2.146	2.869	5.016
	1999	2.797	3.698	6.495
India	2009	3.695	3.921	7.616
	2011	3.716	3.677	7.393
	1992	2.636	2.617	5.253
	1999	3.448	3.514	6.963
China	2009	4.630	4.146	8.776
	2011	4.753	3.880	8.633
	1989	1.582	3.743	5.325
	1999	2.115	4.100	6.215
South Africa	2009	2.838	4.267	7.105
	2011	2.929	4.176	7.105

Note: BSD: Banking sector development; SMD: Stock market development; and FSD: Financial sector development.

$$\Delta Y_t = \mu_i + \gamma_i Y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta Y_{it-j} + \lambda_i t + \varepsilon_{it} \quad \text{... (2)}$$

where Y_t is the logarithm of the variable in time period t; i = 1, 2….N; t = 1, 2…. T; p_i is the number of lags selected for the ADF regression; Δ is the first difference filter (I - L); ΔY_{t-1} is the difference between Y_{t-1} and Y_{t-2}; and ε_{it} are independently and normally distributed random variables for all i and t with zero mean and finite heterogeneous variance, that is, [$\varepsilon_t \sim NI(0, \sigma_i^2)$].

The IPS unit root test verifies the null hypothesis of unit root for each individual in the panel, that is, H_0: $\gamma_i = 0$ for $\forall i$ against an alternative H_A: $\gamma_i < 0$, i = 1, 2… N_1; $\gamma_i = 0$, i = N_1 + 1, … N, which allows for some of the individual series to be integrated. The IPS develops the t-bar statistic calculated as a simple average across groups of the individual ADF t statistics and the standardized t-bar statistic converges to standard normal distribution, when *N* tends to high. The LLC unit root test is also in the lines of model (1); but it differs from IPS in some ways. First, IPS allows the coefficients of the autoregressive term, γ_i, to differ across section units, while LLC considers the coefficients of the autoregressive term as homogenous across all individuals, i.e., $\gamma_i = \gamma$ for $\forall i$. Second, the LLC tests the null hypothesis that each individual in the panel has integrated time series [i.e., H_0: $\gamma_i = \gamma = 0$ for $\forall i$ against an alternative H_A: $\gamma_i = \gamma < 0$ for $\forall i$]. Hence, under an alternative hypothesis, all single series are stationary. LLC considers pooling the cross-section time series data and it follows the t- star statistics.

3. 3 Panel Cointegration Test

If the series are individually integrated of same order, then they can be cointegrated (Granger, 1988). That means there is possibility of some linear combination between them. Traditional cointegration tests, likes Engle and Granger (1987) and Johansen and Juselius (1990), have low power of estimation when the data points are relatively low. Pedroni (2000) proposes a methodology to test for panel data cointegration, which is considered as an extension of traditional Engle and Granger two step residual-biased methods. The Pedroni's method is used in this paper for investigating co-integration in a heterogeneous panel data (Larsson et al., 2001). The technique starts with the following regression equation.

$$FSD_{it} = \beta_{0i} + \beta_{1i}t + \beta_{2i}GDP_{it} + \varepsilon_{it} \text{ and } \varepsilon_{it} = \gamma_i\varepsilon_{it-1} + \xi_{it} \quad \text{... (3)}$$

where, FSD is finance development, which includes both banking sector development indicators and stock market development indicators. The GDP is gross domestic product, which is a proxy to economic growth. The β_{0i} is the fixed effect or individual specific effect that is allowed to vary across individual cross-sectional units. The β_{1i} is a deterministic time trend specific to individual countries in the panel. The slope coefficients β_{2i} can vary from one individual to another allowing the cointegrating vectors to be heterogeneous across countries.

