Author`s Contact Address:

Corresponding Author:

Salih Turan KATIRCIOGLU, Asst.Prof.Dr.
Department of Banking and Finance
Eastern Mediterranean University
P.O. Box 95, Famagusta, North Cyprus
Via Mersin 10, Turkey
Tel: +90 392 630 2008
Fax: +90 392 630 2032
e-mail: salihk@emu.edu.tr

Neslihan KAHYALAR
Department of Economics
Eastern Mediterranean University
P.O. Box 95, Famagusta, North Cyprus
Via Mersin 10, Turkey
Tel: +90 392 630 2008
Fax: +90 392 365 1017
e-mail: neslihan.kahyalar@emu.edu.tr

Hasret BENAR, Ph.D
Department of Economics
Eastern Mediterranean University
P.O. Box 95, Famagusta, North Cyprus
Via Mersin 10, Turkey
Tel: +90 392 630 2008
Fax: +90 392 365 1017
e-mail: hasretbenar@hotmail.com

FINANCIAL DEVELOPMENT, TRADE AND GROWTH TRIANGLE: THE CASE OF INDIA

STRUCTURED ABSTRACT

Purpose of this paper	To investigate the possible co-integration and the direction of causality between financial development, international trade and economic growth in India.
Design/methodology/approach	Annual data covering 1965-2004 period has been used to investigate co-integration and Granger causality tests between financial development, international trade and growth after employing unit root tests to see if the variables under consideration are stationary.
Findings	Results reveal that there is long run equilibrium relationship between financial development, international trade and real income growth in the case of India. Furthermore, unidirectional causality was investigated that runs from real income to exports and imports, from exports to imports, M2 and domestic credits, from M2 to imports, from imports to domestic credits. Bidirectional causality has also been obtained between real income and M2, and between real income and domestic credits. Finally, no direction of causality has been obtained between M2 and domestic credits.
Research limitations/implications (if applicable)	A more expanded data can be used for further comparison.
Practical implications (if applicable)	This study has shown that the *supply-leading* and the *demand-following* hypotheses cannot be inferred for the Indian economy alone themselves. And furthermore, the export-led and the import-led hypotheses cannot again be inferred for the Indian economy based on the sample period, 1965-2004.
What is original/value of paper	This study is the first of its kind which investigates the possible co-integration and the direction of causality between financial development, international trade and economic growth triangle not only in the case of India but also in the relevant literature to the best knowledge of authors of this study.

Keywords: Financial Development, Trade, Growth, Co-integration, Causality, India.

Type: Research Paper

I. INTRODUCTION

The fundamental question in the relevant empirical literature is: Does financial development or trade causes economic growth or is financial development or increase in trade an engine of growth for an economy? One crucial factor that has begun to receive considerable attention more recently is the role of financial market and banking sector in the development of growth process. The nexus between economic growth and financial development has been conducted on number of divergent lines. After the extensive studies in this field, it is now well recognized that financial development is a crucial factor for economic growth (Calderon and Liu, 2003) as it is a necessary condition for achieving a high rate of economic growth (Chang, 2002) and has a strong positive relationship with economic growth (Mazur and Alexander, 2001). However, De Gregorior and Guidotti (1995) point out that financial development significantly reduces economic growth for countries (especially in Latin America) experiencing relatively high inflation rates.

Although the direction of causality between financial development and economic growth is in attention of the researchers in the relevant literature, this causal relationship generally remains unclear (Calderon and Liu, 2003). Patrick (1966) developed two hypotheses testing the possible directions of causality between financial development and economic growth, that is, *the supply-leading hypothesis*, where it posits a causal relationship from financial development to economic growth, and *the demand-following hypothesis*, where it postulates a causal relationship from economic growth to financial development. In the empirical literature, McKinnon (1973), King and Levine (1993), Neusser and Kugler

(1998) and Levine et al. (2000) support *the supply-leading hypothesis* while Gurley and Shaw (1967), Goldsmith (1969), and Jung (1986) support *the demand-following hypothesis*.

