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The multivariate dynamic causal relations between financial depth, inflation, and economic growth

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This paper examines the dynamic causal relationship between financial depth, inflation and economic growth in India and Pakistan using an autoregressive distributive lag bounds testing procedure and vector error correction modeling approach. The paper uses three proxies for financial depth: broad money supply; domestic credit to private sector; and domestic credit provided by the banking sector. The results of this study prove that financial depth, inflation, and economic growth are cointegrated, indicating the presence of a long-run equilibrium relationship between these variables. The study also finds that financial depth, inflation, and economic growth are Granger-causing each other. It is therefore recommended that both India and Pakistan should intensify their financial depth in order to increase economic growth and reduce inflation.

JEL classification: O43, O16, E44, E31
Keywords: autoregressive distributive lag bounds testing, vector error correction modeling, financial depth, inflation, economic growth

1. Introduction

In this paper, we take a fresh look at the empirical evidence on the long-run relationship between financial depth, inflation, and economic growth in India and Pakistan. The study will be conducted in order to examine the possible direction of causality between financial depth, inflation, and growth and to offer some policy

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suggestions about how these variables may be addressed in future to achieve stable inflation, faster financial development, and higher economic growth.

We conduct this study from two angles. First, we attempt to establish whether and how financial depth has contributed to economic growth in the Indian and Pakistani economy during 1988-2011. Second, we investigate whether inflation is a significant factor that affected the relationship between financial depth and economic growth in the same period. Our two key objectives are to investigate the possible existence of any long-run relationships between financial depth, economic growth, and inflation, and to ascertain the direction of any causality in respect of these relationships. The methods used in pursuit of these two objectives were the autoregressive distributive lag (ARDL) bounds testing procedure and the vector autoregressive error correction model (VECM) approach.

The value of this study will be that policy recommendation on inflation, financial development, and economic growth in both India and Pakistan will help to increase these countries' gross domestic product, decrease unemployment, and enhance economic stability. India as a country aims to increase its stance and position in the five major emerging national economies of Brazil, Russia, India, China, and South Africa. Both India and Pakistan still suffer economically from the 2008 world economic crises and are faced with increasing population growth and rising unemployment.

The remainder of this paper consists of four more sections. The second section sets out the theoretical framework between financial depth, inflation, and economic growth. The third section describes the data structure and research methods used in the study. The fourth section presents the results and a discussion of the findings. The fifth and final section provides a conclusion and comments on the potential policy implications of the findings.

2. Theoretical framework

This study is based on the theory of economic development proposed by Schumpeter [1911] and explores additional concepts to the treated object. Is this a holistic vision of interdependence in the face of the changes that are emerging from the economic environment on various situations? This paper focuses on financial depth to explain their involvement in economic growth and inflation. Figure 1 depicts the possible long-run causal relationship between financial depth, economic growth, and inflation. The study explores this relationship by testing for the cointegration of the variables and the estimated coefficients in the short term and the long term in order to understand the impact of financial depth and inflation on economic growth.

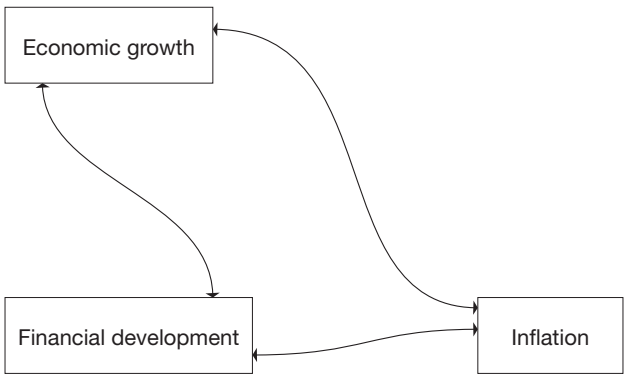


FIGURE 1. The conceptual framework of the possible patterns of causality between the variables from a theoretical point of view

Over the past few decades the effect of financial depth in promoting economic growth has received much attention and has been a focal point of several theoretical and empirical studies (Pradhan et al. [2014]; Chakraborty [2008]; Ma and Jalil [2008]; Odhiambo [2010]; Ang [2008]; Odhiambo [2007]; Levine [2005]; Mukherjee and Bhattacharya [2001]; King and Levine [1993]; Pagano [1993]). Despite a sizeable body of literature on this subject, the direction of the causal effect across the two variables has been inconclusive. Thus, it is still open to question whether financial depth drives economic growth or whether it is economic growth that drives the financial depth of an economy.

More formally, four hypotheses and the corresponding empirical findings of the studies in this area are developed and presented. First, the **supply-leading hypothesis**, which contends that financial depth is a necessary pre-condition to economic growth, must be tested (King and Levine [1993]; Shaw [1973]). Thus, the causality runs from financial depth to economic growth. The proponents of this hypothesis maintain that financial depth induces economic growth by directly facilitating and increasing savings in the form of financial assets, thereby spawning capital formation and hence promoting economic growth (Pradhan [2011]; Quartey and Prah [2008]; Abu-Bader and Abu-Qarn [2008]; Christopoulos and Tsionas [2004]; Levine et al. [2000]; Neusser and Kugler [1998]; Levine [1997]).

A second proposition is the **demand-following hypothesis**, which suggests that causality runs instead from economic growth to financial depth. Supporters of this hypothesis suggest that financial depth plays only a minor role in economic growth and that it is merely a by-product or an outcome of growth in the real side of the economy (Gries et al. [2009]; Ang [2008]; Odhiambo [2008]; Liang and Teng [2006]; Jung [1986]). This hypothesis tests the fact that as an economy grows, additional financial inclusions emerge in the economy in response to higher demand for financial services. Thus, the dearth of financial depth in developing

countries indicates a lack of demand for financial services. Accordingly, as the real side of the economy grows, the financial depth develops further, thereby increasing opportunities for funding investment and diversifying risk (Pradhan [2013]; Gries et al. [2009]; Quartey and Prah [2008]; Ang [2008]).

The third proposition is the **feedback hypothesis**, which suggests that economic growth and financial depth can complement and reinforce each other, making financial depth and real economic growth mutually causal. The argument in favor of this bidirectional causality is that financial depth is indispensable to economic growth and economic growth inevitably requires well-established financial depth (Pradhan et al. [2013]; Pradhan and Gunashekar [2013]; Hassan et al. [2011]; Mukhopadhyay et al. [2011]; Wolde-Rufael [2009]; Odhiambo [2007]; Calderon and Liu [2003]; Shan et al. [2001]; Khan [2001]; Levine [1999]; Luintel and Khan [1999]; Blackburn and Huang [1998]; Demetriades and Hussein [1996]).

The fourth proposition is the **neutrality hypothesis** between financial depth and economic growth. The argument is that both financial depth and economic growth are independent from each other [Chandavarkar 1992].

There is also a body of literature on the direction of causality between economic growth and inflation. However, work on this possible relationship is not as abundant. Some studies report a positive link between inflation and economic growth [Hwang 2001], while others report a negative relationship between the two (Adam and Bevan [2005]; Arai et al. [2004]; Bruno and Easterly [1998]; Barro [1995]; De Gregorio [1993]). On the other hand, Nguyen and Wang [2010] and Andres and Hernando [1997] document the existence of a feedback causal relationship between these variables. The variations in results from these studies warrant further research and empirical validation, hence the goal of the present study.

This paper follows Sunde [2012], Wu et al. [2010], Naceur and Ghazouani [2007], Fountas and Karanassos [2007], Andres et al. [2004], Us [2004], and Boyd et al. [2001] in hypothesizing that both financial depth and inflation may be related to economic growth.

Table 1 presents a brief summary of the existing literature on the causal nexus between financial depth and economic growth.

TABLE 1. Summary of studies on the nexus between financial depth and economic growth

Study	Methods	Study area	Periods covered
Case 1: Studies supporting the supply-leading hypothesis*			
Hsueh et al. [2013]	Bivariate Granger Causality	Ten Asian countries	1980-2007
Chaiechi [2012]	Multivariate Granger Causality (MVGC)	South Korea, Hong Kong, UK	1990-2006
Bojanic [2012]	MVGC	Bolivia	1940-2010
Kar et al. [2011]	MVGC	15 MENA countries	1980-2007
Jalil et al. [2010]	Trivariate Granger Causality (TVGC)	China	1977-2006
Wu et al. [2010]	MVGC	European Union	1976-2005
Abu-Bader and Abu-Qarn [2008b]	TVGC	Egypt	1960-2001
Ang [2008b]	MVGC	Malaysia	1960-2003
Naceur and Ghazouani [2007]	MVGC	MENA region	1979-2003
Boulila and Trabelsi [2004]	Bivariate Granger Causality	Tunisia	1962-1987
Calderon and Liu [2003]	MVGC	109 countries	1960-1994
Case 2: Studies supporting the demand-following hypothesis**			
Odhiambo [2010]	MVGC	South Africa	1969-2006
Panopoulou [2009]	MVGC	5 countries	1995-2007
Ang and McKibbin [2007]	MVGC	Malaysia	1960-2001
Liang and Teng [2006]	MVGC	China	1952-2001
Case 3: Studies supporting the feedback hypothesis***			
Uddin et al. [2014]	TVGC	Bangladesh	1975-2011
Chow and Fung [2011]	TVGC	69 countries	1970-2004
Wold-Rufael [2009]	Quadvariate Granger Causality	Kenya	1966-2005
Dritsakis and Adamopoulos [2004]	TVGC	Greece	1960-2000
Craigwell et al. [2001]	MVGC	Barbados	1974-1998
Ahmed and Ansari [1998]	MVGC	India, Pakistan, Sri Lanka	1973-1991

Notes

*Supply-leading hypothesis: if unidirectional causality is present from financial depth to economic growth.
**Demand-following hypothesis: if unidirectional causality form economic growth to financial depth is present.
***Feedback hypothesis: if bidirectional causality between financial depth and economic growth is present.

