A quantitative assessment of the trade openness – economic growth nexus in India

Rudra P. Pradhan
Vinod Gupta School of Management, Indian Institute of Technology, Kharagpur, India
Mak B. Arvin
Department of Economics, Trent University, Peterborough, Canada, and
Neville R. Norman
Department of Economics, University of Melbourne, Carlton, Australia and University of Cambridge, Cambridge, UK

Received 7 August 2013
Revised 9 August 2014
Accepted 21 September 2014

Abstract

Purpose – The purpose of this paper is motivated by research-based assertions that: the causes of economic growth in countries like India are not well understood; they are not elucidated by using simple bivariate relationships between economic growth and other variables, taken one at a time; and dynamic linkages between growth, trade openness and financial sector depth are required for any comprehensive treatment of this inquiry.

Design/methodology/approach – This paper investigates the pivotal role of financial depth (defined as the relative importance in the economy of the banking sector or the stock market) and whether it bears any evidential relationship to trade openness and economic growth during the era of Indian post-globalization since 1990. Two key objectives are to uncover whether there is a long-run relationship between the variables and whether they can be said to cause one another. Autoregressive distributive lag (ARDL) bounds testing procedures and vector autoregressive error correction model (VECM) approaches were used to derive the results.

Findings – This paper affirms that the variables are indeed formally cointegrated. It was also found that trade openness, economic growth and financial sector depth Granger-cause each other.

Practical implications – This paper demonstrates that greater trade openness can predictably accelerate India's economic growth. If policymakers wish to maintain sustainable economic growth in India, they can do so by encouraging both freer trade and financial market development in the long run.

Originality/value – No investigation of this type and sophistication has hitherto been performed for India. The methods developed for this study can also be applied to any of the vast range of countries for which dynamic growth-openness-financial depth interactions have not already been investigated.

Keywords India, Economic growth, ARDL-bounds testing, Financial depth, Trade openness, VECM approach, Trade openness

Paper type Research paper

1. Introduction

Securing rapid and sustained economic growth is a major concern globally and has a complex interaction with the development of market systems. However, previous empirical evidence on these linkages is inconclusive, the results depending sensitively

International Journal of Commerce and Management
Vol. 25 No. 3, 2015
pp. 267-293

1056-9219
DOI 10.1108/IJCoMA-08-2013-0075

on the country or region that is studied (see below). In this paper, we ask specifically whether economic growth, trade openness and financial depth (the relative coverage of the economy by the financial sector) Granger-cause each other. We seek to inform public policy on the path to achieving higher economic growth for this emerging and important economy.

We examine the problem from two angles:

(1) We establish whether trade openness has causally contributed to economic growth in the Indian economy during the post-globalization era since 1990.

(2) We investigate whether financial depth (defined as banking sector depth or stock market depth) bears any evidential relationship to trade openness and economic growth over the same period.

Our two key objectives are to uncover whether there is a long-run relationship between the variables and whether they cause one another. We use autoregressive distributive lag (ARDL) bounds testing procedures and vector autoregressive error correction model (VECM) approaches to derive our results.

The remainder of this paper consists of five sections. Section 2 sets out the theoretical framework used. Section 3 documents India's progress during the globalization era. Section 4 describes the database and methods used in the study. Section 5 presents the results and discusses the findings. Section 6 provides a conclusion and comments on the implied policy implications of the findings.

2. Theoretical framework and motivation

Trade openness[1] integrates global economies and facilitates the movement of resources and the transfer of technology between countries to bring higher economic growth to the integrating economies (relevant articulated economic models are provided in studies by Coe and Helpman, 1995; Barro and Sala-i-Martin, 1995; Romer, 1992; Helpman and Krugman, 1985). The relationship between trade openness and economic growth has garnered the attention of academics and policymakers for decades. Despite sizeable literature on this subject, with studies for many countries, the direction of any causal effect as between the two variables has been inconclusive (Awokuse, 2006; Edwards, 1998; Bhagwati, 1978)[2]. It remains open to question whether trade openness drives economic growth or whether economic growth drives trade openness. Accordingly, there are two main competing hypotheses here (Eris and Ulasan, 2013; Pradhan *et al.*, 2012; Montalbano, 2011; Wang *et al.*, 2004; Winters, 2004; Yanikkaya, 2003; Bahmani-Oskooee and Niroomand, 1999; Liu *et al.*, 1997; Sinha and Sinha, 1996):

(1) the trade-led growth hypothesis; and

(2) the growth-led trade hypothesis.

For the sake of completeness, in this study, we set out and review four conceivable hypotheses and present the corresponding empirical findings of other studies before conducting our own tests for India.

The trade-led growth hypothesis suggests that trade openness is a necessary pre-condition to economic growth (see, for instance, the evidence for Bolivia in Bojanic, 2012; for Iran in Yavari and Mohseni, 2012; for Kenya in Kumar and Pacheco, 2012; and for Pakistan in Muhammad *et al.*, 2012). Thus, the causality runs from trade openness to

economic growth. The proponents of this hypothesis maintain that trade openness induces economic growth by facilitating resource flows and technology movements across the borders (Shahbaz, 2012; Romer, 1998).

A second (growth-leads trade) hypothesis, asserts that causality runs instead from economic growth to trade openness. This second hypothesis implies that trade openness plays only a minor role in economic growth and is merely a by-product or an outcome of growth in the real economy (Bajwa and Siddiqi's, 2011 findings for South Asian countries). The notion here is that, when an economy matures, additional demand for goods and services emerge. Thus, limited trade openness in developing countries betrays a lack of demand for goods and services. Accordingly, as the real side of the economy grows, trade openness develops further, thereby increasing opportunities for developments in financial markets.

The third proposition is a feedback hypothesis, that economic growth and trade openness can complement and reinforce each other, making trade openness and economic growth mutually causal. The argument in favour of the bidirectional causality is that trade openness is indispensable to economic growth and economic growth inevitably requires well-established trade openness (see the evidence in Pradhan *et al.*, 2013 and Pradhan and Gunashekar, 2013 for a group of Asian countries; Klasra, 2011 for Pakistan and Turkey; Liu *et al.*, 1997 for China; and Chow, 1987a, 1987b for some newly industrialized countries).

The fourth proposition is a neutrality hypothesis, that both trade openness and economic growth are independent of one another (see the findings of Chang *et al.*, 2013 for South Africa; Sarkar, 2007 for a varied group of countries; Din, 2004 for Pakistan; Chow, 1987a, 1987b for eight industrialized countries). Table I provides a compact and comparative synopsis of research on the causal nexus between trade openness and economic growth.

There is also a body of literature relating to the *direction* of causality between economic growth and financial depth[3]. Some studies report a bidirectional causal link between financial depth and economic growth (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 Hung, 1998; Demetriades and Hussein, 1996). Others find unidirectional causal relationships between two variables (Pradhan, 2013; Islam *et al.*, 2012; Gries *et al.*, 2009; Quartey and Prah, 2008; Uğur, 2008; Abu-Bader and Abu-Qarn, 2008; Ang, 2008a, 2008b; Odhiambo, 2008; Awokuse, 2006; Liang and Teng, 2006; Christopoulos and Tsionas, 2004; Levine *et al.*, 2000; Neusser and Kugler, 1998; Levine, 1997; King and Levine, 1993; Jung, 1986; Shaw, 1973). Contrarily, a study by Chandavarkar, 1992 documents a neutral relationship between these variables. Table II provides a synopsis of research on the causal nexus between financial development and economic growth.

Our review of previous studies shows that they have, overall, failed to produce clear guidance for analysts and policymakers on the nexus between economic growth and other variables, including policy variables within the scope of governments to influence. Perhaps this mixture of findings is explained by the diverse set of countries, groups of countries and non-uniform time periods. A core contribution of the present study is to present evidence for just one country that has thus far received no attention in this literature, namely India. Two other novel features of the study are that:

(1) we use a recent (post-globalization) span of time for our study (1994-2011); and

(2) we use sophisticated econometric estimation techniques.

Study	Method	Study area	Period covered
Case 1: studies supporting SLH			
Thornton (1994)	BVGC	Asian countries	1951-1990
Calderon and Liu (2003)	MVGC	109 countries	1960-1994
Boulila and Trabelsi (2004)	BVGC	Tunisia	1962-1987
Naceur and Ghazouani (2007)	MVGC	MENA region	1979-2003
Liu and Sinclair (2008)	BVGC	China	1973-2003
Abu-Bader and Abu-Qarn (2008)	TVGC	Egypt	1960-2001
Ang (2008b)	MVGC	Malaysia	1960-2003
Colombage (2009)	MVGC	5 countries	1995-2007
Wu *et al.* (2010)	MVGC	European Union	1976-2005
Jalil *et al.* (2010)	TVGC	China	1977-2006
Kar *et al.* (2011)	MVGC	15 MENA countries	1980-2007
Bojanic (2012)	MVGC	Bolivia	1940-2010
Chaiechi (2012)	MVGC	South Korea, Hong Kong, UK	1990-2006
Hsueh *et al.* (2013)	BVGC	Ten Asian countries	1980-2007
Pradhan *et al.* (2014)	MVGC	35 Asian Countries	1960-2011
Case 2: studies supporting DFH			
Dritsaki and Dritsaki-Bargiota (2005)	TVGC	Greece	1988-2002
Liang and Teng (2006)	MVGC	China	1952-2001
Ang and McKibbin (2007)	MVGC	Malaysia	1960-2001
Odhiambo (2008)	TVGC	Kenya	1969-2005
Panopoulou (2009)	MVGC	5 countries	1995-2007
Odhiambo (2010)	MVGC	South Africa	1969-2006
Kar *et al.* (2011)	MVGC	15 MENA countries	1980-2007
Case 3: studies supporting FBH			
Ahmed and Ansari (1998)	MVGC	India, Pakistan, Sri Lanka	1973-1991
Craigwell *et al.* (2001)	MVGC	Barbados	1974-1998
Dritsakis and Adamopoulos (2004)	TVGC	Greece	1960-2000
Wolde-Rufael (2009)	MVGC	Kenya	1966-2005
Chow and Fung (2011)	TVGC	69 countries	1970-2004
Uddin *et al.* (2014)	TVGC	Bangladesh	1975-2011
Pradhan *et al.* (2014)	TVGC	34 OECD Countries	1960-2011