Empirical studies of the Trade-Led Growth (TLG) hypothesis fail to produce conclusive findings (Giles and Williams, 1999; Deme 2002). The new trade theory has contributed to the theoretical relationship between exports and growth regarding effects on technical efficiency (Doyle, 2001). Rivera-Batiz and Romer (1991) show that expansion of international trade increases growth by increasing the number of specialized production inputs. However, this outcome is ambiguous when there is imperfect competition and increasing returns to scale (Doyle, 2001). Krugman (1979), Dixit and Norman (1980) and Lancaster (1980) show economies of scale as a major cause of international trade, hinting the validity of the growth-led exports hypothesis. Some empirical studies in the literature confirmed the TLG hypothesis for some countries whereas some others rejected it for some other countries[i]. On the other hand, some studies in the growth literature support the ELG hypothesis while some others investigate the Import-Led Growth (ILG) hypothesis (Deme, 2002).

Recent empirical literature has also revisited the link between financial development and trade openness. These two factors are identified as macroeconomic variables as being highly correlated with economic growth performance across countries in the empirical growth literature (Beck, 2002). The other empirical studies in the literature also searched the channels based on the relationship between financial development and trade openness affecting economic growth. Kletzer and Bardhan (1987) incorporates financial sector into the Heckscher-Ohlin trade model and show that financial sector development gives countries a comparative advantage in industries that rely more on external financing. Additionally, Baldwin (1989) points out that financial markets are a source of comparative advantage. A number of researchers and economists argued that the development of the financial sector *follows* rather than *leads* the development of the real sector due to the fact that the specialization of countries in particular industries would create a demand for a well-developed financial sector (Beck, 2002).

This paper firstly examines the possible co-integrating link between financial development, international trade and economic growth; and secondly, tests the direction of causality between these three variables based on *the supply-leading*, *the demand-following* and *trade-led* hypotheses for the Indian economy. The findings of the study might give interesting conclusions for the literature because of three reasons: (i) the direction of causality between financial development, trade and economic growth nexus needs further investigation (ii), the relationship between financial development, international trade and economic growth triangle needs further attention, and (iii) to the best of authors' knowledge this study is the first of its kind made for the Indian economy.

The remainder of this paper is organized as follows. Section II reviews literature review in the field. Section III describes data and methodology respectively. Section IV discusses the findings. Finally, Section V provides concluding remarks.

II. EMPIRICAL LITERATURE REVIEW FROM INDIA

During the 1980s trade and financial liberalization has been initiated in India. Capital inflows increased in forms of foreign direct investment (FDI). Indian economy attracted foreign investors by providing them a proper situation and financial liberalization that positively affected Indian economy. However, possible negative side effects of the financial liberalization should not be ignored.

It is notable that there are also studies searching the relationship between economic growth and financial sector development in India. Agarwal (2000) examined the financial sector reforms in India and indicated that it’s important to consider the vulnerability of Indian economy to financial crises due to high current account deficits, high fiscal deficits and slow growth of exports. The study by Bhattacharya and Sivasubramanian (2003) investigated the causal relationship between financial development and economic growth in India using causality analysis. They found that for the period 1970 to 1999 financial sector development as measured by M3/GDP leads to GDP growth. The study by Demetriades and Luintel (1996) investigates the relationship between financial development, economic growth and banking sector controls in India. They find that there is bidirectional causation between financial development and economic growth of India. They also points out that policies that affect financial development, also affect economic growth, and financial sector policies affect financial deepening by altering the bank behavior.

On the other hand, Topalova (2004) investigated the impact of trade liberalization on firm's productivity in India, which found that trade liberalization (especially tariff reduction) increases the productivity among firms. This study also claimed that productivity and profitability of firms might lead to economic welfare improvement with more intensive privatization efforts in India. The study by Bajpai (2001) shows that there was potential growth of 7-8 percent per year in India because of structural changes in industrial, financial areas and trade such as the reduction in protection levels, decontrol of prices, and continuing reforms in banking sector. Sachs et al. (2002) indicate that the coastal regions such as Tamil Nadu, Maharashtra and Gujarat take the advantage of export-led growth because of geographical economic performance in India. The key step was through increased exports to coastal regions and greatly improved productivity for local production. The study by Bajpai (2002) points out that with the initiation of economic reforms in India in 1991, the role of private investment has acquired a great deal of significance. State-level data on FDI approvals suggest that the relatively fast growing states have attracted higher levels of FDI.