In the next section, the research methods are described. The data, hypotheses, and statistical techniques employed will be discussed.

3. Methods

3.1. Variable selection and data structure

The data sample of this study consists of per capita economic growth (GDP), financial depth[1] (FD) (broad money supply [FD 1]; domestic credit to private sector [FD 2]; domestic credit by banking sector [FD 3]), and inflation. The annual time series data from 1988 to 2011 for the Indian and Pakistan economies were employed by examining the dynamic causal relationship between financial depth, inflation, and economic growth. The data were obtained from World Development Indicators, International Monetary Fund, Washington. The sample for this study covers a period characterized by tremendous economic growth, inflation, and financial depth in the Indian and Pakistan economies.

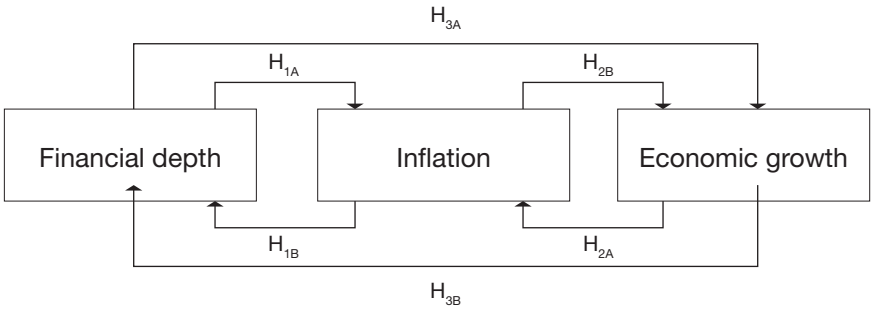
3.2. Hypotheses

The study uses three distinct indicators of financial depth such as broad money supply (M_2), domestic credit to the private sector (DCPS), and domestic credit provided by the banking sector (DCBS) to establish the link with inflation and economic growth. It intends to test the following hypotheses:

H_1: Financial depth (FD) Granger-causes economic growth. This is termed the FD-led growth hypothesis.
H_2: Inflation (INF) Granger-causes economic growth. This is termed the INF-led growth hypothesis.
H_3: Financial depth Granger-causes inflation. This is termed the FD-led inflation hypothesis.

Figure 2 summarizes the possible patterns of causal relations between the variables.

[1] Financial depth is traditionally considered a proxy for financial development. The literature provides several measures of financial development, so it is very difficult to choose a particular indicator that captures the extent to which financial markets in a country fulfill their potential roles. See, inter alia, Pradhan et al. [2017], Klein and Olivei [2008], Levine et al. [2000], Rajan and Zingales [1998], and King and Levine [1993]. Therefore, in our work, we focus on three indicators of financial intermediary development, with each indicator constructed in such a way that an increase reflects greater financial depth. It is plausible, at least in principle, for financial integration to have an impact on the development of financial intermediaries, but also on the development of a country's stock and bond market [Levine and Zervos 1998]. Our paper limits the analysis to indicators of financial intermediary development since this allows us to have better comparison between these two countries.



Notes: We use three indicators for financial development [FD 1: Broad money supply (M2); FD 2: Domestic credit to private sector; FD 3: Domestic credit provided by banking sector]. We use percentage change of consumer price index for inflation (INF) and growth of per capita GDP as a representative to economic growth.

FIGURE 2. Proposed model and hypotheses

In this study, the tests for the FD-led growth hypothesis (H_1) and its counterparts (the INF-led growth hypothesis, H_2, and the FD-led inflation hypothesis, H_3) were performed in two steps: first, tests for cointegration; and second, tests for Granger causality. The ARDL bounds testing procedure and the VECM approach were employed for testing these three hypotheses (H_1, H_2, and H_3). This section provides a brief review of the methodologies adopted in this paper.

3.3. Tests

The study uses Granger causality test, based on the VECM approach or the vector autoregressive model, to establish dynamic causal relations between financial depth, inflation, and economic growth. However, the precondition to this test is to know the existence of cointegration among these variables. We use an ARDL bounds testing approach to examine the cointegration. The ARDL bounds testing approach to cointegration is preferred due to certain advantages that this model contains. For instance, the test procedure is very flexible in response to order of integration [i.e., whether variables are found to be stationary at I (1) or I (0) or I (1)/I (0)]. Besides, the Monte Carlo investigation shows that this approach is superior and provides consistent results for small samples [Pesaran and Shin 1999]. The details of ARDL and Granger causality test are as follows.

a. Testing cointegration: ARDL bounds testing procedure

The ARDL bounds testing approach is used to examine the long-run cointegration relationship between financial depth (FD), economic growth (GDP), and inflation (INF). The ARDL model can be expressed as follows:

MODEL 1. FD 1 (broad money supply: M2), inflation, and economic growth

$$\Delta FD1_t = \mu_{11FD1} + \sum_{i=1}^{p} \lambda_{11FD1i} \Delta FD1_{t-i} + \sum_{j=1}^{q} \alpha_{11FD1j} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{11FD1k} \Delta INF_{t-k} + \delta_{11FD1} FD1_{t-1} + \eta_{11FD1} GDP_{t-1} + \rho_{11FD1} INF_{t-1} + \zeta_{11t} \quad (1)$$

$$\Delta GDP_t = \mu_{12GDP} + \sum_{i=1}^{p} \lambda_{12GDPi} \Delta GDP_{t-i} + \sum_{j=1}^{q} \alpha_{12GDPj} \Delta FD1_{t-j} + \sum_{k=1}^{r} \beta_{12GDPk} \Delta INF_{t-k} + \delta_{12GDP} GDP_{t-1} + \eta_{12GDP} FD1_{t-1} + \rho_{12GDP} INF_{t-1} + \xi_{11t} \quad (2)$$

$$\Delta INF_t = \mu_{I3INF} + \sum_{i=1}^{p} \lambda_{13INF} \Delta INF_{t-i} + \sum_{j=1}^{q} \alpha_{13INF} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{13INFk} \Delta FD1_{t-k} + \delta_{13INF} INF_{t-1} + \eta_{13INF} GDP_{t-1} + \rho_{13INF} FD1_{t-1} + \varsigma_{11t} \quad (3)$$

Model 2: FD 2 (domestic credit to private sector: DCPS), inflation, and economic growth

$$\Delta FD2_t = \mu_{21FD2} + \sum_{i=1}^{p} \lambda_{21FD2i} \Delta FD2_{t-i} + \sum_{j=1}^{q} \alpha_{21FD2j} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{21FD2k} \Delta INF_{t-k} + \delta_{21FD2} FD1_{t-1} + \eta_{21FD2} GDP_{t-1} + \rho_{21FD2} INF_{t-1} + \zeta_{21t} \quad (4)$$

$$\Delta GDP_t = \mu_{22GDP} + \sum_{i=1}^{p} \lambda_{22GDPi} \Delta GDP_{t-i} + \sum_{j=1}^{q} \alpha_{22GDPj} \Delta FD2_{t-j} + \sum_{k=1}^{r} \beta_{22GDPk} \Delta INF_{t-k} + \delta_{22GDP} GDP_{t-1} + \eta_{22GDP} FD2_{t-1} + \rho_{22GDP} INF_{t-1} + \xi_{21t} \quad (5)$$

$$\Delta INF_t = \mu_{23INF} + \sum_{i=1}^{p} \lambda_{23INF} \Delta INF_{t-i} + \sum_{j=1}^{q} \alpha_{23INF} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{23INFk} \Delta FD2_{t-k} + \delta_{23INF} INF_{t-1} + \eta_{23INF} GDP_{t-1} + \rho_{23INF} FD2_{t-1} + \varsigma_{21t} \quad (6)$$

Model 3: FD 3 (domestic credit by banking sector: DCBS), inflation, and economic growth

$$\Delta FD3_t = \mu_{31FD3} + \sum_{i=1}^{p} \lambda_{31FD3i} \Delta FD3_{t-i} + \sum_{j=1}^{q} \alpha_{31FD3j} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{31FD3k} \Delta INF_{t-k} + \delta_{31FD3} FD3_{t-1} + \eta_{31FD3} GDP_{t-1} + \rho_{31FD3} INF_{t-1} + \zeta_{31t} \quad (7)$$

$$\Delta GDP_t = \mu_{32GDP} + \sum_{i=1}^{p} \lambda_{32GDPi} \Delta GDP_{t-i} + \sum_{j=1}^{q} \alpha_{32GDPj} \Delta FD3_{t-j} + \sum_{k=1}^{r} \beta_{32GDPk} \Delta INF_{t-k} + \delta_{32GDP} GDP_{t-1} + \eta_{32GDP} FD3_{t-1} + \rho_{32GDP} INF_{t-1} + \xi_{31t} \quad (8)$$

$$\Delta INF_t = \mu_{33INF} + \sum_{i=1}^{p} \lambda_{33INF} \Delta INF_{t-i} + \sum_{j=1}^{q} \alpha_{33INF} \Delta GDP_{t-j} + \sum_{k=1}^{r} \beta_{33INFk} \Delta FD3_{t-k} + \delta_{33INF} INF_{t-1} + \eta_{33INF} GDP_{t-1} + \rho_{33INF} FD3_{t-1} + \varsigma_{31t} \quad (9)$$

Where
Δ represents change;
μ is the drift component;
ζ_t, ξ_t, and ς_t are white noise error terms;
λ, α, and β are short-run coefficients; and
δ, η, and ρ are the corresponding long-run multiplier of the underlying ARDL model.