Table I.
Summary of studies on the nexus between financial development and economic growth

Notes: Supply-leading hypothesis (SLH): if unidirectional causality is present from financial development to economic growth; demand-following hypothesis (DFH): if unidirectional causality from economic growth to financial development is present; and feedback hypothesis (FBH): if bidirectional causality between financial development and economic growth is present; BVGC = Bivariate Granger Causality; TVGC = Trivariate Granger Causality; and MVGC = Multivariate Granger Causality; 1: banking sector development-economic growth linkage; and 2: stock market development-economic growth linkage

3. India during globalization era of 1990s

Globalization is the process of integrating the world's economies, providing the freer movement of goods and services, technology, capital and labour across national boundaries (Stiglitz, 2002). Our proxy variables for globalization are the relative significance of internationally traded goods – imports and exports – in the overall spending or production base of the Indian economy, as measured by its gross domestic

Study	Method	Study area	Period covered
Case 1: studies supporting SLH			
Nandi (1991)	BVGC	India	1960-1985
Van de Berg and Schmidt (1994)	BVGC	16 LACs	1980-2007
Xu (1996)	BVGC	32 DCs	1960-1990
Riezman *et al.* (1996)	BVGC	126 countries	1950-1990
Anwar and Sampath (2000)	BVGC	97 countries	1960-1992
Konya (2006)	TVGC	24 OECD countries	1960-1997
Gries *et al.* (2009)	MVGC	16 SSA countries	1960-2003
Chandran and Munusamy (2009)	MVGC	Malaysia	1970-2003
Hossain (2011)	MVGC	NICs	1971-2007
Shahbaz (2012)	MVGC	Pakistan	1971-2011
Bojanic (2012)	TVGC	Bolivia	1940-2010
Case 2: studies supporting DFH			
Riezman *et al.* (1996)	BVGC	126 countries	1950-1990
Konya (2006)	TVGC	24 OECD countries	1960-1997
Jayanthakumaran and Verma (2008)	BVGC	ASEAN 5	1967-2005
Shahbaz (2012)	MVGC	Pakistan	1971-2011
Case 3: studies supporting FBH			
Bahmani-Oskooee and Niroomand (1999)	BVGC	20 DCs	1951-1987
Van de Berg and Schmidt (1994)	BVGC	16 LACs	1980-2007
Bhat (1995)	BVGC	India	1950-1993
Xu (1996)	BVGC	32 DCs	1960-1990
Ekanayake (1999)	BVGC	8 ADCs	1960-1997
Din (2004)	MVGC	5 SACs	1960-2002
Clarke and Ralhan (2005)	MVGC	5 DCs	1960-2003
Konya (2006)	TVGC	24 OECD countries	1960-1997
Awokuse (2006)	MVGC	Argentina, Colombia, Peru	1993-2002
Tang and Chea (2013)	BVGC	Cambodia	1972-2008

Notes: Supply-leading hypothesis (SLH): if unidirectional causality is present from trade openness to economic growth; demand-following hypothesis (DFH): if unidirectional causality from economic growth to trade openness is present; and feedback hypothesis (FBH): if bidirectional causality between trade openness and economic growth is present; BVGC = Bivariate Granger Causality; TVGC = Trivariate Granger Causality; and MVGC = Multivariate Granger Causality; NACs = Northeast Asian Countries; EEC = Eastern European Countries; LACs = Latin American Countries; GCT = Granger Causality Test; MST = Modified Sims Test; DCs = Developing Countries; ACs = Asian Countries; SSA = Sub-Saharan African countries; and SACs = South Asian Countries

Table II.
Summary of studies on the connection between trade openness and economic growth

product (GDP). Globalization is not new to India. It became intensive in the 1970s and 1980s and accelerated in 1991, when dramatic changes took place: India realized that being open to trade meant removing trade and other barriers whose primary functions were to protect vested interests. Licensing for domestic manufacturers was abolished and import tariffs for some industries were markedly reduced. Other major changes constitution economic liberalization included:

- the adoption of a flexible interest rate regime;
- the devaluation of the rupee; and

- facilitating freer international capital movements to and from India (Pradhan, 2006 for additional details).

During the globalization period, India experienced remarkable achievements and some failures. Among the achievements was the restoration of solid economic growth, a rise in the value of India's foreign exchange reserves, greater inflows of foreign direct investment and stability in its current account deficit relative to GDP. On the downside, the country experienced higher fiscal deficits, declining tax revenues, slow growth in infrastructure, little human development and often high unemployment (Pradhan, 2007; Wadhva, 2003; Kanda *et al.*, 2001). Rather than focusing on India's achievements and failures, this paper concentrates exclusively on India's economic growth over the past two decades and whether trade openness and financial depth can be found formally to have contributed to such growth.

4. Definition of the variables and the econometric approach

Monthly time series data sets from 1994 to 2011 were used for examining the dynamic causal relationship between trade openness and economic growth in the presence of banking sector depth and stock market depth. The data were obtained from the *Handbook of Statistics*, published by the Reserve Bank of India, Mumbai. Our period of study covers several years when India achieved remarkable economic growth and the post-globalization era of the 1990s. We use percentage changes in the index of industrial production (IIP) as our measure of economic growth[4]. We use three alternative indicators of trade openness:

(1) the value of exports as a percentage of GDP (EXP);

(2) the value of imports as a percentage of GDP (IMP); and

(3) total trade as a percentage of GDP (TOP)[5].

We also use the sum of foreign institutional investment as a percentage of host GDP as a proxy to market openness (FII). Finally, we use two indicators for financial depth simultaneously:

(1) banking sector depth, defined as broad money supply[6] as a percentage of GDP (BMS); and

(2) stock market depth, defined as the market capitalization of the listed companies on the Indian Stock Market as a percentage of GDP (MAC).

All of our monetary variables are measured in real rupees.

The study focuses on testing the following hypotheses:

H1. Trade openness Granger-causes economic growth. This is termed the trade openness-led growth hypothesis.

H2. Economic growth Granger-causes trade openness. This is termed the growth-led trade openness hypothesis.

H3. Banking sector depth Granger-causes economic growth. This is termed the banking sector depth-led growth hypothesis.

H4. Economic growth Granger-causes banking sector depth. This is termed the growth-led banking sector depth hypothesis.

H5. Stock market depth Granger-causes economic growth. This is termed the stock market-led growth hypothesis.

H6. Economic growth Granger-causes stock market depth. This is termed the growth-led stock market growth hypothesis.

We test our hypotheses in two phases:

(1) we have the tests for cointegration; and

(2) the tests for Granger causality.

The ARDL bounds testing procedure and VECM approaches are used for testing the hypotheses. We now explain our methodology in more detail.

4.1 Testing cointegration: ARDL bounds testing procedure

The ARDL bounds testing approach is used to examine the long-run cointegration relationship between economic growth and the other variables. The ARDL model for IIP can be expressed as follows using each of our three definitions of trade openness: EXP, IMP and TOP[7].

Case 1: Considering IIP, EXP, BMS and MAC:

$$\begin{aligned}\Delta IIP = {} & \mu_{11IIP} + \sum_{i=1}^{n_1} \alpha_{11IIPi}\Delta IIP_{t-i} + \sum_{j=1}^{n_2} \beta_{11IIPj}\Delta EXP_{t-j} + \sum_{k=1}^{n_3} \lambda_{11IIPk}\Delta BMS_{t-k} \\ & + \sum_{l=1}^{n_4} \pi_{11IIPl}\Delta MAC_{t-l} + \delta_{11IIP} IIP_{t-1} + \eta_{11IIP} EXP_{t-1} + \rho_{11IIP} BMS_{t-1} \\ & + \theta_{11IIP} MAC_{t-1} + \zeta_{11t}\end{aligned} \quad (1)$$

Case 2: Considering IIP, IMP, BMS and MAC:

$$\begin{aligned}\Delta IIP = {} & \mu_{21IIP} + \sum_{i=1}^{n_1} \alpha_{21IIPi} IIP_{t-i} + \sum_{j=1}^{n_2} \beta_{21IIPj}\Delta IMP_{t-j} + \sum_{k=1}^{n_3} \lambda_{21IIPk}\Delta BMS_{t-k} \\ & + \sum_{l=1}^{n_4} \pi_{21IIPl}\Delta MAC_{t-l} + \delta_{21IIP} IIP_{t-1} + \eta_{21IIP} EXP_{t-1} + \rho_{21IIP} BMS_{t-1} \\ & + \theta_{21IIP} MAC_{t-1} + \zeta_{21t}\end{aligned} \quad (2)$$

Case 3: Considering IIP, TOP, BMS and MAC:

$$\begin{aligned}\Delta IIP = {} & \mu_{31IIP} + \sum_{i=1}^{n_1} \alpha_{31IIPi}\Delta IIP_{t-i} + \sum_{j=1}^{n_2} \beta_{31IIPj}\Delta TOP_{t-j} + \sum_{k=1}^{n_3} \lambda_{31IIPk}\Delta BMS_{t-k} \\ & + \sum_{l=1}^{n_4} \pi_{31IIPl}\Delta MAC_{t-l} + \delta_{31IIP} IIP_{t-1} + \eta_{31IIP} TOP_{t-1} + \rho_{31IIP} BMS_{t-1} \\ & + \theta_{31IIP} MAC_{t-1} + \zeta_{31t}\end{aligned} \quad (3)$$

where Δ represents change; μ is the drift component; ζ_t is the white noise error term; α, β, λ, π and ν are the short-run coefficients; and δ, η, ρ and θ are the corresponding long-run multipliers 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 integrated of order 0 or 1 [i.e. I(0) or I(1)]. Two sets of critical values are generated. One set refers to the I(1) series; the other refers to the I(0) series. The critical values for the I(1) series are said to be upper-bound critical values; the critical values for the I(0) series are referred to as lower-bound critical values (Narayan and Smyth, 2005; Pesaran *et al.*, 2001, 2000; Pesaran and Shin, 1999; Pesaran and Smith, 1998; Pesaran and Pesaran, 1997). To determine the order of integration of series, we used the augmented Dickey–Fuller test (Dickey and Fuller, 1981) and Phillips and Perron's (1988) unit root test.