Pedroni proposed seven different statistics for the cointegration test in the panel data setting. Of the seven proposed statistics, first four are known as panel cointegration statistics and that is within-dimension statistic, while the last three are known as group mean panel cointegrating statistics and that is between-dimension statistic. Their levels are based on the way the autoregressive coefficients are manipulated to arrive at the final statistic. There are basically five steps to obtain these cointegration statistics.

Step 1: compute the residuals ($\hat{\varepsilon}_{it}$) from the panel regression (equation 4). The estimation involves the inclusion of all appropriate fixed effects, time trends or common time dummies.

Step 2: Compute the residuals ($\hat{\zeta}_{it}$) from the following regression:

$$\Delta Y_{it} = \beta_{1i}\Delta X_{it} + \beta_{2i}\Delta X_{it} + ... + \beta_{mi}\Delta X_{mit} + \xi_{it} \quad \text{... (4)}$$

Step 3: Compute ($\hat{L}^2_{11i}$), the long run variance of $\hat{\zeta}_{it}$:

$$\hat{L}^2_{11i} = \frac{1}{T}\sum \hat{c}^2_{it} + \frac{2}{T}\sum_{S=1}^{K_i}\left(1 - \frac{S}{K_i + 1}\right)\sum_{t-s+1}^{T} \hat{c}_{it}\hat{c}_{it-s} \quad \text{... (5)}$$

Step 4: Compute the residuals of the ADF test for $\hat{\varepsilon}_{it}$ ($\hat{u}_{it}$) and compute the following variances of these residuals

$$\hat{S}^2_i = \frac{1}{T}\sum_{t=1}^{T}\hat{u}^2_{it} \quad \text{and} \quad \tilde{S}^2_{NT} = \frac{1}{T}\sum_{t=1}^{T}\hat{S}^2_i \quad \text{... (6)}$$

Step 5: Computation of panel-t and group-t statistics. These statistics are asymptotically normally distributed.

The null of no cointegration is then tested, based on the above description of standard normal distribution. The null hypothesis of no cointegration is H_0: $\gamma_i = 1$ for $\forall i$ against an alternative hypothesis H_A: $\gamma_i < 1$ for $\forall i$, in the residuals from the panel cointegration. In contrast,

the group means panel cointegration statistics test the null hypothesis of no cointegration against an alternative H_A: $\gamma_i < 1$ for $\forall i$, which allows the possibility of an additional heterogeneity source across the countries. These statistics diverge to negative infinity under the alternative hypothesis. So, the left tail of the normal distribution is usually employed here to reject the null hypothesis (see, for more detail, Pedroni, 1999).

3. 4 Fully Modified OLS Panel Estimates

Pedroni proves that the panel OLS estimator is biased when the variables are cointegrated and suggests estimating and testing hypothesis for cointegrating vectors in dynamic panels by fully modified OLS (FMOLS). The model of FMOLS is described as follows:

$$Y_{it} = \delta_i + \beta_i X_{it} + \xi_{it} \quad \text{... (7)}$$

$$X_{it} = X_{it-1} + \zeta_{it} \quad \text{... (8)}$$

where Y is the log of FSD or log of GDP and X represents the corresponding vector of independent variables.

Let $Z_{it} = (Y_{it}, X_{it})' \sim I(1)$ and $\varpi_{it} = (\xi_{it}, \zeta_{it})' \sim I(0)$ with long run covariance matrix $\Omega_i = L_i L_i'$. L_i is the lower triangular decomposition of Ω_i, which can be decomposed as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i'$.

Where, Ω_i^0 is the contemporaneous covariance and Γ_i is a weighted sum of co-variances. We can also augment the above cointegrating regression with lead and lagged differences of the regressors to control for endogenous feedback.