The null hypotheses are tested by using the generalized F-statistics. The test involves asymptotic critical value bounds, depending on whether the variables are I (0) and/or I (1). Two sets of critical values are generated. One set refers to the I (1) series, and the other refers to the I (0) series. The critical values for the I (1) series are referred to as upper bound critical values; the critical values for the I (0) series are referred to as lower bound critical values. For more details, see Narayan and Smyth [2005], Narayan [2005], Pesaran et al. [2001], Pesaran et al. [2000], Pesaran and Shin [1999], Pesaran and Smith [1998], Pesaran and Pesaran [1997]. To determine the order of integration of series, we employed the augmented Dickey Fuller unit root test [Dickey and Fuller 1981].

If the computed F-statistics are above the upper bound, the null hypothesis of no cointegration needs to be rejected, indicating evidence of a long-run equilibrium relationship between the variables, regardless of the order of integration of the variables. If the test statistic falls below the lower bound, we cannot reject the null hypothesis of cointegration, indicating the absence of a long-run equilibrium relationship. If the test statistics fell between the bounds, a conclusive inference could not be made without knowing the order of integration of the underlying regressors.

b. Granger causality test

Once the long-run relationships have been identified, the next step is to examine the short- and long-run Granger causality between financial depth, inflation, and economic growth. The following model involves the estimation of long- and short-run dynamics by using the VECM approach:

$$\Delta FDS_t = A_{11FDS} + \sum_{i=1}^{p} B_{11FDS}\Delta FDS_{t-j} + \sum_{j=1}^{q} C_{11FDS}\Delta GDP_{t-j} + \sum_{j=1}^{r} D_{11FDS}\Delta INF_{t-j} + \nu_{1FDS} ECM_{t-1} + \varepsilon_{1t} \quad (10)$$

$$\Delta GDP_t = A_{21GDP} + \sum_{i=1}^{p} B_{21GDP}\Delta GDP_{t-j} + \sum_{j=1}^{q} C_{21GDP}\Delta FDS_{t-j} + \sum_{j=1}^{r} D_{21GDP}\Delta INF_{t-j} + \nu_{2GDP} ECM_{t-1} + \varepsilon_{2t} \quad (11)$$

$$\Delta INF_t = A_{31INF} + \sum_{j=1}^{p} B_{31INF}\Delta INF_{t-j} + \sum_{j=1}^{q} C_{31INF}\Delta GDP_{t-j} + \sum_{j=1}^{r} D_{31INF}\Delta FDS_{t-j} + \nu_{3INF} ECM_{t-1} + \varepsilon_{3t} \quad (12)$$

In this model, A_{ij}, B_{ij}, C_{ij}, and D_{ij} (for i = 1, 2, 3; J = 1, 2, 3) are short-run coefficients, and v_1, v_2, and v_3 are long-run coefficients. ECM_{t-1} represents the lagged error term, which is estimated from the long-run equilibrium relationship, and FDS is financial depth (for S = 1, 2, 3) [namely FD1 (M2: broad money supply); FD2 (DCPS: domestic credit to private sector); and FD3 (DCBS: domestic credit provided by banking sector)]. The ECM component is removed in the estimation process, if variables are not cointegrated in the ARDL bounds testing procedure.

It can be noted that the estimations of both ARDL and VECM are very sensitive to lag length. We used the Akaike information criterion to choose the optimum lag length, as recommended by Burnham and Anderson [2004].

Furthermore, we have also used generalized impulse response functions to establish the strengths of these causal relationships (Awokuse [2008]; Reizman et al. [1996]; Koop et al. [1996]; Lutkepohl and Reimers [1992]; Pesaran and Shin [1988]).

4. Results and discussion

The empirical results are reported in this section. Tables 2 and 3 report the descriptive statistics and correlation matrix of the variables.

TABLE 2. Summary statistics for the variables

Variables	Mean	Median	Maximum	Minimum	Standard deviation	Skewness	Kurtosis	Jarque Bera
For India								
FD 1: Broad money supply (M2)	1.59	1.54	1.84	1.37	0.17	0.08	1.38	2.54
FD 2: Domestic credit to private sector	1.63	1.59	1.88	1.41	1.17	-0.04	1.42	2.39
FD 3: Domestic credit provided by banking sector	1.41	1.39	1.69	1.16	0.16	0.03	1.81	1.35
Inflation	1.03	1.04	1.20	0.84	0.10	-0.36	2.19	1.13
GDP: Per capita economic growth	1.31	1.31	1.35	1.23	0.03	-0.67	3.19	1.78
For Pakistan								
FD 1: Broad money supply (M2)	1.64	1.65	1.70	1.58	0.04	-0.20	1.75	1.65
FD 2: Domestic credit to private sector	1.72	1.73	1.78	1.63	0.05	-0.80	2.48	2.44
FD 3: Domestic credit provided by banking sector	1.39	1.39	1.47	1.26	0.05	-0.12	3.11	0.07
Inflation	1.13	1.15	1.40	0.90	0.13	-0.26	2.48	0.52
GDP: Per capita economic growth	1.27	1.27	1.36	1.19	0.04	0.13	2.61	0.21

Note: Values reported here are the natural logs of the variables. We use natural log forms in our estimation.

The correlation results show a significant and positive association between financial depth (M2, DCPS, and DCBS) and economic growth, between economic growth and inflation, and between financial depth and inflation.[2] This is an indication that these variables are expected to cause each other in the long run.

Following the correlation results, we also report the unit root results in order to establish the order of integration of the variables. This is essential for the validity of the ARDL model. We deployed the Augmented Dickey Fuller [Dickey and Fuller 1979] test for the same. In Table 4, the results of Augmented Dickey Fuller unit root test are presented.

[2] Please see third row in Case 2, second and third rows in Case 3, and second, third, fourth, and fifth rows in Case 4. The results also show some negative correlation; however, they are not statistically significant at both 1 percent and 5 percent levels.

TABLE 3. Correlation matrix

	India					Pakistan				
Variables	**FD 1: Broad money supply (M2)**	**FD 2: Domestic credit to private sector**	**FD 3: Domestic credit provided by banking sector**	**Inflation**	**GDP: Per capita economic growth**	**FD 1: Broad money supply (M2)**	**FD 2: Domestic credit to private sector**	**FD 3: Domestic credit provided by banking sector**	**Inflation**	**GDP: Per capita economic growth**
Case 1										
FD 1	1.00					1.00				
Inflation	-0.14			1.00		0.01			1.00	
GDP	0.50			0.23	1.00	0.23			-0.11	1.00
Case 2										
FD 2		1.00					1.00			
Inflation		-0.10		1.00			0.10		1.00	
GDP		0.51*		0.35**	1.00		0.35**		-0.11	1.00
Case 3										
FD 3			1.00					1.00		
Inflation			-0.04	1.00				0.67**	1.00	
GDP			0.37**	-0.14				-0.16	-0.11	1.00
Case 4										
FD 1	1.00					1.00				
FD 2	0.96*	1.00				0.76*	1.00			
FD 3	0.92*	0.97*	1.00			0.16	0.27	1.00		
Inflation	-0.14	-0.10	-0.04	1.00		0.01	0.10	0.67*	1.00	
GDP	0.50*	0.51*	0.37**	-0.11		0.26	0.35**	-0.16	-0.11	1.00

Notes
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 5 percent level.

TABLE 4. Unit root test statistics

		No trend		Trend		
Test statistics	**Variables**	**Level data**	**First difference data**	**Level data**	**First difference data**	**Inferences and conclusion**
For India						
	FD 1: Broad money supply (M2)	0.43	-3.55*	-2.09	-4.48*	Stationary and I [1]
	FD 2: Domestic credit to private sector	0.99	-3.36*	-2.72	-2.97**	Stationary and I [1]
Augmented Dickey Fuller test	FD 3: Domestic credit provided by banking sector	1.34	-3.44*	-1.83	-4.48*	Stationary and I [1]
	Inflation rate	-2.67	-5.41*	-2.76	-5.28*	Stationary and I [1]
	GDP: Per capita economic growth	-3.29*	-6.88*	-4.56*	-6.68*	Stationary and I [0]
For Pakistan						
	FD 1: Broad money supply (M2)	-2.68	-3.99*	-2.22	-3.29*	Stationary and I [1]
	FD 2: Domestic credit to private sector	-2.75	-3.95*	-2.45	-3.82*	Stationary and I [1]
Augmented Dickey Fuller test	FD 3: Domestic credit provided by banking sector	-1.92	3.01*	-2.16	-3.92*	Stationary and I [1]
	Inflation rate	-1.73	-5.15*	-1.70	-5.07*	Stationary and I [1]
	GDP: Per capita economic growth	-3.11*	-5.86*	-3.08*	-5.71*	Stationary and I [0]

Notes:
I [1]: Integrated of order one.
I [0]: Integrated of order zero.
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 5 percent level.