If the computed *F*-statistics are above the upper bound, the null hypothesis of 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 falls between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors.

4.2 Granger causality test

Once the long-run relationships have been identified, the next step is to examine the short-run and long-run Granger causality between economic growth, trade openness, banking sector depth and stock market depth using an approach which involves the estimation of long- and short-run dynamics by using the following VECM. Again, three cases are considered – one for each of our definitions of trade openness.

Case 1: Considering IIP, EXP, BMS and MAC:

$$\Delta IIP_t = A_{11} + \sum_{j=1}^{p_1} B_{11j}\Delta IIP_{t-j} + \sum_{j=1}^{p_2} C_{11j}\Delta EXP_{t-j} + \sum_{j=1}^{p_3} D_{11}\Delta BMS_{t-j} + \sum_{j=1}^{p_4} E_{11}\Delta MAC_{t-j} + \nu_{11}ECM1_{t-1} + \varepsilon_{1t} \quad (4)$$

Case 2: Considering IIP, IMP, BMS and MAC:

$$\Delta IIP_t = A_{21} + \sum_{j=1}^{p_1} B_{21j}\Delta IIP_{t-j} + \sum_{j=1}^{p_2} C_{21j}\Delta IMP_{t-j} + \sum_{j=1}^{p_3} D_{21}\Delta BMS_{t-j} + \sum_{j=1}^{p_4} E_{21}\Delta MAC_{t-j} + \nu_{21}ECM2_{t-1} + \varepsilon_{2t} \quad (5)$$

Case 3: Considering IIP, TOP, BMS and MAC:

$$\Delta IIP_t = A_{31} + \sum_{j=1}^{p_1} B_{31j}\Delta IIP_{t-j} + \sum_{j=1}^{p_2} C_{31j}\Delta TOP_{t-j} + \sum_{j=1}^{p_3} D_{31}\Delta BMS_{t-j} + \sum_{j=1}^{p_4} E_{31}\Delta MAC_{t-j} + \nu_{31}ECM4_{t-1} + \varepsilon_{3t} \quad (6)$$

where $A_{i1}, B_{i1}, C_{i1}, D_{i1}, E_{i1}$ (for $i = 1, 2, 3, 4$) are short-run coefficients and v_{i1}(for $i = 1, 2, 3$) are long-run coefficients. The $ECMi_{t-1}$ (for $i = 1, 2, 3$) represents the lagged error term, which is estimated from the long-run equilibrium relationship. The *ECM* component is removed in the estimation process, if variables are not cointegrated.

It should be noted that the estimations of both ARDL and VECM are very sensitive to lag length (Ma, 2007; Granger and Lee, 1989). We use the Akaike information criterion (AIC) to choose the optimum lag length following Burnham and Anderson (2004).

5. Results and discussion

The empirical results are reported in this section and their policy implications thereafter. Table III provides a summary of the variables and proxies adopted, while Table IV shows the correlation matrix.

The correlation results show a significant and positive association between trade openness, economic growth, banking sector depth and stock market depth. Thus, these variables are expected to be causally connected to each other in the long run. Moreover, unsurprisingly, we find that EXP, IMP and TOP are highly (inter-) correlated. Therefore, we use each indicator *separately* in the process of investigating long-run relationships between trade openness, economic growth, banking sector depth and stock market depth.

Following the correlation results, we also report unit-root results for the order of integration of the variables. This is essential to affirm the validity of the ARDL model. We used the Augmented Dickey–Fuller (ADF: Dickey and Fuller, 1979) and the Phillips and Perron (PP: Phillips and Perron, 1988) tests for this purpose. Table V reports the results of ADF and PP unit root tests.

Variables	Mean	Med	Max	Min	Std	Skew	Kur	JB	Probability
IIP	1.16	1.19	1.48	−0.06	0.21	−2.63	13.2	1,166	0.00
EXP	−0.07	−0.09	0.20	−0.26	0.11	0.32	2.05	11.45	0.00
IMP	0.05	−0.01	0.40	−0.23	0.16	0.39	1.82	17.4	0.00
TOP	0.29	0.25	0.58	0.06	0.14	0.40	1.83	17.4	0.00
MAC	3.64	3.58	4.13	3.28	0.21	0.35	1.94	14.3	0.00
BMS	1.77	1.80	1.89	1.63	0.09	−0.28	1.72	17.0	0.00
FII	0.02	0.02	0.14	−0.12	0.04	0.13	5.23	44.5	0.00

Notes: Med = median; Max = maximum; Min = minimum; Std = standard deviation; Skew = skewness; Kur = Kurtosis; JB = Jarque Bera; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply; FII = foreign institutional investment. In this and in subsequent tables and figures, exports, imports, total trade, market capitalization, money supply and foreign institutional investment are all expressed as percentages of GDP – as defined in the text; values reported here are the natural logarithms of the variables. We use natural logarithmic forms in our estimation

Table III. Summary statistics on the variables

Variables	IIP	EXP	IMP	TOP	MAC	BMS	FII
IIP	1.00						
EXP	0.03	1.00					
IMP	−0.03	0.93*	1.00				
TOP	−0.01	0.97*	0.99*	1.00			
MAC	−0.05	0.77*	0.83*	0.82*	1.00		
BMS	−0.7*	0.85*	0.87	0.88*	0.63*	1.00	
FII	0.12	0.05	0.05	0.45**	0.11	0.12	1.00

Table IV.
Results: correlation matrix

Notes: IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply; FII = foreign institutional investment. See also Table III significant at the *1% and **5% levels

Test statistics	Variables	NTI		WT		WIT		Inference and conclusion
		LD	FD	LD	FD	LD	FD	
ADF	IIP	−0.79	−14.0*	−2.60	−14.0*	−3.71	−14.0*	I[1]
	EXP	−1.27	−5.25*	−0.23	−5.56*	−2.62	−5.59*	I[1]
	IMP	−0.66	−24.8*	−1.10	−24.9*	−2.35	−24.9*	I[1]
	TOP	1.85	−4.79*	−0.06	−5.26*	−2.38	−5.29*	I[1]
	MAC	0.35	−12.9*	−1.21	−12.9*	−1.98	−12.9*	I[1]
	BMS	1.53	−3.53*	−2.29	−3.01*	−2.01	−3.34*	I[1]
	FII	−4.62*	−12.1*	−10.6*	−12.1*	−10.7*	−12.0*	I[0]
PP	IIP	−1.53	−17.4*	−2.69	−17.3*	−2.79	−17.2*	I[1]
	EXP	−2.55	−40.28	2.69	−46.9*	9.35	−46.7*	I[1]
	IMP	−1.17	−25.0*	−1.49	−25.9*	5.89	−25.8*	I[1]
	TOP	1.14	−27.1*	−1.49	−27.9*	6.64	−27.8*	I[1]
	MAC	0.32	−12.9*	−1.34	−12.9*	−2.15	−12.9*	I[1]
	BMS	3.54	−13.3*	−0.82	−14.0*	−1.25	−14.1*	I[1]
	FII	−9.89*	−96.6*	−11.0*	−96.2*	−11.1*	−100.9*	I[0]

Table V.
Results: unit root test statistics

Notes: LD = level data; FD = first-difference data; ADF = augmented Dickey-Fuller Test; I[1] = integrated of order one; I[0] = integrated of order zero; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply; FII = foreign institutional investment. See also Table III; significant at the *1% level; since FII attains stationarity in the level data, it is removed from our ARDL and VECM estimation to achieve consistency, as we have several other variables in our analysis

The tests results reveal that our time series variables IIP, EXP, IMP, TOP, BMS and MAC all have unit roots in their levels. This is because the estimated ADF and PP statistics cannot reject the null hypothesis of non-stationarity at the 5 per cent level of significance. However, each of the stated six variables is stationary at the 5 per cent significance level in their first differences. Hence, the variables are I(1), meaning they are integrated of order one. At the same time, FII attains stationarity at the level data and thus it is integrated of order zero [i.e. I(0)]. For maintaining consistency, we exclude the variable FII in the final analysis for the assessment on the nexus between trade openness and economic growth. This is justified because we have included several other variables in our analysis which are integrated or order one [i.e. I(1)] (Table V).

It can be noted that ADF and PP unit root tests can provide biased results regarding the order of integration when data show structural breaks in the series. To deal with this issue, we utilized Zivot and Andrews's (1992) structural-break unit-roots test. Table VI reports the results of the Zivot and Andrews unit root-test. The results reveal that all the series are non-stationary at the level but attain stationary at the first difference level with intercept and trend. This implies that variables are I(1) which supports the validity of using ADF and PP tests.

Hence, we then apply our ARDL bounds testing approach to cointegration to confirm the existence of long-run relationships between trade openness, banking sector depth, stock market depth and economic growth. The purpose here is to check the cointegration between various proxies of trade openness (EXP, IMP and TOP), banking sector depth, stock market depth and economic growth.

Three steps are used in this procedure: first, the order of lags on the first-differenced variables in equations (1)-(3) is obtained from the unrestricted models by using the AIC; second, we apply the bounds *F*-test to these equations to establish that there exist a long-run relationships between the variables under study; and third, we apply ordinary least square (OLS) analysis to explore the long-run marginal effects of trade openness (EXP, IMP and TOP), banking sector depth and stock market depth on economic growth; and fourth, we use the VECM approach [equations (4)-(6)] to ascertain the direction of causality between these variables. The results of the bounds test are reported in Table V. The results show that there is evidence of cointegration between trade openness (however defined), banking sector depth, stock market depth and economic growth. We also verified these findings through Johansen's cointegration test (Johansen, 1988; Johansen and Juselius, 1990). The results here are not reported due to space constraints (Table VII).