III. DATA AND METHODOLOGY

Data

Data used in this paper for the Indian economy are annual figures covering the period 1965 – 2004. The variables of the study are measured as follows: real gross domestic product

(GDP) at 1995 constant US$ prices (lnGDP), the first financial development measure[1] is the ratio of broad money (M2) to nominal GDP, namely; lnM2 and the second financial development measure is the ratio of domestic credit to nominal GDP; namely; lnDC. There are many studies in the literature which uses the proxy for trade openness as the ratio of trade of goods and services including exports and imports relative to GDP. And there also many studies which uses exports and imports separately to consider individual effects. This study will use real exports of goods and services (lnEXP) and real imports of goods and services (lnMP) where both are at 1995 constant US$ prices to capture individual relationships with other variables of the study. All of the variables in the study are at their natural logarithm. Data were gathered from World Bank database for World Development Indicators (2005).

Methodology

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)[2] Unit Root Tests are employed to test the integration level and the possible co-integration among the variables (Dickey and Fuller 1981; Phillips and Perron 1988). The PP procedures, which compute a residual variance that is robust to auto-correlation, are applied to test for unit roots as an alternative to ADF unit root test.

[1] The definition of financial development, which is the improvement in quantity, quality, and efficiency of financial intermediary services cannot be captured by a single measure, thus, two common measures are advised in the literature (See also Calderon and Liu, 2003).
[2] PP approach allows for the presence of unknown forms of autocorrelation with a structural break in the time series and conditional heteroscedasticity in the error term.

Unless the researcher knows the actual data generating process, there is a question concerning whether it is most appropriate to include constant term and trend factor in the unit root process (Enders 1995). It might seem reasonable to test the existence of a unit root in the series using the most general of the models. That is,

$$\Delta y_t = a_0 + \gamma y_{t-1} + a_2 t + \sum_{i=2}^{p} \beta_j \Delta y_{t-i-1} + \in_t \qquad (1)$$

where y is the series; t = time (trend factor); a = constant term (drift); ε_t = Gaussian white noise and p = the lag order. The number of lags "p" in the dependent variable was chosen by the Akaike Information Criteria (AIC) to ensure that the errors are white noise. One problem with the presence of the additional estimated parameters is that it reduces degrees of freedom and the power of the test.

On the other hand, the researcher may fail to reject the null hypothesis of a unit root ($\gamma = 0$) because of a misspecification concerning the deterministic part of the regression. Therefore, Doldado, Jenkinson and Sosvilla-Rivero (1990) also suggest starting from the most general model to test for a unit root when the form of the data generating process is unknown. The general principle is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses (Hamilton 1994). If the intercept or time trend is inappropriately omitted, the power of the test can go to zero (Campbell and Perron 1991). "Reduced power means that the researcher will conclude that the process contains a unit root when, in fact, none is present" (Enders 1995: 255). A linear combination of integrated variables are said to be co-integrated if the variables are stationary. Many economic models entail such co-integrating relationships (Enders 1995).

After the order of integration is determined, co-integration between the variables should be tested to identify any long run relationship. Johansen trace test is used for the co-integration test in this paper. Cheung and Lai (1993) mention that the trace test is more robust than the maximum eigen value test for co-integration. The Johansen trace test attempts to determine the number of co-integrating vectors among variables. There should be at least one co-integrating vector for a possible co-integration. The Johansen (1988) and Johansen and Juselius (1990) approach allows the estimating of all possible co-integrating vectors between the set of variables and it is the most reliable test to avoid the problems which stems from Engel and Granger (1987) procedure[3]. This procedure can be expressed in the following VAR model:

$$X_t = \Pi_1 X_{t-1} + \ldots + \Pi_K X_{t-K} + \mu + e_t \qquad (\text{for } t = 1, \ldots T) \qquad (2)$$

Where X_t, X_{t-1}, …, X_{t-K} are vectors of current and lagged values of P variables which are $I(1)$ in the model; $\Pi_1, \ldots, \Pi_K$ are matrices of coefficients with (PXP) dimensions; μ is an intercept vector[4]; and e_t is a vector of random errors. The number of lagged values, in practice, is determined in such a way that error terms are not significantly autocorrelated. The rank of Π is the number of co-integrating relationship(s) (i.e. r) which is determined by testing whether its Eigen values (λ_i) are statistically different from zero. Johansen (1988)