This can be presented as follows:

$$Y_{it} = \delta_i + \beta_i X_{it} + \sum_{k=k_i}^{k_i} \lambda_{ik} \Delta X_{it-k} + \xi_{it} \quad \text{... (9)}$$

The panel FMOLS estimator of the β is:

$$\beta_{NT}^{*} = N^{-1} \sum_{i=1}^{N} \left(\sum_{i=1}^{T} \left(X_{it} - \bar{X}_i \right)^2 \right)^{-1} \left(\sum_{i=1}^{T} \left(X_{it} - \bar{X}_i \right) Y_{it}^{*} - T\hat{\tau}_i \right) \quad \text{... (10)}$$

where, $Y_{it}^{*} = (Y_{it} - \bar{Y}_i) - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta X_{it}$ and $\hat{\tau}_i = \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} (\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0)$ ... (11)

3. 5 Panel Causality Test

The panel causality test, proposed by Holtz-Eakin et al. (1988), is deployed to know the direction of causality. The proposed panel VAR model is as follows:

$$\Delta FSD_{it} = \eta_{1j} + \sum_{k=1}^{p} \alpha_{11ik} \Delta FSD_{it-k} + \sum_{k=1}^{q} \alpha_{12ik} \Delta GDP_{it-k} + \lambda_{1i} EC_{1it-1} + \varepsilon_{1it} \quad \text{... (12)}$$

$$\Delta GDP_{it} = \eta_{2j} + \sum_{k=1}^{p} \alpha_{21ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \alpha_{22ik} \Delta FSD_{it-k} + \lambda_{2i} EC_{2it-1} + \varepsilon_{2it} \quad \text{... (13)}$$

where, FSD is finance development and GDP is gross domestic product; EC is error correction term derived from the long run cointegrating relationship; and ε_{1it} and ε_{2it} are disturbance terms. The null hypotheses are to test the followings:

$\alpha_{12i} \neq 0$ & $\lambda_{1i} \neq 0$ in equation (12)

$\alpha_{22i} \neq 0$ & $\lambda_{2i} \neq 0$ in equation (13)

The significance of α parameters represent the possibility of short run causality, while the significance of λ parameters represent the possibility of long run causality. It can be noted that FSD stands here the overall financial sector development, which is sum of banking sector development (BSD) and stock market development (SMD). So in reality, banking sector development or stock market development alone can affect the economic growth significantly. Hence, we also like to integrate economic growth with banking sector development and stock market development separately in addition to overall financial sector development. This will give better reflection to finance-growth nexus in BRICS countries. Accordingly, in the estimation process, we use the above two models (cited in equations 12 and 13); however, the replacement is BSD and SMD in place of FSD. The variables incorporated in the panel VAR model are used in natural logarithms so that their first differences approach the growth rates.

4. Empirical Results

The objective of this paper is to study the causal nexus between finance development and economic growth by using panel VAR model in the BRICS countries. The investigation starts with the integration and cointegration properties of time series variables (FSD and GDP). The panel unit root test and panel cointegration are used for the same. The unit root test results confirm that all variables that used in the panel VAR model are non-stationary in the level data but found stationary in the first difference (see Table 1). That means they are unit root variables of order one [1 (1)]. It opens the path to apply panel cointegration for knowing the existence of long run relationship between finance development and economic growth. The Pedroni's panel cointegration is used for the same.

The Pedroni's panel cointegration test can reject the null hypothesis of no cointegration only at case 1 (see Table 2). So the unit root variables (FSD and GDP) are cointegrated. This indicates the presence of long run equilibrium relationship between finance development and economic growth for the five countries in the panel. Following Pedroni (2004), the long run equation (2) is estimated by fully modified OLS (FMOLS) in order to avoid the bias of the OLS estimator. The FMOLS results indicate that the coefficient of finance development are statistically significant and is true for all the five countries in the panel (see Table 3).

After knowing the status of cointegration, the next step is to check the direction of causality between finance development and economic growth. The panel causality test, based on panel VAR model, is used for the same. The estimated results are reported in Table 4. The results confirm the bidirectional causality between finance development and economic growth. The estimated results are also supported by the generalized impulse response functions (GIRFs), which are very responsive to panel VAR results (see Figure 1). This suggests that finance development and economic growth cause each other.