Having established the existence of cointegration (long-run relationships between the variables), we examined the marginal effects of trade openness and the other two variables (BMS and MAC) on economic growth. Table VIII provides the estimates and results of the marginal effects. The results confirm that trade openness (however defined) is positively linked to economic growth and is statistically significant at the demanding 1 per cent significance level. This is consistent with the findings of Shahbaz (2012), Shahbaz *et al.* (2011) for Pakistan, Dufrenot *et al.* (2010) for a group of developing

Variables	*t*-statistics	Break points	Possible reasons for the break
IIP	−8.717*	2006:2009	Rapid industrial and service sector growth[a]
EXP	−5.199*	2000:2002	Rapid industrial and service sector growth[a]
IMP	−5.617*	2004:2005	Rapid industrial and service sector growth[a]
TOP	−5.214*	2004:2008	Rapid industrial and service sector growth[a]
MAC	−3.229	2004:2005	Rapid industrial and service sector growth[a]
BMS	−2.701	2003:2004	Rapid industrial and service sector growth[a]
Critical values: 1%: −5.57; 5%: −5.08			

Notes: IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; significant at the *1% level

Sources: [a]Hatekar and Dongre (2005) and Mazumdar (2010)

Table VI. Results: structural break unit root test statistics

Estimated models	Optimal lag length	*F*-statistics	χ^2_N	χ^2_A	χ^2_R	χ^2_S
	Bounds testing to cointegration		Diagnostic tests			
Case 1: export intensity as the indicator of trade openness						
F_G (G/ E, M, B)	1, 1, 0, 0	115*	[2]:429.0	[1]:16.9	[1]:44.5	[1]:0.01
F_E (E/G, M, B)	1, 0, 1, 0	4.75*	[2]:4.91	[1]:0.64	[1]:0.01	[1]:22.5
F_M (M/E, G, B)	1, 0, 0, 0	1.10	[2]:25.6	[1]:2.43	[1]:0.33	[1]:2.72
F_B (B/E, M, G)	1, 0, 0, 0	3.48**	[2]:70.6	[1]:0.01	[1]:9.54	[1]:0.11
Case 2: import intensity as the indicator of trade openness						
F_G (G/I, M, B)	1, 1, 0, 0	84.4*	[2]:927.0	[1]:5.15	[1]:22.7	[1]:1.18
F_I (I/G, M, B)	1, 1, 0, 0	2.52	[2]:89.0	[1]:1.36	[1]:0.01	[1]:3.46
F_M (M/I, G, B)	1, 0, 0, 0	1.00	[2]:26.4	[1]:2.46	[1]:0.01	[1]:2.76
F_B (B/I, M, G)	1, 0, 0, 0	3.71*	[2]:77.9	[1]:0.03	[1]:1.21	[1]:0.02
Case 3: total trade intensity as the indicator of trade openness						
F_G (G/O, M, B)	1, 1, 0, 0	87.4*	[2]:903.0	[1]:9.07	[1]:29.8	[1]:2.42
F_O (O/G, M, B)	1, 1, 0, 0	1.52	[2]:6.36	[1]:0.67	[1]:0.09	[1]:26.9
F_M (M/O, G, B)	1, 0, 0, 0	1.02	[2]:25.8	[1]:2.44	[1]:0.08	[1]:2.74
F_B (B/O, M, G)	1, 0, 0, 0	3.54**	[2]:75.8	[1]:0.01	[1]:4.14	[1]:0.05

Significance level	Critical values: Lower bounds: I(0)	Upper bounds: I(1)
5 % level	2.51	3.68
10 % level	2.04	3.07

Table VII.
Results: ARDL bounds testing cointegration

Notes: G = index of industrial production; E = exports; I = imports; O = total trade; M = market capitalization; B = broad money supply. See also Table III; significant at the *5% and **10% levels; χ^2_N: χ^2 Normal; χ^2_A: χ^2 ARCH; χ^2_R: χ^2 RESET; and χ^2_S: χ^2 serial

Variables	Exports model CO	Exports model TS	Imports model CO	Imports model TS	Top model CO	Top model TS
Constant	1.43	2.28	1.10	1.55	−2.96	−1.67
EX	0.21	3.64*	–	–	–	–
IMP	–	–	0.002	2.08**	–	–
TOP	–	–	–	–	0.0001	0.019
MAC	−0.001	0.16	0.0002	0.53	−0.001	−1.52
BMS	−0.001	−3.38	−0.001	−0.817	2.91	2.34**
R^2	0.06		0.004		0.03	
F	4.55		0.25		1.97	

Table VIII.
Marginal effect of trade openness on economic growth

Notes: CO = coefficients of parameters; TS = test statistics; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; significant at the *1% and **10% levels

countries, Khan and Qayyum (2007) for East Asian countries and Liu *et al.* (1997) for China.

We also studied the interactive effect of trade openness, banking sector depth and stock market depth on evolving economic growth. The estimated results are shown in Tables IX-XI. Our findings suggest that all integrations have positive impacts on economic growth and are statistically significant at the 5 per cent level. Thus, we can infer that trade openness stimulates economic growth through greater banking sector depth and greater stock market depth.

The presence of cointegrated long-run relationships between trade openness, banking sector depth, stock market depth and economic growth, as well as the marginal effects on growth, entitles us to apply the VECM Granger causality approach [equations (4)-(6)] to ascertain the direction of causality between the variables. The direction of causality is essential as it informs public policy on priorities and the relative significance of alternative approaches to stimulating economic growth. Table XII reports the results of Granger causality tests between economic growth, trade openness, banking sector depth and stock market depth.

	Exports model		Imports model		Top model	
Variables	CO	TS	CO	TS	CO	TS
Constant	1.66	2.00	0.94	1.10	1.22	1.70
EX × MAC	0.0007	1.52	–	–	–	–
IMP × MAC	–	–	0.01	0.281	–	–
TOP × MAC	–	–	–	–	0.001	1.08
BMS	−0.001	−1.42	−0.00	−0.26	−0.001	−1.02
R^2	0.01		0.001		0.01	
F	1.16		0.04		0.587	

Notes: CO = coefficients of parameters; TS = test statistics; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; none of these cases is statistically significant

Table IX.
Interaction between trade openness and stock market depth

	Exports model		Imports model		Top model	
Variables	CO	TS	CO	TS	CO	TS
Constant	0.78	1.45	0.65	1.22	0.68	1.35
EX × BMS	0.0001	0.59	–	–	–	–
IMP × BMS	–	–	−0.001	−0.26	–	–
TOP × BMS	–	–	–	–	0.000	0.24
MAC	−0.001	−0.41	0.001	0.34	−0.000	−0.14
R^2	0.002		0.001		0.001	
F	0.21		0.062		0.06	

Notes: CO = coefficients of parameters; TS = test statistics; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; none of these cases is statistically significant

Table X.
Interactions between trade openness and banking sector depth

Variables	Exports model CO	Exports model TS	Imports model CO	Imports model TS	Top model CO	Top model TS
Constant	−0.48	−0.64	0.69	1.09	−1.97	−1.21
EXP	0.008	2.01	–	–	–	–
IMP	–	–	0.00	0.12	–	–
TOP	–	–	–	–	1.61	1.72**
MAC × BMS	−0.00	−1.88	−0.00	−0.07	−0.00	−1.34
R^2	0.01		0.00		0.014	
F	2.045		0.02		1.489	

Table XI.
Interaction between stock market depth and banking sector depth

Notes: CO = coefficients of parameters; TS = test statistics; IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; significant at the **10% level

Dependent variable	Independent variables ΔIIP	ΔEXP	ΔIMP	ΔTOP	ΔMAC	ΔBMS	ECT_{-1}	Inferences
Case 1: export intensity as an indicator of trade openness								
ΔIIP	–	14.7*	NA	NA	5.36*	61.4*	−8.98*	EXP <=> IIP
ΔEXP	5.25*	–	NA	NA	1.54	16.9*	−0.05	BMS <=> IIP
ΔMAC	1.42	1.82	NA	NA	–	0.49	0.84	EXP <=> BMS
ΔBMS	12.8*	8.83*	NA	NA	2.99	–	2.52	MAC => IIP
								MAC => BMS
Case 2: import intensity as an indicator of trade openness								
ΔIIP	–	NA	12.3*	NA	4.26*	71.5*	−8.97*	IMP <=> IIP
ΔIMP	1.58	NA	–	NA	1.81	1.62	−2.85**	BMS <=> IIP
ΔMAC	1.45	NA	2.85**	NA	–	0.03	0.703	IMP => MAC
ΔBMS	7.52*	NA	5.70*	NA	1.97	–	2.561	IMP => BMS
								MAC => IIP
Case 3: total trade intensity as an indicator of trade openness								
ΔIIP	–	NA	NA	17.4*	4.89*	67.7*	−9.63*	TOP <=> IIP
ΔTOP	3.47**	NA	NA	–	2.40	9.17*	−2.03	IIP <=> BMS
ΔMAC	1.87	NA	NA	3.19**	–	0.18	0.57	TOP <=> BMS
ΔBMS	12.5*	NA	NA	3.86*	2.17	–	2.93	TOP => MAC
								MAC => IIP

Table XII.
Results of Granger causality tests

Notes: IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP = total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; significant at the *1% and **5% levels; ECT_{-1}: lagged error correction term; NA indicates not applicable since we are using only one indicator of trade openness at a time

The estimated results (as summarized in Table XIII) are as follows:

- *For Model 1*: The results suggest the existence of bidirectional causality between economic growth and exports [IIP <=> EXP], economic growth and banking sector depth [IIP <=> BMS] and between banking sector depth and exports [BMS <=> EXP]. In addition, we find the existence of unidirectional causality

Causal relationships tested in the model	Direction of relationships observed in case 1	Direction of relationships observed in case 2	Direction of relationships observed in case 3
IIP vs EXP	EXP <=> IIP	NA	NA
IIP vs IMP	NA	IMP <=> IIP	NA
IIP vs TOP	NA	NA	TOP <=> IIP
IIP vs MAC	MAC => IIP	MAC => IIP	MAC => IIP
IIP vs BMS	BMS <=> IIP	BMS <=> IIP	IIP <=> BMS
EXP vs MAC	EXP <#> MAC	NA	NA
EXP vs BMS	EXP <=> BMS	NA	NA
IMP vs MAC	NA	IMP => MAC	NA
IMP vs BMS	NA	IMP => BMS	NA
TOP vs MAC	NA	NA	TOP => MAC
TOP vs BMS	NA	NA	TOP <=> BMS
MAC vs BMS	MAC => BMS	MAC <#> BMS	MAC <#> BMS

Notes: IIP = index of industrial production; EXP = value of exports; IMP = value of imports; TOP: total trade; MAC = market capitalization; BMS = broad money supply. See also Table III; **<#>:** no causality; =>: unidirectional causality; <=>: bidirectional causality; NA indicates not applicable since we are using only one indicator of trade openness at a time

Table XIII. Summary of Granger causality tests between trade openness and economic growth in India

from stock market depth to economic growth and from stock market depth to banking sector depth [MAC => IIP; MAC => BMS]. This suggests some primacy for encouraging the evolution of equity markets within the financial sectors of growth-seeking developing countries, like India.