The tests results reflect that time series variables, namely financial depth (FD1: M2, FD2: DCPS, and FD3: DCPS), inflation (INF), and economic growth (GDP) have unit roots in their levels. This is due to the fact that the estimated Augmented Dickey Fuller statistics cannot reject the null hypothesis of non-stationarity at a 5 percent level of significance. However, all variables are stationary at a 5 percent significance level of the first difference. Hence, the variables are I (1), meaning that they are integrated in the first order. This finding is true for both India and Pakistan.

This result also points toward the possibility of cointegration between financial depth, inflation, and economic growth. The ARDL model was deployed for the same purpose. The reason for this was to establish the cointegration between various proxies of financial depth, inflation, and economic growth.

Two steps are used in this procedure in a stepwise fashion: first, the order of lags on the first differenced variables in equations 1-9 obtained from the unrestricted models by using the Akaike information criterion; and second, we apply the bounds F-test to these equations (1-9) in order to establish whether there exists a long-run relationship between the variables in this study.

Tables 5 and 6 present the computed F-values for testing the existence of long-run relationship, with the null hypothesis stating that there is no long-run equilibrium relationship between these variables (financial depth, inflation, and economic growth). The F-statistics in Tables 4 and 5 are compared with the critical bounds provided by Pesaran et al. [2001] and Narayan [2005]. The outcome of the bounds test critically depends on the choice of lag length in the ARDL models. We use Schwartz Bayesian Criterion to select the optimum lag length. The null hypotheses (H_0: $\partial_{ij} = \eta_{ij} = \rho_{ij} = 0$ for i = 1, 2, 3, and j = 1, 2, 3) that no long-run relationship exists between these variables are conclusively rejected. When financial depth is the dependent variable, the calculated F-statistic F_{FD1} (FD1/INF, GDP) is 6.38, which is greater than the upper bound of the critical value obtained from Narayan [2005] or Pesaran et al. [2001], suggesting there is compelling evidence for cointegration between financial depth (M2), inflation, and economic growth. This finding is also true when the dependent variable is FD2 (domestic credit provided to private sector) and FD3 (domestic credit provided by banking sector) for the Indian economy, but it is only true for FD1 in the Pakistani economy. The process was repeated for the other variables too, where in some cases it supports cointegration, and in other cases it is rejected. For instance, for India, F_{INF} (INF/FD1, GDP) is 1.62, which is below Narayan's lower bound critical value at the 1 percent level. Tables 4 and 5 present these results as well as the results of the other models. The ARDL test is used here for two specific reasons: firstly, for the advantage of examining long-run equilibrium relationship between these variables under the umbrella of different orders of integration [see the unit test results in Table 3]; and secondly, due to the fact that the long-run equilibrium relationship can give an indication to detect the direction of causality. For instance, if the variables are cointegrated, we can use the VECM approach to establish the direction of causality, and if not, one can use the vector autoregressive model in order to confirm the result.

We also verified the long-run relationship through the cointegration test of Johansen and Juselius [1990]. The result shows one cointegrating vector among financial depth, economic growth, and inflation. However, the results are not made available here due to space constraints.

TABLE 5. Results of autoregressive distributive lag cointegration test for India

Bounds testing		Diagnostic tests			
Dependent variable	**F-statistic**	χ^2_N	χ^2_A	χ^2_R	χ^2_S
Model 1: FD 1, inflation rate, GDP					
FD 1: Broad money supply (M2)	6.38[a]	[2]: 1.87	[1]: 0.01	[1]: 5.69	[1]: 0.86
Inflation rate	1.62[b]	[2]: 0.04	[1]: 0.28	[1]: 3.47	[1]: 0.16
GDP: Per capita economic growth	3.58[a]	[2]: 1.68	[1]: 0.30	[1]: 9.14	[1]: 1.49
Model 2: FD 2, inflation rate, GDP					
FD 2: Domestic credit to private sector	3.62[a]	[2]: 1.59	[1]: 0.01	[1]: 0.07	[1]: 7.86
Inflation rate	3.79[a]	[2]: 0.42	[1]: 1.26	[1]: 3.18	[1]: 4.95
GDP: Per capita economic growth	3.66[a]	[2]: 2.30	[1]: 0.19	[1]: 9.14	[1]: 3.65
Model 3: FD 3, inflation rate, GDP					
FD 3: Domestic credit provided by banking sector	4.01[a]	[2]: 0.86	[1]: 0.61	[1]: 0.01	[1]: 0.22
Inflation rate	3.55[a]	[2]: 0.39	[1]: 0.01	[1]: 1.09	[1]: 0.42
GDP: Per capita economic growth	3.62[a]	[2]: 0.46	[1]: 2.02	[1]: 2.04	[1]: 0.55

Critical bounds

F-statistic[#]		F statistic[##]		Significance level (percentage)
I (0)	**I (1)**	**I (0)**	**I (1)**	
3.74	5.06	4.188	5.694	1
2.86	4.01	3.068	4.274	5
2.45	3.52	2.574	3.682	10

Notes
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 10 percent level.
χ^2_N: χ^2 Normal
χ^2_A: χ^2 ARCH
χ^2_R: χ^2 RESET
χ^2_S: χ^2 serial
[a]Indicates that the statistic lies above the upper bound.
[b]Indicates that the statistic falls below the lower bound.
[#]Pesaran et al. [2001]
[##]Narayan [2005]

TABLE 6. Results of autoregressive distributive lag cointegration test for Pakistan

Bounds testing		Diagnostic tests			
Dependent variable	**F statistic**	χ^2N	χ^2A	χ^2R	χ^2S
Model 1: FD 1, inflation rate, GDP					
FD 1: Broad money supply (M2)	4.17[a]	[2]: 1.52	[1]: 0.15	[1]: 1.27	[1]: 1.87
Inflation rate	1.47[b]	[2]: 5.18	[1]: 0.50	[1]: 0.13	[1]: 0.05
GDP: Per capita economic growth	1.91[b]	[2]: 4.52	[1]: 1.19	[1]: 2.29	[1]: 0.09
Model 2: FD 2, inflation rate, GDP					
FD 2: Domestic credit to private sector	3.60[a]	[2]: 1.70	[1]: 0.48	[1]: 0.17	[1]: 2.26
Inflation rate	1.65[b]	[2]: 0.58	[1]: 0.53	[1]: 0.07	[1]: 0.07
GDP: Per capita economic growth	1.31[b]	[2]: 3.80	[1]: 1.04	[1]: 5.13	[1]: 0.79
Model 3: FD 3, inflation rate, GDP					
FD 3: Domestic credit provided by banking sector	3.55[a]	[2]: 1.63	[1]: 1.51	[1]: 0.01	[1]: 1.11
Inflation rate	1.22[b]	[2]: 0.01	[1]: 1.24	[1]: 0.34	[1]: 0.02
GDP: Per capita economic growth	0.64[b]	[2]: 5.25	[1]: 3.11	[1]: 4.09	[1]: 0.64

Critical bounds

F statistic[#]		F statistic[##]		Significance level (percentage)
I (0)	**I (1)**	**I (0)**	**I (1)**	
3.74	5.06	4.188	5.694	1
2.86	4.01	3.068	4.274	5
2.45	3.52	2.574	3.682	10

Notes
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 10 percent level.
χ^2N: χ^2 Normal
χ^2A: χ^2 ARCH
χ^2R: χ^2 RESET
χ^2S: χ^2 serial
[a]Indicates that the statistic lies above the upper bound.
[b]Indicates that the statistic falls below the lower bound.
[#]Pesaran et al. [2001]
[##]Narayan [2005]

Once the required information about the existence of cointegration (a long-run relationship) was obtained, we proceeded to a multivariate dynamic Granger causality test, based on the VECM platform. Tables 7 and 8 present the multivariate Granger causalities between financial depth, inflation and economic growth. Table 7 provides the VECM results for India, while Table 8 provides the VECM results for Pakistan.

TABLE 7. Results of vector autoregressive error correction model causality for India

Dependent variables	Independent variables						Inferences
	ΔFD 1	ΔFD 2	ΔFD 3	ΔINF	ΔGDP	ECTt-1	
Model 1: FD 1, inflation rate, GDP							
ΔFD 1	------			5.26*	5.56*	-2.48***	INF = > FD 1
ΔINF	0.30			------	5.15*	-1.62	GDP = > INF
ΔGDP	1.54			3.72***	------	-2.89**	INF = > GDP
Model 2: FD 2, inflation rate, GDP							
ΔFD 2		------		1.74	0.74	1.49	
ΔINF		5.53*		------	9.74*	1.54	FD 2 => INF; GDP = > INF
ΔGDP		4.35**		3.33***	------	-2.73**	FD 2 => GDP; INF = > GDP
Model 3: FD 3, inflation rate, GDP							
ΔFD 3			------	4.17**	4.27**	2.54	INF = > FD 3; GDP = > FD 3
ΔINF			6.33*	------	15.0*	2.40	FD 3 => INF; GDP = > INF
ΔGDP			3.18***	7.80*	------	-2.98**	FD 3 => GDP; INF = GDP

Notes
FD 1: Broad money supply (M2)
FD 2: Domestic credit to private sector
FD 3: Domestic credit provided by banking sector
ECT_{t-1}: Error correction term
GDP: Per capita economic growth
INF: Inflation rate
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 5 percent level.
***Indicates statistical significance at a 10 percent level.