[3]See Kremers et al. (1992) and Gonzalo (1994) for the comments about disadvantages of Engel and Granger (1987) procedure compared with Johansen and Juselius (1990) co-integration technique.
[4] μ is a vector of $I(0)$ variables which represent dummy variables as well. This ensures that errors e_t are white noise.

and Johansen and Juselius (1990) propose that using the Eigen values of *Π* ordered from the largest to the smallest is for computation of trace statistics[5].. The trace statistic (λ_{trace}) is computed by the following formula[6]:

$$\lambda_{trace} = -T\sum Ln(1-\lambda_i),\ i = r+1,\ \ldots,\ n-1 \text{ and the hypotheses are : } \quad (3)$$

H_0: r = 0 H_1: r ≥ 1

H_0: r ≤ 1 H_1: r ≥ 2

H_0: r ≤ 2 H_1: r ≥ 3

The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Empirical studies have shown that the existence of non-stationarity in the time series considered can lead to spurious regression results and invalidate the conclusions reached using Granger causality. Toda and Phillips (1993) have led the methods to deal with Granger causality in I (1) systems of variables. A causal long run relationship between non-stationary time series when they are co-integrated could be inferred. Therefore, if co-integration analysis is omitted, causality tests present evidence of simultaneous correlations rather than causal relations between variables. The presence of a co-integrating relation forms the basis of the Vector Error Correction (VEC) specification. Additionally, standard Granger or Sims tests

[5] Asymptotic critical values are obtained from Osterwald-Lenum (1992).

[6] At the beginning of the procedure, we test the null hypothesis that there are no co-integrating vectors. If it can be rejected, the alternative hypothesis (i.e. $r \leq 1,\ \ldots,\ r \leq n$) are to be tested sequentially. If $r=0$ cannot be rejected in the first place, then there is no co-integrating relationship between the variables, and the procedure stops

may provide invalid causal information due to the omission of error correction terms from the tests (Doyle, 2001).

The simple Granger's causality test becomes inappropriate when co-integrating vectors are obtained in the series. According to Granger's representation theorem, the results of co-integration imply that X and Y have the following error-correction representations in equations (4) and (5). These are necessary to augment the simple Granger causality test with the Error Correction Mechanism (ECM), derived from the residuals of the appropriate co-integration relationship to test for causality:

$$\Delta \ln \mathrm{Y_t} = C_0 + \sum_{i=1}^{k} \beta_i \Delta \ln \mathrm{Y_{t-i}} + \sum_{i=1}^{k} \alpha_i \Delta \ln \mathrm{X_{t-i}} + p_i ECT_{t-1} + u_t \qquad (4)$$

$$\Delta \ln \mathrm{X_t} = C_0 + \sum_{i=1}^{k} \gamma_i \Delta \ln \mathrm{X_{t-i}} + \sum_{i=1}^{k} \varsigma_i \Delta \ln \mathrm{Y_{t-i}} + \eta_i ECT_{t-1} + \varepsilon_t \qquad (5)$$

where Y and X are the variables under consideration, and ρ_i is the adjustment coefficient while ECT_{t-1} expresses the error correction term of growth equation, Δ indicates first difference operator. In equation (4), X Granger causes Y if α_i and ρ_i are significantly different from zero. In equation (5), Y Granger causes X if ς_i and η_i are significantly different from zero. F-statistic is used to test the joint null hypothesis of α_i, $\varsigma_i = 0$, and t test is employed to estimate the significance of the error coefficient.

IV. RESULTS

Table 1 gives ADF and PP test results for unit root, which prove that all the variables are integrated of order one; that is I (1). This indicates that the first differences of lnGDP, lnM2, lnDC, lnEXP and lnIMP are stationary in the Indian case for this sample period.

"take in Table 1"

Having established the necessary conditions for the stationarity of data under inspection, we conduct Johansen`s co-integration test (Johansen, 1988; Johansen and Juselius, 1990), which is very sensitive to the choice of lag length (Chang 2002), to explore any possible long run relationship among the variables under consideration. We employ both Akaike and Schwartz Criteria to select the number of lags in the co-integration test where the two criteria suggest a VAR model with 1 lag. The results showing number of co-integrating vectors are reported in Table 2 that presents only the trace test results as suggested by Cheung and Lai (1993)[7]. Johansen test results show that every pair in Table 2 is co-integrated with each other. This means that long run equilibrium relationship exists between these pairs. It is also useful to mention that more than one co-integrating vector has been obtained between lnGDP and lnEXP, lnGDP and lnIMP, and lnM2 and lnIMP whereas other pair of the variables are co-integrated with at most one co-integrating vector.