- *For Model 2*: The results demonstrate the existence of bidirectional causality between economic growth and imports [IIP <=> IMP] and between economic growth and banking sector depth [IIP <=> BMS]. Moreover, we find the existence of unidirectional causality from imports to banking sector depth and from imports to stock market depth [IMP => BMS; IMP => MAC]. There is also unidirectional causality here from stock market depth to economic growth [MAC => IIP].
- *For Model 3*: The results uncover the existence of bidirectional causality between economic growth and total trade [IIP <=> TOP], between economic growth and banking sector depth [IIP <=> BMS] and between banking sector depth and total trade [BMS <=> TOP]. We also find the existence of unidirectional causality from stock market depth to economic growth [MAC => IIP] and from total trade to stock market depth [TOP => MAC].

Finally, to complement this study, we use generalized impulse-response functions (GIRFs). The GIRFs trace the effect of a one-time shock to one of the innovations on the current and future values of endogenous variables (Koop *et al.*, 1996). The key importance of the GIRFs are that the responses are invariant to any re-ordering of the variables in the VECM and, as an orthogonality condition 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 GIRFs provide more robust results than the orthogonalized method (Ewing *et al.*, 2007). For instance, the GRIFs provided insight into how shocks to a particular variable (such as trade openness) can be affected by other variables (such as economic growth, banking sector depth and stock market depth). The GIRFs provided support for the presence of causality between these variables in the multivariate vector-autoregressive system (Figures 1-3).

6. Conclusion and policy implications arising from this study

This paper examined dynamic causal relationships between trade openness, banking sector depth, stock market depth and economic growth in India during the period 1994 to 2011. The study offers four innovations in estimation procedure in relation to this

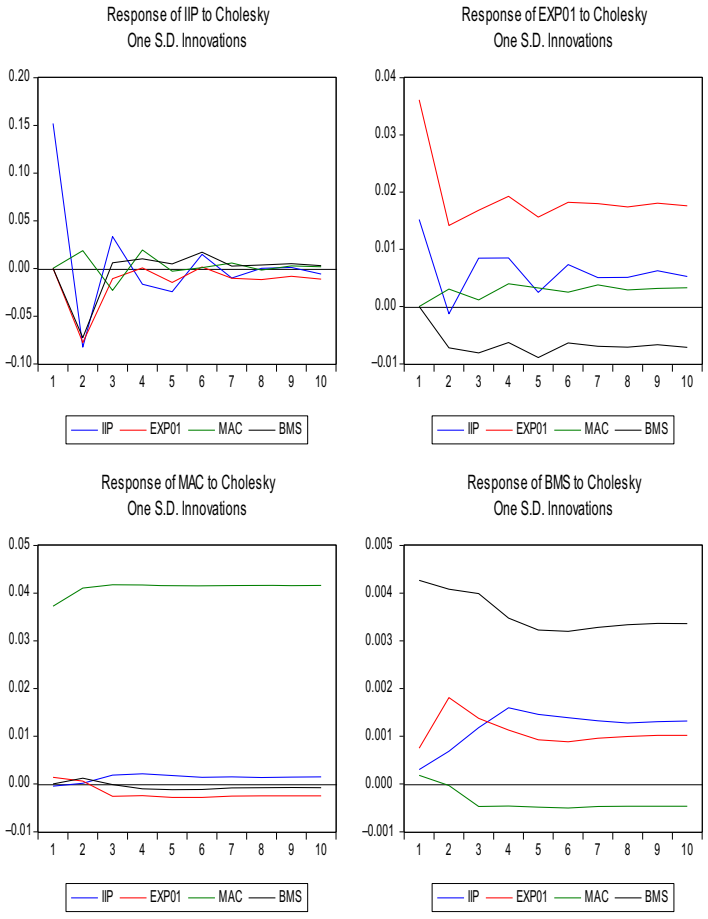
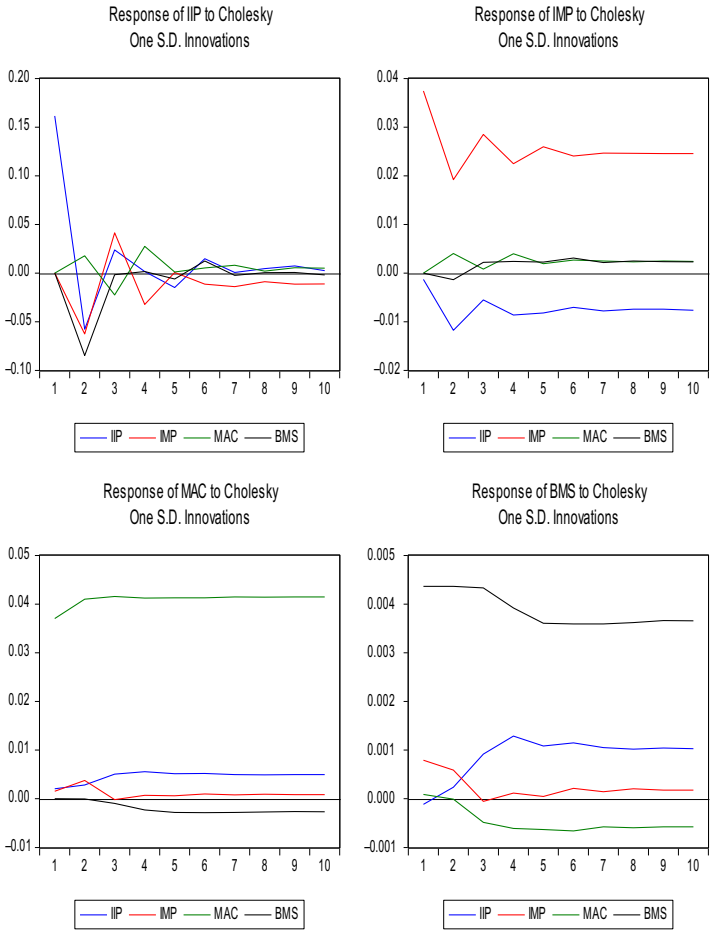


Figure 1.
Granger causal relations between IIP, EXP, MAC and BMS

Notes: IIP = index of industrial production; EX = value of exports; MAC = market capitalization; and BMS = broad money supply



Notes: IIP = index of industrial production; IMP = value of imports; MAC = market capitalization; and BMS = broad money supply

Figure 2.
Granger causal relations between IIP, IMP, MAC and BMS

topic. First, we used the ARDL bounds-testing procedure for cointegration instead of either the standard Engle and Granger (1987) approach or the Johansen (1988) approach. The technique used here offers better statistical determination for smaller sample sizes. Second, we used a multivariate causality tests instead of bivariate causality tests. Advancing beyond previous studies, we observe not merely the nexus between trade openness and economic growth but the conjoint interaction of trade openness, economic growth and financial depth. Further, we investigated also the marginal effects of:

- trade openness;
- banking sector depth; and
- stock market depth on economic growth, both individually and interactively.

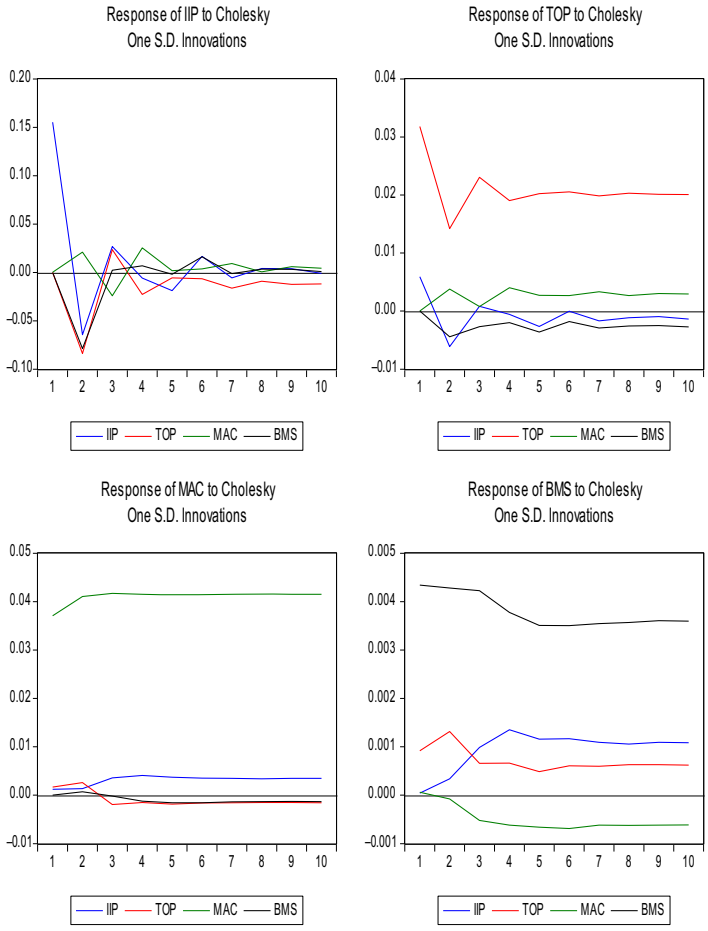


Figure 3.
Granger causal relations between IIP, TOP, MAC and BMS

Notes: IIP = index of industrial production; TOP = total trade; MAC = market capitalization; and BMS = broad money supply

Finally, we used three indicators of trade openness to check the robustness of our results. The methods we developed for this study can be applied to any of the large number of growth-seeking countries for which dynamic growth-openness-financial depth interactions have not already been investigated.