Table 2. Unit Roots Test Results

Variables	Statistics	At Level			At First Difference			Conclusion
		NIT	T	IT	NIT	T	IT	
GDP	LLC	4.55	2.17	0.06	-2.59*	2.95*	-2.12*	1 (1)
	IPS	-----	4.35	1.01	-----	2.32*	-1.56*	1 (1)
	ADF	0.33	0.50	4.20	22.9*	20.9*	16.4*	1 (1)
	PP	0.17	0.23	2.01	37.6*	34.5*	30.6*	1 (1)
BSD	LLC	5.21	-2.46	0.46	-5.83*	-1.44*	-2.17*	1 (1)
	IPS	-----	-0.08	-0.27	-----	-4.59*	-3.31*	1 (1)
	ADF	0.10	9.25	9.38	42.8*	39.1*	28.2*	1 (1)
	PP	0.10	14.1	18.9	87.5*	90.8*	80.2*	1 (1)
SMD	LLC	5.21	-2.46	0.46	-5.83*	-1.44*	-2.17*	1 (1)
	IPS	-----	-0.08	-0.27	-----	-4.59*	-3.31*	1 (1)
	ADF	0.10	9.25	9.38	42.8*	39.1*	28.2*	1 (1)
	PP	0.10	14.1	18.9	87.5*	90.8*	80.2*	1 (1)
FSD	LLC	5.21	-2.46	0.46	-5.83*	-1.44*	-2.17*	1 (1)
	IPS	-----	-0.08	-0.27	-----	-4.59*	-3.31*	1 (1)
	ADF	0.10	9.25	9.38	42.8*	39.1*	28.2*	1 (1)
	PP	0.10	14.1	18.9	87.5*	90.8*	80.2*	1 (1)

Note: NIT: No trend and intercept; T: only trend and no intercept; IT: Both trend and intercept; *: Indicates level of significance at 5%; and other notations are defined earlier.

Table 3. Cointegration Test Results

Statistics	*Model 1*		*Model 2*		*Model 3*	
With Dimension						
Panel v- Statistics	-1.62	[0.94]	1.00	[0.16]	-0.15	[0.56]
Panel ρ- Statistics	-0.97	[0.16]	-0.68	[0.25]	1.39	[0.92]
Panel PP- Statistics	-3.62*	[0.00]	-0.86	[0.19]	1.18	[0.88]
Panel ADF- Statistics	-1.91*	[0.03]	0.65	[0.74]	0.04	[0.52]
Between Dimension						
Group ρ- Statistics	-1.27	[0.90]	0.17	[0.57]	2.13	[0.98]
Group PP- Statistics	-2.39*	[0.01]	0.03	[0.51]	1.99	[0.97]
Group ADF- Statistics	-1.71*	[0.04]	1.01	[0.84]	1.61	[0.95]

Note: Model 1 is cointegration between BSD and GDP; Model 2 is cointegration between SMD and GDP; Model 3 is cointegration between FSD and GDP; parentheses indicate the probability level; and * indicates statistically significant at 5%.

Table 4. Fully Modified OLS Estimates

Country	*BSD*	*SMD*	*FSD*
Brazil	0.12 (6.30)*	0.12 (6.30)*	0.12 (6.30)*
Russia	0.24 (3.80)*	0.12 (6.30)*	0.24 (3.80)*
India	0.11 (7.45)*	0.12 (6.30)*	0.11 (7.45)*
China	0.24 (5.43)*	0.12 (6.30)*	0.24 (5.43)*
South Africa	0.15 (6.86)*	0.12 (6.30)*	0.15 (6.86)*
Panel	0.14 (7.84)*	0.12 (6.30)*	0.14 (7.84)*

Note: Parentheses figure indicates t statistics; and * indicates statistically significant at 5%.