TABLE 8. Results of vector autoregressive error correction model causality for Pakistan

Dependent variables	Independent variables						Inferences
	ΔFD 1	ΔFD 2	ΔFD 3	ΔINF	ΔGDP	ECTt-1	
Model 1: FD 1, inflation rate, GDP							
ΔFD 1	------			10.9*	2.32	-3.22*	FD 1 => INF
ΔINF	2.11			------	0.49	8.98	GDP => INF
ΔGDP	5.53***			1.09	------	-2.79**	
Model 2: FD 2, inflation rate, GDP							
ΔFD 2		------		2.84	11.7*	-4.43*	GDP => FD 2
ΔINF		2.96***		------	0.24	-0.84	FD 2 => INF
ΔGDP		0.01		0.61	------	0.14	FD 2 => GDP
Model 3: FD 3, inflation rate, GDP							
ΔFD 3			-----	0.8	0.3	0.97	
ΔINF			0.83	------	0.94	1.37	FD 3 => INF
ΔGDP			1.17	3.27***	------	-3.11*	FD 3 => GDP

Notes
FD 1: Broad money supply (M2)
FD 2: Domestic credit to private sector
FD 3: Domestic credit provided by banking sector
ECT_{t-1}: Error correction term
GDP: Per capita economic growth
INF: Inflation rate
*Indicates statistical significance at a 1 percent level.
**Indicates statistical significance at a 5 percent level.
***Indicates statistical significance at a 10 percent level.

The summary of the estimated results of VECM, compiled from Tables 7 and 8, are presented in Table 9 for both India and Pakistan. It reflects the comparative analysis between these two countries. The estimated results depict the following.

4.1. Case 1: India

The study finds bidirectional causality between inflation and economic growth (INF < = > GDP) for all these three models, where financial depth involves broad money supply (M2), domestic credit to private sector (DCPS), and domestic credit provided by banking sector (DCBS), respectively. This finding supports the feedback hypothesis between inflation and economic growth. In addition, it confirms bidirectional causality between inflation and FD3 (domestic credit provided by banking sector: DCBS) (FD3 < = > INF) and between economic growth and FD 3 (GDP < => FD3). These findings support the feedback hypothesis between inflation and financial depth and between economic growth and financial depth. The results also indicate unidirectional causality from inflation to FD1 (broad money supply: M2) (INF = > FD1) and from FD2 (domestic credit to private sector: DCPS) to inflation and economic growth (FD2 = > INF; FD2 => GDP), respectively. This finding supports the supply-leading hypothesis of financial depth, inflation, and economic growth.

TABLE 9. Summary of Granger causality test between financial depth, inflation, and economic growth in India and Pakistan

Causal relationships tested in the model	Direction of relationships observed in India	Direction of relationships observed in Pakistan
Model 1		
FD 1 vs. INF	INF => FD 1	FD 1 => INF
FD 1 vs. GDP	Causal relationships do not exist.	Causal relationships do not exist.
INF vs. GDP	INF <=> GDP	GDP => INF
Model 2		
FD 2 vs. INF	FD 2 => INF	FD 2 => INF
FD 2 vs. GDP	FD 2 => GDP	FD 2 < => GDP
INF vs. GDP	INF <=> GDP	Causal relationships do not exist.
Model 3		
FD 3 vs. INF	INF <=> FD 3	FD 3 => INF
FD 3 vs. GDP	FD3 <=> GDP	FD 3 => GDP
INF vs. GDP	INF <=> GDP	Causal relationships do not exist.

Notes
FD 1: Broad money supply (M2)
FD 2: Domestic credit to private sector
FD 3: Domestic credit provided by banking sector
INF: Inflation rate
GDP: Per capita economic growth
<#>: No causality
=>: Unidirectional causality
<=>: Bidirectional causality

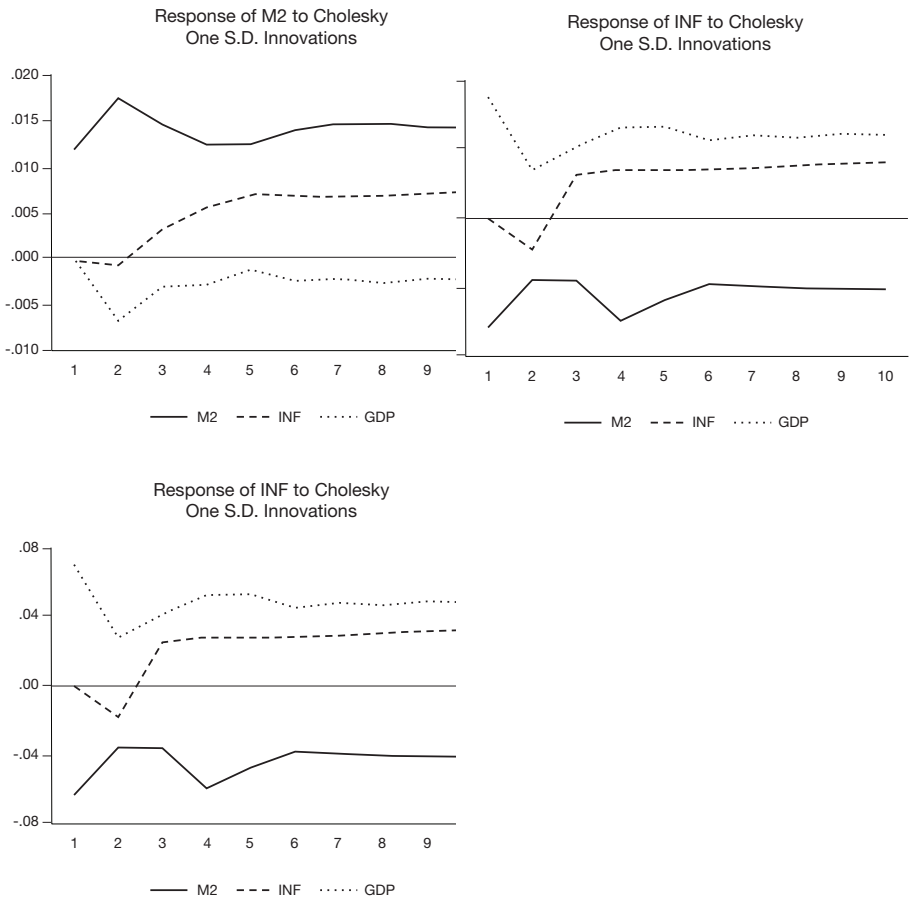
4.2. Case 2: Pakistan

The results indicate bidirectional causality between financial depth (domestic credit provided to private sector) and economic growth (FD2 < = > GDP). This finding supports the feedback hypothesis between financial depth and economic growth. In addition, unidirectional causality from financial depth (FD1, FD2, and FD3) to inflation (FD1 => INF; FD2 => INF; FD3 => INF) is found. This finding

supports the supply-leading hypothesis of inflation and financial depth. The results also indicate unidirectional causality from financial depth (domestic credit provided by banking sector) to economic growth (FD3 = > GDP). This finding also supports the supply-leading hypothesis of economic growth and financial depth.

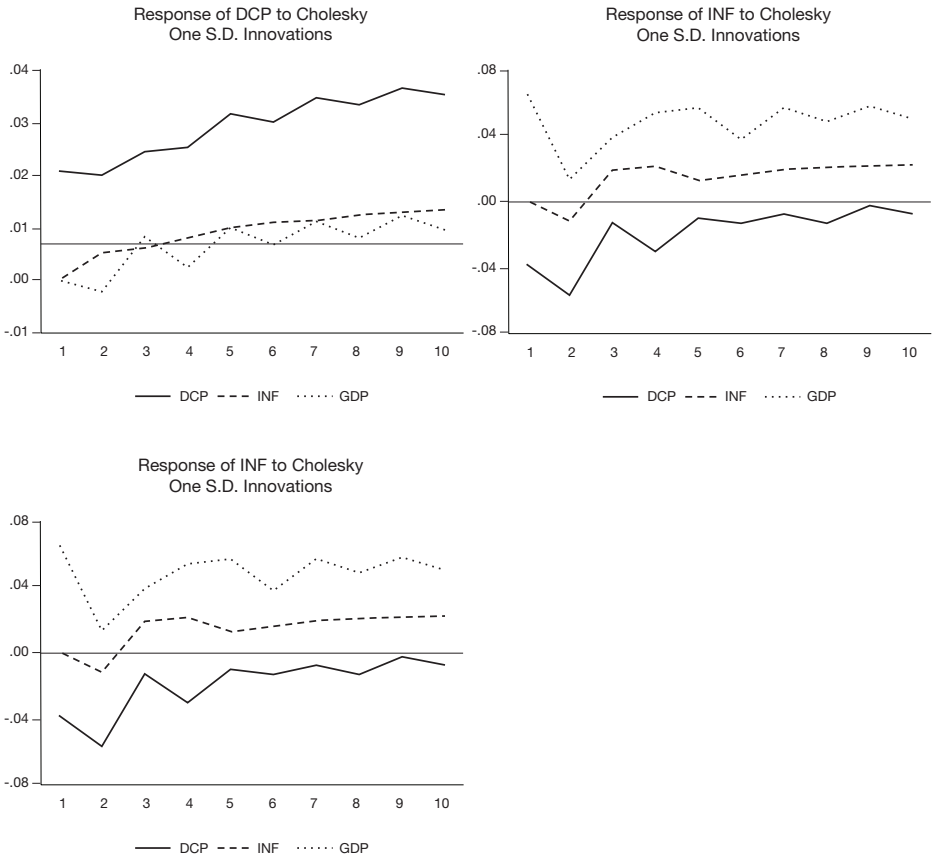
In summary, it is evident that in order to increase long-run economic growth, both financial depth and inflation need to be addressed carefully in these two countries.