Using the ARDL bounds testing approach in conjunction with the VECM approach, our study reaches the following conclusions which are documented in Tables VII-XII inclusive. The ARDL cointegration results show that trade openness, banking sector depth and stock market depth are cointegrated with economic growth, indicating the presence of a long-run equilibrium relationship between them. This result is significant for policy makers because it affirms the policy-growth connections in the presence of multiple interacting variables over time. Our results also suggest that trade openness (no matter how it is defined and however it is achieved) has a positive impact on

economic growth. The VECM approach results show that bidirectional causality is present between economic growth and trade openness. This finding supports the earlier findings of Tang and Chea (2013), Awokuse (2006), Konya (2006), Clarke and Ralhan (2005), Din (2004), Ekanayake (1999), Xu (1996), Bhat (1995), Van de Berg and Schmidt (1994), Bahmani-Oskooee and Niroomand (1999).

There is also bidirectional causality between banking sector depth and economic growth and between stock market depth and economic growth. This finding supports the earlier findings of Pradhan *et al.* (2014), Uddin *et al.* (2014), Chow and Fung (2011), Wolde-Rufael (2009), Dritsakis and Adamopoulos (2004), Craigwell *et al.* (2001), and Ahmed and Ansari (1998).

Furthermore, we find unidirectional causality running from stock market depth to banking sector depth. This finding supports the earlier findings of Pradhan *et al.* (2014), Rashid (2008), Rousseau and Xiao (2007), Darrat *et al.* (2006), Bilson *et al.* (2001), Rousseau and Wachtel (2000), Garcia and Liu (1999).

The policy imperatives available to foster trade openness include unilateral reductions in import duties, reciprocal trade liberalization through bilateral and international fora, such as the WTO, and further freeing quotas and other technical barriers to trade. Banking and stock market coverage of an economy like that of India is enhanced by financial education programs, enriching public and business confidence in placing their funds in financial institutions, improving financial stability by better and more predictable monetary policy, enabling financial institutions to issue a wider range of risk-based securities and equity floats as in more developed economies and ensuring that any financial-fraudulent activities are overtly detected. This ambitious policy package gives practical meaning to what lies behind our economic concepts and data described in this study as "trade openness" and "financial market depth". An immediate policy implication of our detailed econometric results is that if policymakers wish to advance economic growth in India, they need to facilitate some or all of this policy package.

Notes

1. Trade openness is often loosely defined as ensuring freer exchange of goods and services, capital, labour, information and ideas across national borders (Shahbaz, 2012; Okuyan *et al.*, 2012; Bajwa and Siddiqi, 2011).
2. There is also significant literature looking at the *correlation* between economic growth and a number of other variables. These studies which cover a cross section of countries are surveyed in Barro and Sala-i-Martin (1995, Chapter. 12). However, the challenge is beyond documenting correlations to demonstrating *causation* – i.e. not that certain variables go hand-in-hand with growth, but that they demonstrably cause it. The current paper focuses on causality.
3. Financial depth is defined inconsistently as between studies in this literature. Moreover, some authors refer to "financial maturity" instead of financial depth even when the same sets of financial variables are used.
4. The index of industrial production in India includes both industry *and* services production.
5. India publishes only annual GDP figures. We use a log-linear interpolation method in order to obtain monthly GDP data from January 1994 to December 2011. We use the figures as a divisor for the other series noted here.

6. Broad money supply is the sum of currency outside banks, demand and term deposits (including foreign currency deposits of resident sectors other than the central bank), and certificates of deposit and commercial paper.
7. Careful readers will have noticed that we do not include *FII* in the set of equations below or under the system of equations (4)-(6). The reason for this will become apparent later: all the variables become stationary in first differences except *FII*. Therefore, for consistency we drop *FII* in our analysis of cointegration and causality. We further comment on this in Section 5.

References

Abu-Bader, S. and Abu-Qarn, A.S. (2008), "Financial development and economic growth: empirical evidence from six MENA countries", *Review of Development Economics*, Vol. 12 No. 4, pp. 803-817.

Ahmed, S.M. and Ansari, M.I. (1998), "Financial sector development and economic growth: the South-Asian experience", *Journal of Asian Economics*, Vol. 9 No. 3, pp. 503-517.

Ang, J.B. (2008a), "Survey of recent developments in the literature of finance and growth", *Journal of Economic Surveys*, Vol. 22 No. 3, pp. 536-576.

Ang, J.B. (2008b), "What are the mechanisms linking financial development and economic growth in Malaysia?", *Economic Modelling*, Vol. 25 No. 1, pp. 38-53.

Ang, J.B. and McKibbin (2007), "Financial liberalization, financial sector development and growth: evidence from Malaysia? *Journal of Development Economics*, Vol. 84 No. 1, pp. 215-233.

Anwar, M. and Sampath, R. (2000), "Exports and economic growth", *Indian Economic Journal*, Vol. 47 No. 3, pp. 79-88.

Awokuse, T.O. (2006), "Causality between exports, imports and economic growth: evidence from transition economies", *Economics Letters*, Vol. 94 No. 3, pp. 389-395.

Bahmani-Oskooee, M. and Niroomand, F. (1999), "Openness and economic growth: an empirical investigation", *Applied Economics Letters*, Vol. 6 No. 9, pp. 557-561.

Bajwa, S. and Siddiqi, M.W. (2011), "Trade openness and its effects on economic growth in selected South Asian countries: a panel data study", *International Journal of Human and Social Sciences*, Vol. 6 No. 2, pp. 138-143.

Barro, R. and Sala-i-Martin, X. (1995), *Economic Growth*, McGraw-Hill, New York, NY.

Bhagwati, J. (1978), *Anatomy and Consequences of Exchange Control Regimes: Liberalization Attempts and Consequences*, Ballinger Publishing, Cambridge, MA.

Bhat, S. (1995), "Export and economic growth in India", *Artha Vijana*, Vol. 37 No. 44, pp. 350-358.

Bilson, C.M., Brailsford, T.J. and Hooper, V.J. (2001), "Selecting macroeconomic variables as explanatory factors of emerging stock market returns", *Pacific-Basin Finance Journal*, Vol. 9 No. 4, pp. 401-426.

Blackburn, K. and Hung, V.T.Y. (1998), "A theory of growth, financial development and trade", *Economica*, Vol. 65 No. 257, pp. 107-124.

Bojanic, A.N. (2012), "The impact of financial development and trade on the economic growth of Bolivia", *Journal of Applied Economics*, Vol. 15 No. 2, pp. 51-70.

Boulila, G. and Trabelsi, M. (2004), "Financial development and long run growth: evidence from Tunisia: 1962-1997", *Savings and Development*, Vol. 28 No. 3, pp. 289-314.

Burnham, K.P. and Anderson, D.R. (2004), "Multimodal inference: understanding AIC and BIC in model selection", *Sociological Methods and Research*, Vol. 33 No. 2, pp. 261-304.

Calderon, C. and Liu, L. (2003), "The direction of causality between financial development and economic growth", *Journal of Development Economics*, Vol. 72 No. 1, pp. 321-334.

Chaiechi, T. (2012), "Financial development shocks and contemporaneous feedback effect on key macroeconomic indicators: a Post-Keynesian time series analysis", *Economic Modelling*, Vol. 29 No. 2, pp. 487-501.

Chandavarkar, A. (1992), "Of finance and development: neglected and unsettled questions", *World Development*, Vol. 20 No. 1, pp. 133-142.

Chandran, V.G.R. and Munusamy (2009), "Trade openness and manufacturing growth in Malaysia", *Journal of Policy Modeling*, Vol. 31 No. 5, pp. 637-647.

Chang, T., Simo-Kengne, B.D. and Gupta, R. (2013), "The causal relationship between imports and economic growth in the nine provinces of South Africa: evidence from panel granger causality tests", Working Paper No. 2013-2020, University of Pretoria, Pretoria.

Chow, P.C.Y. (1987a), "Causality between export growth and industrial development: empirical evidence from the NICs", *Journal of Development Economics*, Vol. 26 No. 1, pp. 55-63.

Chow, P.C.Y. (1987b), "Causality between export growth and industrial development: empirical evidence from newly industrialized countries", *Journal of Development Economics*, Vol. 28 No. 1, pp. 265-276.

Chow, W.W. and Fung, M.K. (2011), "Financial development and growth: a clustering and causality analysis", *Journal of International Trade and Economic Development*, Vol. 35 No. 3, pp. 1-24.

Christopoulos, D.K. and Tsionas, E.G. (2004), "Financial development and economic growth: evidence from panel unit root and cointegration tests", *Journal of Development Economics*, Vol. 73 No. 1, pp. 55-74.

Clarke, J.A. and Ralhan, M. (2005), "Direct and indirect causality between exports and economic output for Bangladesh and Sri Lanka: horizon matters", Econometrics Working Paper No. EWPOS012, University of Victoria, Victoria.

Coe, T. and Helpman, E. (1995), "International R&D spillovers", *European Economic Review*, Vol. 39 No. 5, pp. 859-887.

Colombage, S.R.N. (2009), "Financial markets and economic performances: empirical evidence from five industrialized countries", *Research in International Business and Finance*, Vol. 23 No. 3, pp. 339-348.

Craigwell, R., Downes, D. and Howard, M. (2001), "The finance-growth Nexus: a multivariate VAR analysis of a small open economy", *Savings and Development*, Vol. 25 No. 2, pp. 209-223.

Darrat, A.F., Elkhal, K. and McCallum, B. (2006), "Finance and macroeconomic performance: some evidence from emerging markets", *Emerging Markets Finance and Trade*, Vol. 42 No. 3, pp. 5-28.