Table 5. Results of Panel Causality Test

Independent Variables	**Dependent Variable**			
MODEL 1: GDP AND BSD	**∆GDP**		**∆BSD**	
∆GDP (-1)	0.13	[0.04]*	0.19	[0.01]*
∆BSD (-1)	0.19	[0.03]*	-0.10	[0.05]*
ECT	0.07	[0.02]*	-0.15	[0.04]*
C	0.02	[0.01]	0.07	[0.01]
F	12.6*		5.35*	
AIC	-2.90		-1.49	
SBC	-2.79		-1.48	
MODEL 2: GDP AND SMD	**∆GDP**		**∆SMD**	
∆GDP (-1)	0.13	[0.04]*	0.19	[0.01]*
∆SMD (-1)	0.19	[0.03]*	-0.10	[0.05]*
ECT	0.07	[0.02]*	-0.15	[0.04]*
C	0.02	[0.01]	0.07	[0.01]
F	12.6*		5.35*	
AIC	-2.90		-1.49	
SBC	-2.79		-1.48	
MODEL 3: GDP AND FSD	**∆GDP**		**∆FSD**	
∆GDP (-1)	0.13	[0.04]*	0.19	[0.01]*
∆FSD (-1)	0.19	[0.03]*	-0.10	[0.05]*
ECT	0.07	[0.02]*	-0.15	[0.04]*
C	0.02	[0.01]	0.07	[0.01]
F	12.6*		5.35*	
AIC	-2.90		-1.49	
SBC	-2.79		-1.48	

Note: GDP: Gross Domestic Product; BSD: Banking Sector Development Index; SMD: Stock Market Development Index; FSD: Financial Sector Development Index; *: Statistically significant at 5%.