Figures 3 to 8 are presented below, providing the results of the generalized impulse response functions.



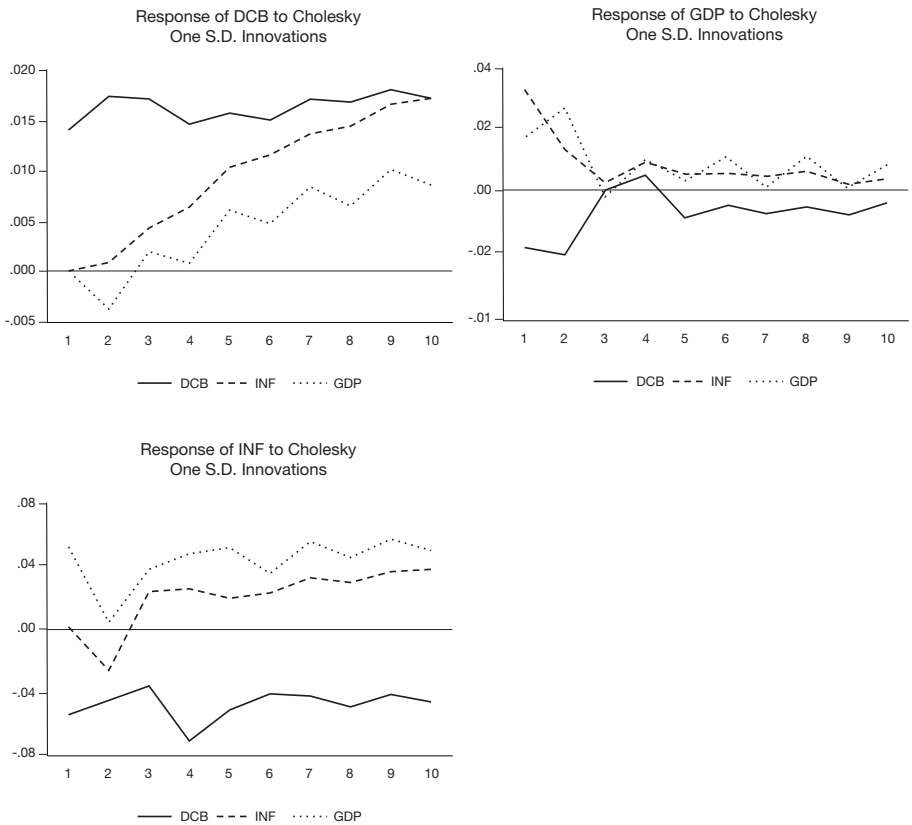
Notes
FD 1: Broad money supply (M2)
GDP: Per capita economic growth

FIGURE 3. Granger causal relations between FD 1, inflation rate, and GDP for India



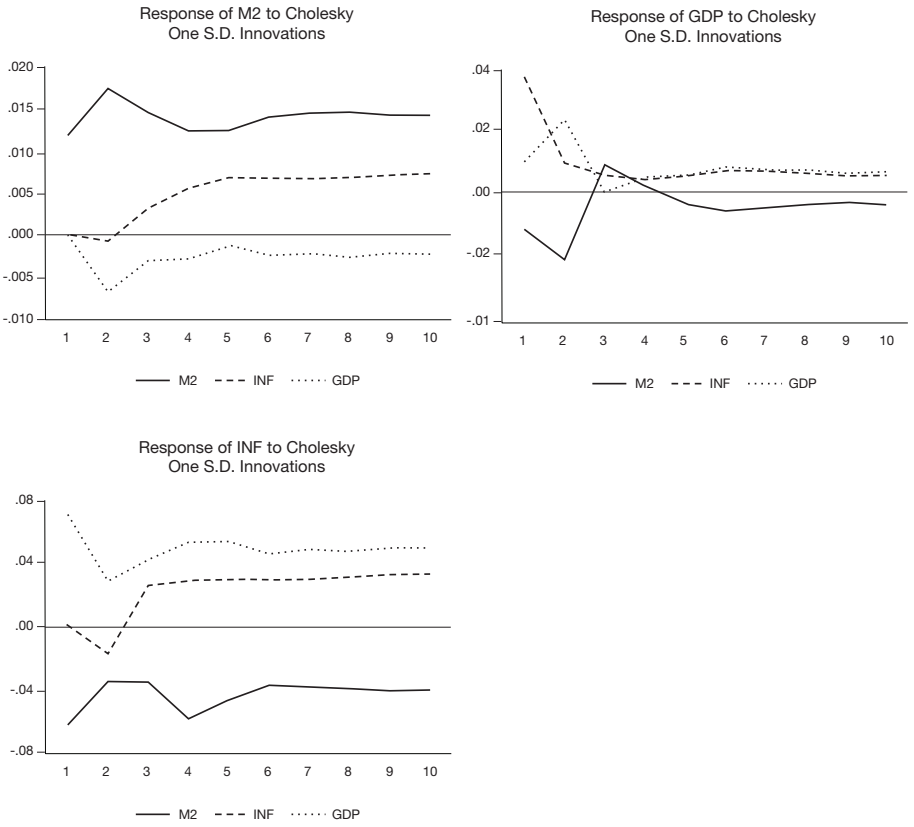
Notes
FD 2: Domestic credit to private sector
GDP: Per capita economic growth

FIGURE 4. Granger causal relations between FD 2, inflation rate, and GDP for India



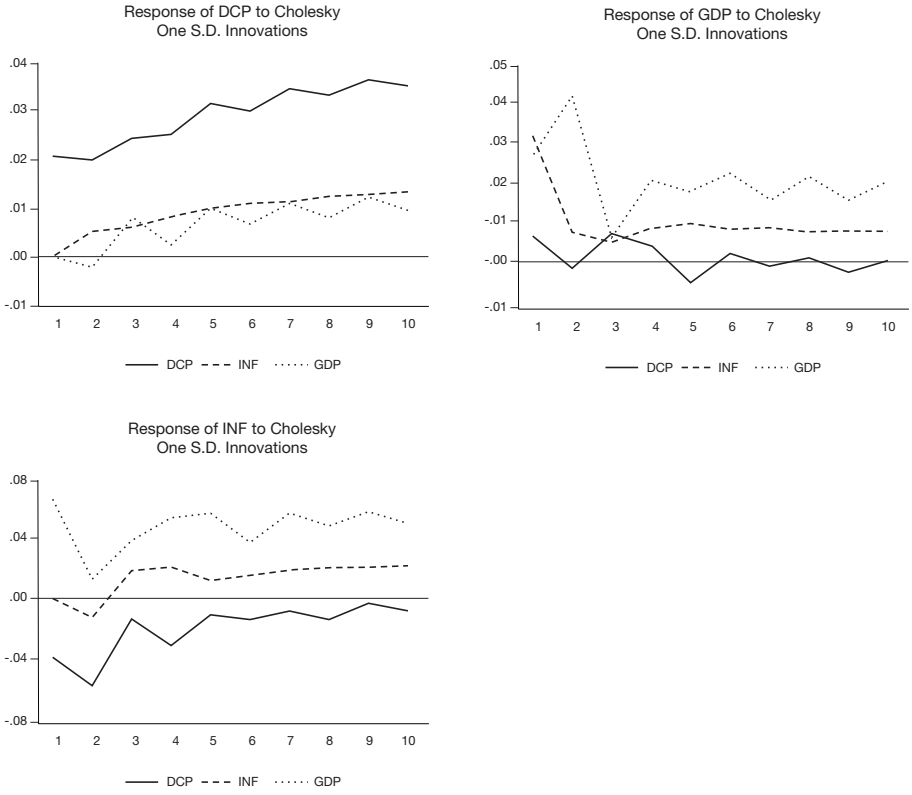
Notes
FD 3: Domestic credit provided by banking sector
GDP: Per capita economic growth

FIGURE 5. Granger causal relations between FD 3, inflation rate, and GDP for India



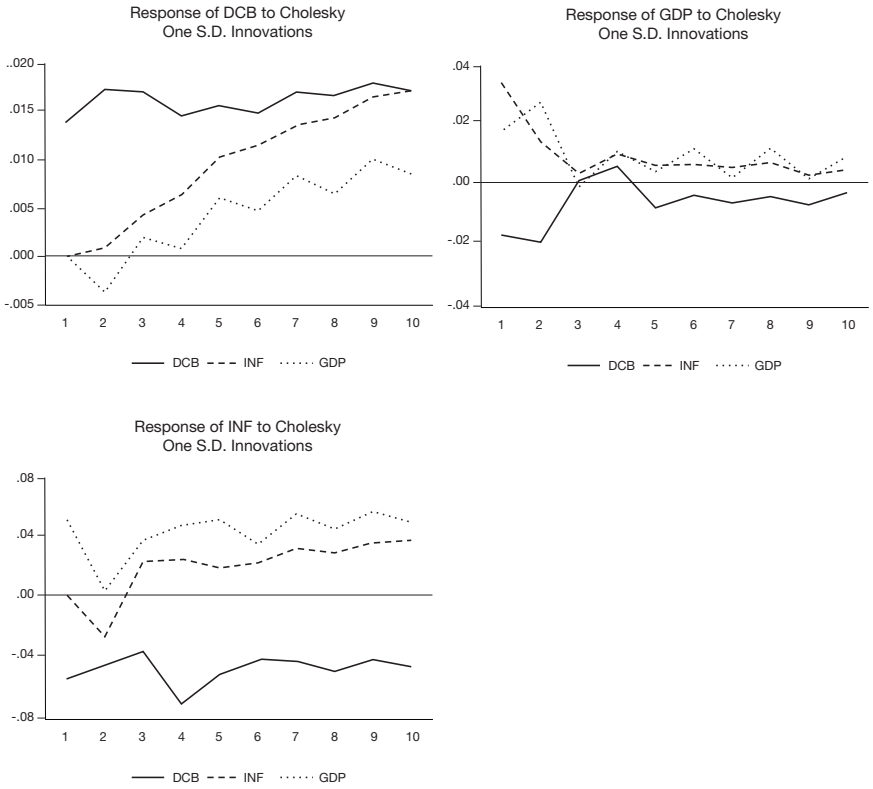
Notes
FD 1: Broad money supply (M2)
GDP: Per capita economic growth