[7] Cheung and Lai (1993) show that trace test are much more robust than max eigen value test statistics regarding to skewness and excess kurtosis in the residuals. Therefore, trace statistic was preferred in this study.

"take in Table 2"

Since co-integration relationship is found between the variables under inspection, an ECM model should be constructed to determine the direction of the causality. Granger (1988) mentions that there should be at least one direction of causality among the variables if they are co-integrated. The causality model is expressed as an error correction model as in equations (4) and (5) since the variables are co-integrated.

"take in Table 3"

Table 3 reports the F-statistics and t-statistics for error correction term constructed under the null hypothesis of non-causality. Rejection of the null hypothesis implies that the corresponding variable Granger-Causes the dependent variable. The Granger causality test results Table 4 suggest that unidirectional causality runs from GDP to exports, from GDP to imports, from exports to M2, from M2 to imports, from exports to domestic credits, from imports to domestic credits, and from exports to imports. Bidirectional causality has also been obtained between GDP and M2, and between GDP and domestic credits. Finally, no direction of causality has been obtained between M2 and domestic credits.

If these results are to be summarized, the supply-leading, the demand-following, export-led and import-led hypotheses cannot be inferred about the Indian economy based on VECM analysis. But it is important to note that a change in exports and imports leads to a change in domestic credits. Furthermore, a change in exports leads to a change in M2 and imports, where a change in M2 leads to a change in imports in India.

V. CONCLUSION

This study has investigated possible co-integration and the direction of causality between financial development, international trade and economic growth in India using annual data that covers the period 1965-2004. Results reveal that there is long run equilibrium relationship between financial development, international trade and real income growth in the case of India. Granger causality tests show that growth in real income leads to growth in international trade sector, namely exports and imports. Thus, there is unidirectional causation that runs from real income growth to international trade growth. On the other hand, bidirectional causality has been obtained between real income growth and financial development measures, namely M2 and domestic credits. Furthermore, exports of India leads to a change in financial development (both M2 and domestic credits) in India. But in the case of imports, there is unidirectional causality that runs from M2 to imports and from imports to domestic credits.

If results are to be summarized, findings of this study have shown that the *supply-leading* and the *demand-following* hypotheses cannot be inferred for the Indian economy alone themselves. And furthermore, the export-led and the import-led hypotheses cannot again be inferred for the Indian economy based on the sample period, 1965-2004.

REFERENCES

Agarwal, R.N., (2000), "Global Financial Integration and Vulnerability to Crisis in Developing Countries: A Study of Indian Economy", Institute of Economic Growth, University Enclave, Delhi-110007.

Baldwin, R. E. (1989), Exporting the Capital Markets: Comparative Advantage and Capital Market Imperfections, Chap. 5, in The Convergence of International and Domestic Markets, David Audretsch (ed), North-Holland Press,

Bajpai, N., (2001), "Sustaining High Rates of Economic Growth in India", CID Working Paper No. 65, Center for International Development, Harvard University.

Bajpai, N., (2002). "A Decade of Economic Reforms in India: the Unfinished Agenda", CID Working Paper No. 89, Center for International Development, Harvard University.

Beck, T. (2002), "Financial development and international trade: Is there a link?" *Journal of International Economics*, Vol. 57, pp. 107-131.

Bhattacharya, P.C. and Sivasubramanian, M.N. (2003), "Financial development and economic growth in India: 1970-1971 to 1998-1999", *Applied Financial Economics*, Vol. 13, pp. 925-29.

Calderon, C. and Liu, L. (2003), "The direction of causality between financial development and economic growth", *Journal of Development Economics*, Vol. 72, 321-34.

Campbell, J. Y. and Perron, P. (1991), "Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots", Technical Working Paper, 100, NBER Working Paper Series, April.

Chang, T. (2002), "Financial development and economic growth in Mainland China: a note on testing demand-following or supply-leading hypothesis", *Applied Economic Letters*, Vol. 9, pp. 869-73.