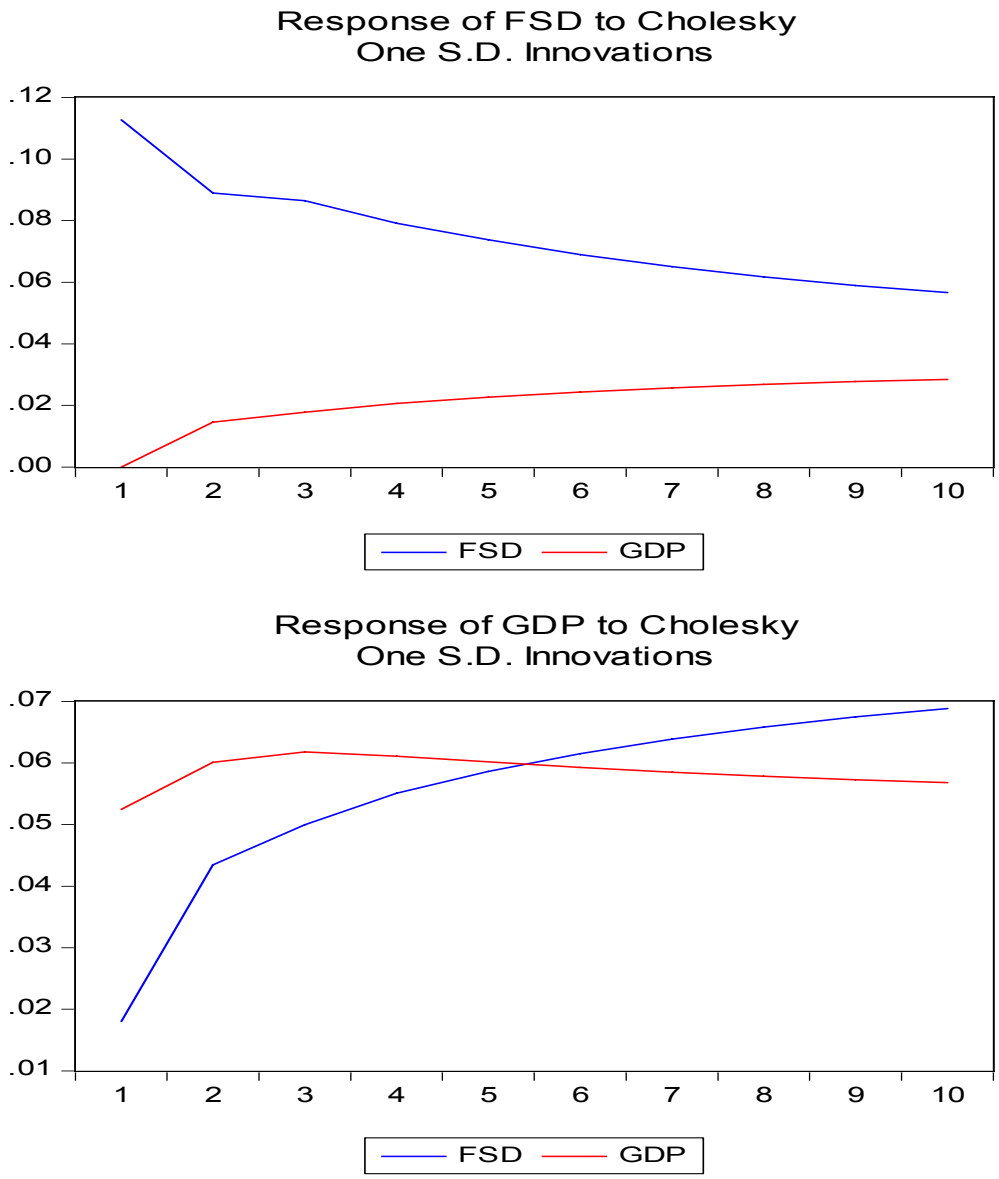

Figure 1. The Generalized Impulse Response to one SE shock in ECM

5. Conclusion and Policy Implications

The close relationship between financial development and real development (in terms of economic growth) has been deeply highlighted in the development literature (Jung, 1986). So, understanding the policy implications in the finance-growth nexus is of great importance in the development economics. Much still needs to be understood about the various integrations between the two for the policy makers to make the right decisions in the financial markets for the achievement of high economic growth.

We presume that finance development is a key to economic growth. The debate is, however, whether finance development determines economic growth or economic growth determines finance development or they cause each other simultaneously. The existing literature usually provides very inconclusive findings. The present investigation gives some limelight to the existing literature and creates a path in designing appropriate financial policies in different countries for the achievement sustainable economic development. The study uses panel vector autoregressive model to the debate between finance development and economic growth.

The findings demonstrate the presence of bidirectional causality between finance development and economic growth, imparting to the support of both 'demand following' and 'supply leading' hypothesis. The findings is similar in the lines of Demetriades and Luintel (1996), Greenwood and Smith (1997), Blackburn and Hung (1998), Luintel and Khan (1999), Levine (1999), Caleron and Liu (2003), Ang (2008), Wolde-Rufael (2009), Pradhan (2011), Bangake and Eggoh (2011) and Hassan et al. (2011). This implies that financial development plays a central role in economic growth and that economic growth leads to the further formation of financial development in the economy.

This suggests that finance development can be used as a policy variable to foster economic growth in the five BRICS countries. The reverse is also true; that means economic growth can be sued as a policy variables to foster financial development in the economy. The policy implication of this study is that the current economic policies should recognize the finance-growth nexus in order to maintain sustainable economic development in the economy.

The study is restricted to panel of five BRICS countries only for the period 1961-2012. This is one of the limitations of this paper. So, there can be much room for further research in this area of economic development. For instance, one can try to lengthen the time series data on an individual country to see how causal patters evolve over time within the same country. Moreover, the behaviour of the monetization variable warrants detailed reinvestigation. Emphasizing the role of a repressed financial sector within the structural framework might shed some light on the exact nature of the relationship between financial development and economic growth (see, for instance, Porter and Ranney, 1982).

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