FIGURE 6. Granger causal relations between FD 1, inflation rate, and GDP for Pakistan



Notes
FD 2: Domestic credit to private sector
GDP: Per capita economic growth

FIGURE 7. Granger causal relations between FD 2, inflation rate, and GDP for Pakistan



Notes
FD 3: Domestic credit provided by banking sector
GDP: Per capita economic growth0

FIGURE 8. Granger causal relations between FD 3, inflation rate, and GDP for Pakistan

These figures give an indication of the statistical significance of a particular past change or changes; however, they does not indicate whether or not a series responds to perturbations or unexpected changes (i.e., the shocks) in another series. Hence, we deployed generalized impulse response functions to complement this shortcoming. The use of generalized impulse response functions is to trace the effect of a one-off shock (such as financial depth or inflation) to one of the innovations on the current and future values of the endogenous variables (such as inflation/economic growth or financial depth/economic growth). The key importance of the generalized impulse response functions is that the responses are invariant to any re-ordering of the variables in the VECM and, as orthogonality is not imposed, it allows for meaningful interpretation of the initial impact response of each variable to shocks to any other variables. That means the generalized impulse response functions provide more robust results than the orthogonalized

method [Ewing et al. 2007]. Figures 3 to 8 display the generalized impulse response functions of the six vector autoregressive models.

5. Conclusion and policy implications

This paper examined the dynamic causal relationship between financial depth, inflation, and economic growth in India and Pakistan during the period 1988-2011. The study made three major contributions towards the existing body of knowledge. First, the ARDL bounds testing procedure of cointegration was employed instead of the Engle and Granger approach [1987] and the Johansen and Juselius approach [1990]. The former technique, ARDL, is more appropriate here for small sample sizes. Second, we used a trilateral causality test instead of the bivariate causal nexus between financial depth and economic growth. This is an attempt to address the methodological weaknesses associated with previous studies. Third, we used three indicators to financial depth, i.e., broad money supply (M2), domestic credit to private sector (DCPS), and domestic credit provided by banking sector (DCBS). They are assumed to be broad based measures of financial depth. The long-run relationships between these variables are important and of great value to policy makers.

Using the ARDL bounds testing approach of cointegration, suggested by Pesaran et al. [2001] and Narayan [2005], together with VECM, the study reached the following conclusions.

The ARDL cointegration results showed that financial depth and inflation were cointegrated with economic growth, indicating the presence of a long-run equilibrium relationship between them. The VECM results showed that there was presence of both bidirectional and unidirectional causality between economic growth, inflation, and financial depth. However, it varied from situation to situation, depending upon the involvement of financial depth integration, as well as between countries (i.e., between India and Pakistan). In short, financial depth determined and was determined by inflation and economic growth, both directly and indirectly in India and Pakistan. However, in the case of India, almost every financial variable affected economic growth significantly. This was mostly due to the development of basic economic conditions such as a well developed financial infrastructure and human capital in the Indian economy.

A policy implication of this study is that financial depth (M2, DCPS, and DCBS) and inflation can be considered as the proposed policy variables to generate economic growth and inflation in the Indian and Pakistani economies. If policy makers attempt to maintain sustainable economic growth and economic stability, they need to focus on mild inflation and favorable financial depth in the economy in the long run. Such a policy could also be supported by restructuring of the financial markets focusing on promoting depth in financial services.

References

Abu-Bader, S. and A. S. Abu-Qarn [2008a] "Financial development and economic growth: the Egyptian experience", *Journal of Policy Modeling* **30**(5): 887-898.

Abu-Bader, S. and A. S. Abu-Qarn [2008b] "Financial development and economic growth: empirical evidence from six MENA countries", *Review of Development Economics* **12**(4): 803-817.

Adam, C. S. and D. L. Bevan [2005] "Fiscal deficits and growth in developing countries", *Journal of Public Economics* **89**: 571–597.

Ahmed, S. M. and M. I. Ansari [1998] "Financial sector development and economic growth: the South-Asian experience", *Journal of Asian Economics* **9**(3): 503-517.

Andres, J., I. Hernando, and J. D. Lopez-Salido [2004] "The role of the financial system in the growth-inflation link: the OECD experience", *European Journal of Political Economy* **20**: 941-961.

Ang, J. B. [2008] "What are the mechanisms linking financial development and economic growth in Malaysia?", *Economic Modeling* **25**(1): 38-53.

Ang, J. B. and W. J. McKibbin [2007] "Financial liberalization, financial sector development and growth: evidence from Malaysia", *Journal of Development Economics* **84**(1): 215-233.

Arai, M., M. Kinnwall, and P. S. Thoursie [2004) "Cyclical and causal patterns of inflation and GDP growth", *Applied Economics* **36**: 1705–1715.

Awokuse, T. O. [2008] "Trade openness and economic growth: is growth export-led or import-led?", *Applied Economics* **40**: 161-173.

Barro R. J. [1995] "Inflation and economic growth", NBER Working Paper no. 5326.

Blackburn K. and V. T. Y. Hung [1998] "A theory of growth, financial development and trade", *Economica* **65**(257): 107-124.

Bojanic, A. N. [2012] "The impact of financial development and trade on the economic growth of Bolivia", *Journal of Applied Economics* **15**(1): 51-70.

Boulila, G. and M. Trabelsi [2004] "Financial development and long run growth: evidence from Tunisia: 1962-1997", *Savings and Development* **28**(3): 289-314.

Boyd, J., R. Levine, and B. Smith [2001] "Inflation and financial market performance", *Journal of Monetary Economics* **47**: 221-248.

Brown, R. L., J. Durbin, and J. M. Evans [1975] "Techniques for testing the consistency of regression relations over time", *Journal of Royal Statistical Society* **37**: 149-192.

Bruno, M. and W. Easterly [1998] "Inflation crisis and long-run growth", *Journal of Monetary Economics* **41**: 3-26.

Burnham, K. P. and D. R. Anderson [2004] "Multimodal inference: understanding AIC and BIC in model selection", *Sociological Methods and Research* **33**: 261-304.

Calderon, C. and L. Liu [2003] "The direction of causality between financial development and economic growth", *Journal of Development Economics* **72**(1): 321- 334.

Chaiechi, T. [2012] "Financial development shocks and contemporaneous feedback effect on key macroeconomic indicators: a post Keynesian time series analysis", *Economic Modeling* **29**(2): 487-501.

Chakraborty, I. [2008] "Does financial development cause economic growth? The case of India", *South Asian Economic Journal* **9**(1): 109-139.

Chandavarkar, A. [1992] "Of finance and development: neglected and unsettled questions", *World Development* **20**(1): 133-142.

Chow, W. W. and M. K. Fung (2011] "Financial development and growth: a clustering and causality analysis", *Journal of International Trade and Economic Development* **35**(3): 1-24.

Christopoulos, D. K. and E. G. Tsionas [2004] "Financial development and economic growth: evidence from panel unit root and cointegration tests", *Journal of Development Economics* **73**(1): 55-74.

Craigwell, R., D. Downes, and M. Howard [2001] "The finance-growth nexus: a multivariate VAR analysis of a small open economy", *Savings and Development* **25**(2): 209-223.

De Gregorio, J. [1993] "Inflation, taxation, and long-run growth", *Journal of Monetary Economics* **31**: 271-298.

Demetriades, P. and K. Hussein [1996] "Financial development and economic growth: cointegration and causality tests for 16 countries", *Journal of Development Economics* **51**(2): 387- 411.

Dickey, D. A. and W. A. Fuller [1981] "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica* **49**: 1057- 1072.

Dritsakis, N. and A. Adamopoulos [2004] "Financial development and economic growth in Greece: an empirical investigation with Granger causality analysis", *International Economic Journal* **18**(4): 547-559.

Engle, R. F. and Granger, C. W. J. [1987] "Cointegration and error correction: representation, estimation and testing", *Econometrica* **55**: 251-276.

Ewing, B. T., K. Riggs, and K. L. Ewing [2007] "Time series analysis of a predator-prey system: application of VAR and generalized impulse response function", *Ecological Economics* **60**(3): 605-612.

Fountas, S. and M. Karanasos [2007] "Inflation, output growth, and nominal and real uncertainty: empirical evidence for the G7", *Journal of International Money and Finance* **26**: 229-250.

Gries, T., M. Kraft, and D. Meierrieks [2009] "Linkages between financial deepening, trade openness, and economic development: causality evidence from sub-Saharan Africa", *World Development* **37**: 1849-1860.