Cheung, Y. and Lai, K. (1993), "Finite-sample sizes of Johansen's likelihood ratio tests for co-integration", *Oxford Bulletin of Economics and Statistics*, Vol. 55, pp. 313-28.

De Gregorio, J. and Guidotti, P. (1995), "Financial development and economic growth", *World Development*, Vol. 23, pp. 433-48.

Deme, M. (2002), "An Examination of the Trade-Led Growth Hypothesis in Nigeria: A Cointegration, Causality, and Impulse Response Analysis", *The Journal of Developing Areas*, Vol. 36, No. 1, pp. 1-15.

Demetriades, P. and Luitel, K. B. (1996), “Financial development, economic growth and banking sector controls: Evidence from India”, *Economic Journal,* Vol. 106 (435), pp. 359-74.

Dickey, D. and Fuller, W. A. (1981), “Likelihood ratio statistics for autoregressive time series with a unit root”, *Econometrica*, Vol. 49, pp. 1057-72.

Doldado, J., Jenkinson, T. And Sosvilla-Rivero, S. (1990), “Cointegration and Unit Roots”, *Journal of Economic Surveys,* Vol. 4, pp. 249-273.

Doyle, E. (2001), “Export-output causality and the role of exports in Irish growth: 1950-1997”, *International Economic Journal,* Vol. 15, Issue 2, pp. 147-61.

Enders, W. (1995), *Applied Econometric Time Series*, John Wiley & Sons, Inc., U.S.A.

Engle, R. F. and Granger, C. W. J. (1987), “Co-integration and error correction: representation, estimation, and testing”, *Econometrica*, Vol. 55, pp. 251-76.

Goldsmith, R. W. (1969), *Financial Structure and Development*, Yale University Press, New Haven, CT.

Gonzalo, J. (1994), “Five alternative methods of estimating long-run equilibrium relationships”, *Journal of Econometrics*, Vol. 60, pp. 203-33.

Granger, C. W. J. (1988), “Some recent developments in a concept of causality”, *Journal of Econometrics*, Vol. 39, pp. 199-211.

Gurley, J. and Shaw, E. (1967), “Financial structure and economic development”, *Economic Development and Cultural Change*, Vol. 34, pp. 333-46.

Hamilton, J. D. (1994), *Time Series Analysis*, Princeton University Press.

Johansen, S. (1988), “Statistical analysis of co-integration vectors”, *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-54.

Johansen, S. and Juselius, K. (1990), “Maximum likelihood estimation and inference on co-integration with application to the demand for money”, *Oxford Bulletin of Economics and Statistics*, Vol. 52, pp. 169-209.

Jung, W. S. (1986), “Financial development and economic growth: international evidence”, *Economic Development and Cultural Change*, Vol. 34, pp. 336-46.

King, R. G. and Levine, R. (1993), “Finance and growth: Schumpeter might be right”, *Quarterly Journal of Economics*, Vol. 108, pp. 717-38.

Kletzer, K. and Bardhan, P. (1987), "Credit markets and patterns of international trade", *Journal of Development Economics*, Vol. 27, pp. 57-70.

Kremers, J. M., Erisccos, N. R. and Dolado, J. J. (1992), "The power of co-integration tests", *Oxford Bulletin of Economics and Statistics*, Vol. 54, pp. 325-46.

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

Mazur, E. A. and Alexander, W. R. J. (2001), "Financial sector development and economic growth in New Zealand", *Applied Economic Letters*, Vol. 8, pp. 545-49.

McKinnon, R. I. (1973), *Money and Capital in Economic Development*, Brookings Institution, Washington, DC.

Neusser, K. and Kugler, M. (1998), "Manufacturing growth and financial development: evidence from OECD countries", *Review of Economics and Statistics*, Vol. 80, pp. 638-46.

Osterwald-Lenum, M. (1992), "A note with quantiles of the asymptotic distribution of the ML co-integration rank tests statistics", *Oxford Bulletin of Economic and Statistics*, Vol. 54, pp. 461-72.

Patrick, H. T. (1966), "Financial development and economic growth in underdeveloped economies", *Economic Development and Cultural Change*, Vol. 14, pp. 174-189.

Phillips, P.C.B. and Perron, P. (1988), "Testing for a unit root in time series regression", *Biometrica*, Vol. 75, pp. 335-46.