Demetriades, P. and Hussein, K. (1996), "Financial development and economic growth: cointegration and causality tests for 16 countries", *Journal of Development Economics*, Vol. 51 No. 2, pp. 387-411.

Dickey, D.A. and Fuller, W.A. (1979), "Distribution of the estimators for auto-regressive time series with a unit root", *Journal of the American Statistical Association*, Vol. 74 No. 366, pp. 427-431.

Dickey, D.A. and Fuller, W.A. (1981), "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica*, Vol. 49 No. 4, pp. 1057-1072.

Din, M. (2004), "Exports, imports, and economic growth in South Asia: evidence using a multivariate time-series framework", *Pakistan Development Review*, Vol. 43 No. 2, pp. 105-124.

Dritsaki, C. and Dritsaki-bargiota, M. (2005), "The causal relationship between stock, credit market and economic development: an empirical evidence of Greece", *Economic Change and Restructuring*, Vol. 38 No. 1, pp. 113-127.

Dritsakis, N. and Adamopoulos, A. (2004), "Financial development and economic growth in Greece: an empirical investigation with granger causality analysis", *International Economic Journal*, Vol. 18 No. 4, pp. 547-559.

Dufrenot, G., Mignon, V. and Tsangarides, C. (2010), "The trade-growth Nexus in the developing countries: a quintile regression approach", *Review of World Economics*, Vol. 146 No. 4, pp. 731-761.

Edwards, S. (1998), "Openness, productivity and growth: what do we really know?", *Economic Journal*, Vol. 108 No. 447, pp. 383-398.

Ekanayake, E.M. (1999), "Exports and economic growth in Asian developing countries: cointegration and error correction models", *Journal of Economic Development*, Vol. 24 No. 2, pp. 43-56.

Engle, R.F. and Granger, C.W.J. (1987), "Cointegration and error correction: representation, estimation and testing", *Econometrica*, Vol. 55 No. 2, pp. 251-276.

Eris, M.N. and Ulasan, B. (2013), "Trade openness and economic growth: Bayesian model averaging estimate of cross-country growth regressions", *Economic Modelling*, Vol. 33 No. 1, pp. 867-883.

Ewing, B.T., Riggs, K. and Ewing, K.L. (2007), "Time series analysis of a predator-prey system: application of VAR and generalized impulse response function", *Ecological Economics*, Vol. 60 No. 3, pp. 605-612.

Garcia, V.F. and Liu, L. (1999), "Macroeconomic determinants of stock market development", *Journal of Applied Economics*, Vol. 11 No. 1, pp. 29-59.

Granger, C.W.J. and Lee, T.H. (1989), "Investigation of production, sales and inventory relations using multicointegration and non-symmetric error correction models", *Journal of Applied Econometrics*, Vol. 4 No. S1, pp. S145-S159.

Gries, T., Kraft, M. and Meierrieks, D. (2009), "Linkages between financial deepening, trade openness, and economic development: causality evidence from Sub-Saharan Africa", *World Development*, Vol. 37 No. 12, pp. 1849-1860.

Hassan, M.K., Sanchez, B. and Yu, J. (2011), "Financial development and economic growth: new evidence from panel data", *Quarterly Review of Economics and Finance*, Vol. 51 No. 1, pp. 88-104.

Helpman, E. and Krugman, P. (1985), *Market Structure and Foreign Trade*, MIT Press, Cambridge, MA.

Hossain, M.S. (2011), "Panel estimation for CO2 emissions, energy consumption, economic growth, trade openness and urbanization of newly industrialized countries", *Energy Policy*, Vol. 39 No. 11, pp. 6991-6999.

Hsueh, S., Hu, Y. and Tu, C. (2013), "Economic growth and financial development in Asian countries: a bootstrap panel granger causality analysis", *Economic Modelling*, Vol. 32 No. 3, pp. 294-301.

Islam, F., Hye, Q.M.A. and Shahabaz, M. (2012), "Import-economic growth Nexus: ARDL approach to cointegration", *Journal of Chinese Economic and Foreign Trade Studies*, Vol. 5 No. 3, pp. 194-214.

Jalil, A., Feridun, M. and Ma, Y. (2010), "Finance-growth Nexus in China revisited: new evidence from principal components and ARDL bounds tests", *International Review of Economics and Finance*, Vol. 19 No. 2, pp. 189-195.

Jayanthakumaran, K. and Verma, R. (2008), "International trade and regional income convergence: the ASEAN-5 evidence", available at: http://ro.uow.edu.au/commpapers/479

Johansen, S. (1988), "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control*, Vol. 12 Nos 2/3, pp. 231-254.

Johansen, S. and Juselius, K. (1990), "Maximum likelihood estimation and inference on cointegration with application to the demand for money", *Oxford Bulletin of Economics and Statistics*, Vol. 52 No. 2, pp. 169-210.

Jung, W.S. (1986), "Financial development and economic growth: international evidence", *Economic Development and Cultural Change*, Vol. 34 No. 2, pp. 336-346.

Kanda, D., Reynolds, P. and Towe, C. (2001), "Structural reform in India", in Callen, T., Reynolds, P. and Towe, C. (Eds), *India at the Cross Roads: Sustaining Growth and Reducing Poverty*, International Monetary Fund, Washington, DC.

Kar, M., Nazlioglu, S. and Agir, H. (2011), "Financial development and economic growth Nexus in the MENA countries: bootstrap panel granger causality analysis", *Economic Modelling*, Vol. 28 Nos 1/2, pp. 685-693.

Khan, A. (2001), "Financial development and economic growth", *Macroeconomic Dynamics*, Vol. 5 No. 3, pp. 413-433.

Khan, M.A. and Qayyum, A. (2007), "Trade liberalization, financial development and economic growth", Trade Working Paper No. 22204, East Asian Bureau of Economic Research, Crawford School of Public Policy, Canberra.

King, R. and Levine, R. (1993), "Finance and growth: Schumpeter might be right", *The Quarterly Journal of Economics*, Vol. 108 No. 3, pp. 717-737.

Klasra, M.A. (2011), "Foreign direct investment, trade openness and economic growth in Pakistan and Turkey: an investigation using bounds test", *Quality and Quantity*, Vol. 45 No. 1, pp. 223-231.

Konya, L. (2006), "Exports and growth: granger causality analysis on OECD countries with a panel data approach", *Economic Modelling*, Vol. 23 No. 6, pp. 978-992.

Koop, G., Pesaran, M.H. and Potter, S.M. (1996), "Impulse response analysis in nonlinear multivariate models", *Journal of Econometrics*, Vol. 74 No. 1, pp. 119-147.

Kumar, S. and Pacheco, G. (2012), "What determines the long run growth rate in Kenya?", *Journal of Policy Modeling*, Vol. 34 No. 2, pp. 705-718.

Liu, X. and Sinclair, P. (2008), "Does the linkage between stock market performance and economic growth vary across greater China?", *Applied Economics Letters*, Vol. 15 No. 7, pp. 505-508.

Levine, R. (1997), "Financial development and economic growth: views and agenda", *Journal of Economic Literature*, Vol. 35 No. 2, pp. 688-726.

Levine, R. (1999), "Law, finance and economic growth", *Journal of Financial Intermediation*, Vol. 8 Nos 1/2, pp. 8-35.

Levine, R., Loayza, N. and Beck, T. (2000), "Financial intermediation and growth: causality analysis and causes", *Journal of Monetary Economics*, Vol. 46 No. 1, pp. 31-77.

Liang, Q. and Teng, J. (2006), "Financial development and economic growth: evidence from China", *China Economic Review*, Vol. 17 No. 4, pp. 395-411.

Liu, X., Song, H. and Romilly, P. (1997), "An empirical investigation of the causal relationship between openness and economic growth in China", *Applied Economics*, Vol. 29 Nos 8/9, pp. 1679-1686.

Luintel, K. and Khan, M. (1999), "A quantitative reassessment of the finance-growth Nexus: evidence from a multivariate VAR", *Journal of Development Economics*, Vol. 60 No. 2, pp. 381-405.

Ma, C. (2007), *Essays on China's Energy Consumption, Carbon Emissions and Economic Growth*, ProQuest, PhD Thesis, Rensselaer Polytechnic Institute, Troy, New York.

Menyah, K., Nazlioglu, S. and Wolde-Rufael, Y. (2014), "Financial development, trade openness and economic growth in African countries: new insights from a panel causality approach", *Economic Modelling*, Vol. 37 No. 2, pp. 386-394.

Montalbano, P. (2011), "Trade openness and developing countries' vulnerability: concepts, misconceptions, and directions for research", *World Development*, Vol. 39 No. 9, pp. 1489-1502.

Muhammad, S.D., Hussain, A. and Ali, S. (2012), "The causal relationship between openness and economic growth: empirical evidence in case of Pakistan", *Pakistan Journal of Commerce and Social Sciences*, Vol. 6 No. 2, pp. 382-391.

Mukhopadhyay, B., Pradhan, R.P. and Feridun, M. (2011), "Finance-growth Nexus revisited for some Asian countries", *Applied Economics Letters*, Vol. 18 No. 16, pp. 1527-1530.

Naceur, S.B. and Ghazouani, S. (2007), "Stock markets, banks, and economic growth: empirical evidence from the MENA region", *Research in International Business and Finance*, Vol. 21 No. 2, pp. 297-315.

Nandi, S. (1991), "Export and economic growth in India: empirical evidence", *Indian Economic Journal*, Vol. 38 No. 3, pp. 53-59.

Narayan, P.K. and Smyth, R. (2005), "Trade liberalization and economic growth in Fiji: an empirical assessment using the ARDL approach", *Journal of the Asia Pacific Economy*, Vol. 10 No. 1, pp. 96-115.

Neusser, K. and Kugler, M. (1998), "Manufacturing growth and financial development: evidence from OECD countries", *Review of Economics and Statistics*, Vol. 80 No. 4, pp. 638-646.

Odhiambo, N.M. (2007), "Supply-leading versus demand-following hypotheses: empirical evidence from three SSA countries", *African Development Review*, Vol. 19 No. 2, pp. 257-280.