Hassan, M. K., B. Sanchez, and J. Yu [2011] "Financial development and economic growth: new evidence from panel data", *Quarterly Review of*

Economics and Finance **51**: 88-104.

Hsueh, S., Y. Hu, and C. Tu [2013] "Economic growth and financial development in Asian countries: a bootstrap panel Granger causality analysis", *Economic Modeling* **32**(3): 294-301.

Hwang, Y. [2001] "Relationship between inflation rate and inflation uncertainty", *Economics Letters* **73**: 179–186.

Jalil, A., M. Feridun, and Y. Ma [2010] "Finance-growth nexus in China revisited: new evidence from principal components and ARDL bounds tests", *International Review of Economics and Finance* **19**: 189-195.

Johansen, S. and K. Juselius [1990] "Maximum likelihood estimation and inference on cointegration with application to the demand for money", *Oxford Bulletin of Economics and Statistics* **52**: 169-210.

Jung, W. S. [1986] "Financial development and economic growth: international evidence", *Economic Development and Cultural Change* **34**(2): 336-346.

Kar, M., S. Nazlioglu, and H. Agir [2011] "Financial development and economic growth nexus in the MENA countries: bootstrap panel Granger causality analysis", *Economic Modeling* **28**(1-2): 685-693.

Khan, A. [2001] "Financial development and economic growth", *Macroeconomics Dynamics* **5**: 413-433.

Khan, M. A., A. Qayyum, and A. Sheikh [2005] "Financial development and economic growth: the case of Pakistan", *Pakistan Development Review* **44**: 819-837.

King, R. and R. Levine [1993] "Finance and growth: Schumpeter might be right", *The Quarterly Journal of Economics* **108**(3): 717-737.

Klein, M. W. and G. P. Olivei [2008] "Capital account liberalization, financial depth, and economic growth", *Journal of International Money and Finance* **27**: 861-875.

Koop, G., M. H. Pesaran, and S. M. Potter [1996] "Impulse response analysis in non-linear multivariate models", *Journal of Econometrics* **74**: 119-147.

Levine, R. [1997] "Financial development and economic growth: views and agenda", *Journal of Economic Literature* **35**: 688-726.

Levine, R. [1999] "Law, finance and economic growth", *Journal of Financial Intermediation* **8**(1-2): 8-35.

Levine, R. [2005] "Finance and growth: theory and evidence", in P. Aghion and S. Durlauf, eds., *Handbook of economic growth*. The Netherlands: Elsevier Science.

Levine, R. and S. Zervos [1998] "Stock markets, banks and economic growth", *American Economic Review* **88**(3): 537-558.

Levine, R., N. Loayza, and T. Beck [2000] "Financial intermediation and growth: causality analysis and causes", *Journal of Monetary Economics* **46**(1): 31-77.

Liang, Q. and J. Teng [2006] "Financial development and economic growth: evidence from China", *China Economic Review* **17**(4): 395-411.

Luintel, K. and M. Khan [1999] "A quantitative reassessment of the finance-growth nexus: evidence from a multivariate VAR", *Journal of Development Economics* **60**(2): 381-405.

Lutkepohl, H. and H. E. Reimers [1992] "Impulse response analysis of cointegrated systems", *Journal of Economic Dynamics and Control* **16**: 53-78.

Ma, Y. and A. Jalil [2008] "Financial development, economic growth and adaptive efficiency: a comparison between China and Pakistan", *China and World Economy* **16**(6): 97-111.

Mukherjee, J. and B. Bhattacharya [2001] "Is financial sector improvement sufficient for overall economic development? A case study for Indian economy", *Decision* **28**(2): 139-156.

Mukhopadhyay, B., R. P. Pradhan, and M. Feridun [2011] "Finance-growth nexus revisited for some Asian countries", *Applied Economics Letters* **18**(16): 1527-1530.

Naceur, S. B. and S. Ghazouani [2007] "Stock markets, banks, and economic growth: empirical evidence from the MENA region", *Research in International Business and Finance* **21**(2): 297-315.

Narayan, P. K. [2005a] "The savings and investment nexus for China: evidence from cointegration tests", *Applied Economics* **37**: 1979-1990.

Narayan, P. K. and R. Smyth [2005b] "Trade liberalization and economic growth in Fiji: an empirical assessment using the ARDL approach", *Journal of the Asia Pacific Economy* **10**: 96-115.

Neusser, K. and M. Kugler [1998] "Manufacturing growth and financial development: evidence from OECD countries", *Review of Economics and Statistics* **80**: 638-646.

Nguyen, T. T. and K. Wang [2010] "Causality between housing returns, inflation and economic growth with endogenous breaks", *Journal of Chinese Economic and Business Studies* **8**(1): 95-115.

Odhiambo, N. M. [2007] "Supply-leading versus demand-following hypotheses: empirical evidence from three SSA countries", *African Development Review* **19**: 257-280.

Odhiambo, N. M. [2008] "Financial development in Kenya: a dynamic test of the finance-led growth hypotheses", *Economic Issues* **13**(2): 21-36.

Odhiambo, N. M. [2010] "Finance-investment-growth nexus in South Africa: an ARDL bounds testing procedure", *Economic Change Restructuring* **43**(3): 205-219.

Pagano, M. [1993] "Financial markets and growth: an overview", *European Economic Review* **37**: 613-622.

Panopoulou, E. [2009] "Financial variables and euro area growth: a non-parametric causality analysis", *Economic Modeling* **26**(6): 1414-1419.

Pesaran, H. H. and Y. Shin [1998] "Generalized impulse response analysis in linear multivariate models", *Economics Letters* **58**: 17-29.

Pesaran, M. H. and B. Pesaran [1997] *Working with Microfit 4.0: interactive econometric analysis*. Oxford, UK: Oxford University Press.

Pesaran, M. H. and Y. Shin [1999] "An autoregressive distributive lag modeling approach to cointegration analysis", in S. Strom, ed., *Econometrics and economic theory in 20th century: the Ragnar Frisch centennial symposium*. Cambridge, UK: Cambridge University Press. 371-413.

Pesaran, M. H. and R. Smith [1998] "Structural analysis of cointegration VRS", *Journal of Economic Surveys* **12**: 471-505.

Pesaran, M. H., Y. Shin, and R. Smith [2000] "Structural analysis of vector error correction models with exogenous I (1) variables", *Journal of Econometrics* **97**: 293-343.

Pesaran, M. H., Y. Shin, and R. Smith [2001] "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics* **16**: 289-326.

Phillips, P. C. B. and P. Perron [1988] "Testing for a unit root in time series regression", *Biometrica* **75**: 335-346.

Pradhan, R. P. [2011] "Financial development, growth and stock market development: the trilateral analysis in India", *Journal of Quantitative Economics* **9**(1): 134-145.

Pradhan, R. P. [2013] "The determinants of long run financial development: the ARDL bounds testing approach", *Journal of Social and Management Sciences* (forthcoming).

Pradhan, R. P. and A. Gunashekar [2013] "Finance-growth nexus in selected Asian countries", *IUP Journal of Applied Finance* (forthcoming).

Pradhan, R. P., M. B. Arvin, S. Bahmani, J. H. Hall, and N. R. Norman [2017] "Finance and growth: evidence from the ARF countries", *Quarterly Review of Economics and Finance* (forthcoming).

Pradhan, R. P., M. B. Arvin, N. R. Norman, and Y. Nishigaki [2014] "Does banking sector development affect economic growth and inflation? A panel cointegration and causality approach", *Applied Financial Economics* **24**(7): 465-480.

Pradhan, R. P., P. Dasgupta, and B. Samadhan [2013] "Finance development and economic growth in BRICKS: a panel data", *Journal of Quantitative Economics* (forthcoming).

Quartey, P. and F. Prah [2008] "Financial development and economic growth in Ghana: is there a causal link?", *African Finance Journal* **10**: 28-54.

Rajan, R. and L. Zingales [1998] "Financial dependence and growth", American Economic Review **88**(3): 559-586.

Riezman, R. G., P. M. Summers, and C. H. Whiteman [1996] "The engine of growth or its handmaiden? A time series assessment of export-led growth", *Empirical Economics* **21**: 77-113.

Schumpeter, J. A. [1911] *The theory of economic development*. Cambridge, Mass.: Harvard University Press.

Shan, J., A. Morris, and F. Sun [2001] "Financial development and economic growth: an egg-chicken problem?", *Review of International Economics* **9**(3): 443-454.

Shaw, E. S. [1973] *Financial deepening in economic development*. New York: Oxford University Press.

Sunde, T. [2012] "Financial sector development and economic growth nexus in South Africa", *International Journal of Monetary Economics and Finance* **5**(1): 64-75.

Uddin, G. S., M. Shahbaz, M. Arouri, and F. Teulon [2014] "Financial development and poverty reduction nexus: a cointegration and causality analysis in Bangladesh", *Economic Modeling* **36**: 405-412.

Us, V. [2004] "Inflation dynamics and monetary policy strategy: some prospects for the Turkish economy", *Journal of Policy Modeling* **26**: 1003-1013.

Wolde-Rufael, Y. [2009] "Re-examining the financial development and economic growth nexus in Kenya", *Economic Modeling* **26**(6): 1140-1146.

Wu, J., H. Hou, and S. Cheng [2010] "The dynamic impacts of financial institutions on economic growth: evidence from the European Union", *Journal of Macroeconomics* **32**(3): 879-891.