Sachs, J., Bajpai, N., and Ramiah, A., (2002). "Understanding Regional Economic Growth in India", CID Working Paper No. 88, Center for International Development, Harvard University. Also, forthcoming in Asian Economic Papers, MIT Press, 1, 2.

Toda, H. Y. and Phillips, P. C. B. (1993), "Vector autoregression and causality", *Econometrica*, Vol. 61, pp. 1367-93.

Topalova, P., (2004), "Trade Liberalization and Firm Productivity: The Case of India", IMF Working Paper, Asia and Pacific Department.

Worldbank, 2005. World Development Indicators. CD-ROM database.

Table I. ADF and PP Tests for Unit Root

Statistics (Levels)	lnGDP	Lag	lnM2	lag	lnDC	lag	lnExp	lag	LnImp	lag
τ_T (ADF)	-1.48	(0)	-2.55	(1)	-2.01	(3)	-1.38	(0)	-1.58	(0)
τ_μ (ADF)	1.93	(0)	-0.51	(1)	-1.12	(1)	0.45	(0)	1.15	(0)
τ (ADF)	10.42	(0)	2.46	(1)	1.78	(1)	6.07	(0)	3.85	(0)
τ_T (PP)	-1.18	(4)	-2.09	(2)	-1.29	(3)	-1.50	(7)	-0.61	(22)
τ_μ (PP)	4.09	(7)	0.25	(0)	-1.04	(3)	1.66	(38)	4.99	(34)
τ (PP)	11.16	(1)	4.69	(0)	1.98	(4)	12.77	(38)	4.99	(24)

Statistics (First Difference)	lnGDP	Lag	lnM2	lag	lnDC	lag	lnExp	Lag	LnImp	lag
τ_T (ADF)	-5.34^{*}	(3)	-4.31^{*}	(1)	-4.21*	(0)	-7.98^{*}	(0)	-6.34^{*}	(0)
τ_μ (ADF)	-6.92^{*}	(0)	-4.44^{*}	(1)	-4.22*	(0)	-7.53^{*}	(0)	-5.66^{*}	(0)
τ (ADF)	-0.60	(2)	-2.87^{*}	(0)	-2.56^{**}	(1)	-0.52	(3)	-2.64^{*}	(1)
τ_T (PP)	-8.85^{*}	(6)	-3.72^{**}	(4)	-4.17^{**}	(2)	-8.83^{*}	(12)	-7.76^{*}	(12)
τ_μ (PP)	-6.90^{*}	(1)	-3.82^{**}	(4)	-4.20^{*}	(2)	-7.37^{*}	(5)	-5.64^{*}	(5)
τ (PP)	-2.09^{**}	(4)	-2.85^{*}	(1)	-3.69^{*}	(3)	-4.62^{*}	(2)	-4.51^{*}	(1)

Note:
τ_T represents the most general model with a drift and trend; τ_μ is the model with a drift and without trend; τ is the most restricted model without a drift and trend.
Numbers in brackets are lag lengths used in ADF test (as determined by AIC set to maximum 3) to remove serial correlation in the residuals. When using PP test, numbers in brackets represent Newey-West bandwith (as determined by Bartlett-Kernel).
*, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively.
GDP stands for gross domestic product, M2 stands for money and quasi money as % of GDP, and DC stands for domestic credit provided by banking sector as % of GDP, Exp stands for exports of goods and services and Imp stands for imports of goods and services.
Tests for unit roots have been carried out in E-VIEWS 5.1.

Table 3. Co-integration Tests using the Johansen (1988) and Johansen and Juselius (1990) Approach

Variables	Trace Statistic	5% Critical Value	1% Critical Value
(1) lnGDP and M2			
H_0: r = 0	29.01*	15.41	20.04
H_0: r ≤ 1	1.93	3.76	6.65
(2) lnGDP and lnDC			
H_0: r = 0	26.69*	15.41	20.04
H_0: r ≤ 1	2.02	3.76	6.65
(3) lnGDP and lnEXP			
H_0: r = 0	29.49*	15.41	20.04
H_0: r ≤ 1	6.79*	3.76	6.65
(4) lnGDP and lnIMP			
H_0: r = 0	22.53*	15.41	20.04
H_0: r ≤ 1	4.24**	3.76	6.65
(5) lnM2 and lnDC			
H_0: r = 0	15.55**	15.41	20.04
H_0: r ≤ 1	0.78	3.76	6.65
(6) lnM2 and lnEXP			
H_0: r = 0	19.02**	15.41	20.04
H_0: r ≤ 1	2.10	3.76	6.65
(7) lnM2 and lnIMP			
H_0: r = 0	10.16	15.41	20.04
H_0: r ≤ 1	4.13**	3.76	6.65
(8) lnDC and lnEXP			
H_0: r = 0	23.69*	15.41	20.04
H_0: r ≤ 1	1.84	3.76	6.65
(9) lnDC and lnIMP			
H_0: r = 0	17.19**	15.41	20.04
H_0: r ≤ 1	3.01	3.76	6.65
(10) lnEXP and lnIMP			
H_0: r = 0	18.89**	15.41	20.04
H_0: r ≤ 1	2.03	3.76	6.65