Odhiambo, N.M. (2008), "Financial development in Kenya: a dynamic test of the finance-led growth hypotheses", *Economic Issues*, Vol. 13 No. 2, pp. 21-36.

Odhiambo, N.M. (2010), "Finance-investment-growth Nexus in South Africa: an ARDL bounds testing procedure", *Economic Change Restructuring*, Vol. 43 No. 3, pp. 205-219.

Okuyan, H.A., Ozun, A. and Erbaykal, E. (2012), "Trade openness and economic growth: further evidence without relying on data stationarity", *International Journal of Commerce and Management*, Vol. 22 No. 1, pp. 26-35.

Panopoulou, E. (2009), "Financial variables and Euro area growth: a non-parametric causality analysis", *Economic Modelling*, Vol. 26 No. 6, pp. 1414-1419.

Pesaran, M.H. and Pesaran, B. (1997), *Working with Microfit 4.0: Interactive Econometric Analysis*, Oxford University Press, Oxford.

Pesaran, M.H. and Shin, Y. (1999), "An autoregressive distributive lag modelling approach to cointegration analysis", in Strom, S. (Ed.), *Econometrics and Economic Theory in 20th Century: The Ragnar Frisch Centennial Symposium*, Cambridge University Press, Cambridge, pp. 371-413.

Pesaran, M.H., Shin, Y. and Smith, R. (2000), "Structural analysis of vector error correction models with exogenous I(1) variables", *Journal of Econometrics*, Vol. 97 No. 2, pp. 293-343.

Pesaran, M.H., Shin, Y. and Smith, R. (2001), "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*, Vol. 16 No. 3, pp. 289-326.

Pesaran, M.H. and Smith, R. (1998), "Structural analysis of cointegration VRS", *Journal of Economic Surveys*, Vol. 12 No. 5, pp. 471-505.

Phillips, P.C.B. and Perron, P. (1988), "Testing for a unit root in time series regression", *Biometrica*, Vol. 75 No. 2, pp. 335-346.

Pradhan, R.P. (2006), "Globalization in India: achievements and failures", *South Asian Journal of Human Rights*, Vol. 11 No. 1, pp. 1-24.

Pradhan, R.P. (2007), "India's BOP in the globalization era: the trends and determinants", *Indian Journal of Commerce*, Vol. 60 No. 3, pp. 150-159.

Pradhan, R.P. (2013), "The determinants of long-run finance development: the ARDL bound testing approach", *Journal of Social and Management Sciences*, Vol. 52 No. 1, pp. 43-63.

Pradhan, R.P., Arvin, M.B., Norman, N.R. and Hall, J.H. (2014), "The dynamics of banking sector and stock market maturity and the performance of Asian economies: time series evidence", *Journal of Economics and Administrative Sciences*, Vol. 30 No. 1, pp. 16-44.

Pradhan, R.P., Arvin, M.B., Samadhan, B. and Taneja, S. (2013), "The impact of stock market development on inflation and economic growth of 16 Asian countries: a panel VAR approach", *Applied Econometrics and International Development*, Vol. 13 No. 1, pp. 203-220.

Pradhan, R.P., Bagchi, T.P., Chowdhury, K. and Norman, N.R. (2012), "Growth, foreign investment and trade-openness interactions in ten OECD countries: a panel-VAR approach", *International Journal of Banking, Accounting and Finance*, Vol. 4 No. 4, pp. 273-293.

Pradhan, R.P. and Gunashekar, A. (2013), "Finance-growth Nexus in selected Asian countries", *IUP Journal of Applied Finance*, Vol. 19 No. 1, pp. 1-17.

Quartey, P. and Prah, F. (2008), "Financial development and economic growth in Ghana: is there a causal link?", *African Finance Journal*, Vol. 10 No. 1, pp. 28-54.

Rashid, A. (2008), "Macroeconomic variables and stock market performance: testing for dynamic linkages with a known structural break", *Savings and Development*, Vol. 32 No. 1, pp. 77-102.

Riezman, R.G., Summers, P.M. and Whiteman, C.H. (1996), "The engine of growth or its handmaiden? A time series assessment of export-led growth", *Empirical Economics*, Vol. 21 No. 1, pp. 77-113.

Romer, D. (1998), "A new assessment of openness and inflation: reply", *Quarterly Journal of Economics*, Vol. 113 No. 2, pp. 649-652.

Romer, P.M. (1992), "Two strategies for economic development: using ideas and producing ideas", *World Bank Annual Conference on Economic Development*, Washington, DC.

Rousseau, P.L. and Wachtel, P. (2000), "Banks, stock markets and China's great leap forward", *Emerging Markets Review*, Vol. 8 No. 3, pp. 206-217.

Rousseau, P.L. and Xiao, S. (2007), "Equity Markets and growth: cross country evidence on timing and outcomes", *Journal of Banking and Finance*, Vol. 24 No. 12, pp. 1933-1957.

Sarkar, P. (2007), "Trade openness and growth: is there any link?", *MPRA Paper No. 4997*, pp. 4-22.

Shahbaz, M. (2012), "Does trade openness affect long run growth? cointegration, causality and forecast error variance decomposition tests for Pakistan", *Economic Modelling*, Vol. 29 No. 6, pp. 2325-2339.

Shahbaz, M., Azim, P. and Ahmad, K. (2011), "Exports-led growth hypothesis in Pakistan: further evidence", *Asian Economic and Financial Review*, Vol. 1 No. 3, pp. 182-197.

Shan, J., Morris, A. and Sun, F. (2001), "Financial development and economic growth: an egg-chicken problem?", *Review of International Economics*, Vol. 9 No. 3, pp. 443-454.

Shaw, E. (1973), *Financial Deepening in Economic Development*, Oxford University Press, Oxford.

Sinha, T. and Sinha, D. (1996), "An empirical investigation into the relationship between openness and economic growth: evidence from Asia", *International Review of Economics and Business*, Vol. 43 No. 2, pp. 359-370.

Stiglitz, J. (2002), *Globalization and its Discontents*, Penguin Press, London.

Tang, T.C. and Chea, R. (2013), "Export-Led growth in Cambodia: an empirical study", *Economics Bulletin*, Vol. 33 No. 1, pp. 655-662.

Thornton, J. (1994), "Financial deepening and economic growth: evidence from Asian economies", *Savings and Development*, Vol. 18 No. 1, pp. 41-51.

Uddin, G.S., Shahbaz, M., Arouri, M. and Teulon, F. (2014), "Financial development and poverty reduction Nexus: a cointegration and causality analysis in Bangladesh", *Economic Modelling*, Vol. 36 No. 3, pp. 405-412.

Uğur, A. (2008), "Import and economic growth in Turkey: evidence from multivariate VAR analysis", *East-West Journal of Economics and Business*, Vol. 11 Nos 1/2, pp. 54-75.

Van de Berg, H. and Schmidt, J.R. (1994), "Foreign trade and economic growth: time series evidence from Latin America", *Journal of International Trade and Economic Development*, Vol. 3 No. 2, pp. 121-130.

Wadhva, C.D. (2003), "Economic reforms in India: in retrospect and prospect", *Man and Development*, Vol. 25 No. 3, pp. 17-62.

Wang, C., Liu, X. and Wei, Y. (2004), "Impact of openness on growth in different country groups", *World Economy*, Vol. 27 No. 4, pp. 567-585.

Winters, A.L. (2004), "Trade liberalisation and economic performance: an overview", *Economic Journal*, Vol. 114 No. 493, pp. F4-F21.

Wolde-Rufael, Y. (2009), "Re-examining the financial development and economic growth Nexus in Kenya", *Economic Modelling*, Vol. 26 No. 6, pp. 1140-1146.

Wu, J., Hou, H. and Cheng, S. (2010), "The dynamic impacts of financial institutions on economic growth: evidence from the European union", *Journal of Macroeconomics*, Vol. 32 No. 3, pp. 879-891.

Xu, Z. (1996), "On the causality between export growth and GDP growth: an empirical re-investigation", *Review of International Economics*, Vol. 4 No. 2, pp. 172-184.

Yanikkaya, H. (2003), "Trade openness and economic growth: a cross country empirical investigation", *Journal of Development Economics*, Vol. 72 No. 1, pp. 57-89.

Yavari, K. and Mohseni, R. (2012), "Trade liberalization and economic growth: a case study of Iran", *Journal of Economic Policy Reform*, Vol. 15 No. 1, pp. 13-23.

Zivot, E. and Andrews, D. (1992), "Further evidence of great crash, the oil price shock and unit root hypothesis", *Journal of Business and Economic Statistics*, Vol. 10 No. 3, pp. 251-270.

Further reading

Giles, J.A. and Williams, C.L. (2000), "Export-led growth: a survey of the empirical literature and some non-causality results", *Journal of International Trade and Economic Development*, Vol. 9 No. 3, pp. 261-337.

Hatekar, N. and Dongre, A. (2005), "Structural breaks in India's growth: revisiting the debate with a longer perspective", *Economic and Political Weekly*, Vol. 40 No. 14, pp. 1432-1435.

Mazumdar, S. (2010), "Industry and services in growth and structural change in India: some unexplored features", Working Paper No. 2010/2002, Institute for Studies in Industrial Development, New Delhi.

Pradhan, R.P. (2011), "Financial development, growth and stock market development: the trilateral analysis in India", *Journal of Quantitative Economics*, Vol. 9 No. 1, pp. 134-145.

Pradhan, R.P., Arvin, M.B., Norman, N.R. and Nishigaki, Y. (2014), "Does banking sector development affect economic growth and inflation? A panel cointegration and causality approach", *Applied Financial Economics*, Vol. 24 No. 7, pp. 465-480.

Pradhan, R.P., Dasgupta, P. and Samadhan, B. (2013), "Finance development and economic growth in BRICS: a panel data analysis", *Journal of Quantitative Economics*, Vol. 11 Nos 1/2, pp. 308-322.

Corresponding author
Rudra P. Pradhan can be contacted at: rudrap@vgsom.iitkgp.ernet.in