Notes: 1. r denotes the number of co-integrating vectors.
2. Akaike Information Criterion (AIC) and Schwartz Criteria (SC) were used to select the number of lags required in the co-integration test. Both gave the same level of lag order.

Table 3. Granger Causality Tests

Null Hypothesis	F – Statistic	t statistic on ECM_{t-1}	F – Statistic	t statistic on ECM_{t-1}	F – Statistic	t statistic on ECM_{t-1}	Conclusion
	Lag 1		Lag 2		Lag 3		
(1) lnGDP and lnM2							
M2 does not Granger cause GDP	2.81***	-2.33**	1.72	-2.43**	1.80***	-2.89*	GDP ⇔ M2
GDP does not Granger cause M2	14.29*	-2.74*	6.53*	-2.34**	4.23*	-1.88***	
(2) lnGDP and lnDC							
DC does not Granger cause GDP	3.35**	-2.15**	1.92	-1.94***	1.60	-2.03***	GDP ⇔ DC
GDP does not Granger cause DC	4.17**	-1.80***	2.83**	-2.42**	1.98***	-2.36**	
(3) lnGDP and lnEXP							
EXP does not Granger cause GDP	1.27	1.33	0.70	1.53	0.52	1.59	GDP ⇒ EXP
GDP does not Granger cause EXP	2.74***	-2.35**	1.75	-2.46**	1.85***	-2.59**	
(4) lnGDP and lnIMP							
IMP does not Granger cause GDP	0.20	0.42	0.39	1.08	0.80	2.10	GDP ⇒ IMP
GDP does not Granger cause IMP	7.60*	-4.55*	3.21**	-3.38*	1.81***	-2.07**	
(5) lnM2 and lnDC							
DC does not Granger cause M2	2.86***	0.94	2.11***	1.45	1.72	1.11	
M2 does not Granger cause DC	2.35***	-1.49	1.93	-2.15**	1.47	-2.16**	M2 ….. DC
(6) lnM2 and lnEXP							
EXP does not Granger cause M2	7.44*	-3.00*	3.13**	-2.14**	3.16*	-2.91*	EXP ⇒ M2
M2 does not Granger cause EXP	0.44	0.95	0.91	1.51	1.94	2.75	
(7) lnM2 and lnIMP							
IMP does not Granger cause M2	2.90***	-0.81	2.02***	-1.58***	2.41**	0.00	M2 ⇒ IMP
M2 does not Granger cause IMP	3.21	-2.29**	1.60	-1.77**	1.70	-2.25**	
(8) lnDC and lnEXP							
EXP does not Granger cause DC	2.93***	-1.67***	2.07***	-2.27**	2.23**	-2.80*	EXP ⇒ DC
DC does not Granger cause EXP	1.81	1.47	1.35	1.28	3.80*	3.27	
(9) lnDC and lnIMP							
IMP does not Granger cause DC	1.87	-1.09	2.50**	-2.25**	2.55**	-2.01**	IMP ⇒ DC
DC does not Granger cause IMP	1.34	1.94	0.89	-1.25	2.18**	-1.06	
(10) lnEXP and lnIMP							
IMP does not Granger cause EXP	0.52	0.90	0.61	-0.67	1.23	1.43	EXP ⇒ IMP
EXP does not Granger cause IMP	6.55*	4.35*	2.69**	-3.06*	2.18**	-2.68**	

*, **, and *** denote the rejection of the null hypothesis at 1%, 5% and 10% respectively.

Note:

[i] See Deme (2002).