

# Reexamining the Finance–Growth Relationship for a Developing Economy: A time series analysis of post-reform India

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## ABSTRACT

The cross-country empirical literature on the finance-growth relationship has debated three propositions: (i) financial deepening has a strong impact on the growth process; (ii) measures of financial “activity” rather than the “size” of the sector plays a more significant role in the growth process; and (iii) financial structure (bank-based versus stock market-based) has no impact on the growth process at all. The present study reexamines the validity of these propositions for a developing economy. We test these propositions for the post-reform Indian economy using the modified Pantula principle associated with the Vector Error Correction Model (VECM) methodology. In the context of the “size versus activity” debate, we also test whether these two aspects of the financial sector can impact growth rates independently. The results support the strong impact of financial deepening on growth but find that the other propositions are not as robust.

Keywords: Financial deepening, financial structure, financial activity, economic growth, India, modified Pantula principle.

JEL codes: E24, E44, O16, G10, G21



## 1. INTRODUCTION

The role of financial development in the growth of nations has been long recognized (Schumpeter 1911; Gershenkron 1962). Voluminous literature, both theoretical and empirical, has come up on this issue over the years. The theoretical contributions have highlighted the different services provided by the financial sector that can affect output and growth (Saint-Paul 1992; Diamond 1984; Bencivenga and Smith, 1991). These services include

- i. mobilizing and pooling savings from a large number of investors;
- ii. acquiring and processing information about possible investment projects;
- iii. monitoring ongoing investment projects;
- iv. diversifying investment risk;
- v. reducing intertemporal risk by providing liquidity; and
- vi. easing the exchange of goods and services by providing payment services.

The empirical literature, on the other hand, has focused mostly on the relationship between aggregate, country-level indicators of financial development and growth outcomes. Goldsmith (1969) systematically analyzed these issues using a cross-section of 35 countries. Not surprisingly, this early, pioneering study had a number of shortcomings (see Levine 1997), including

- (i) a small sample size due to the lack of adequate and comparable financial sector data for many countries;
- (ii) the lack of rigorous statistical testing of the impact of financial deepening on growth (the analysis neither controlled for other variables affecting growth nor tested for the direction of causality between financial deepening and growth); and
- (iii) the failure to recognize that the financial sector may affect the growth process not only through an increase in its size but also through a higher level of activity.

Another shortcoming of this study was that although it attempted to analyze the impact of financial structure (the relative size of the banking sector vis-à-vis the stock market) on growth rates, it failed to provide any robust result—again due to the paucity of data (Levine 2002). Following the development of the endogenous growth literature, a number of papers that addressed these shortcomings was published in the 1990s (King and Levine 1993a, 1993b, 1993c). However, the size of the sample still remained somewhat limited. Beck et al (2000) made a very important contribution to the literature by constructing a comparable

database of financial variables for various countries. This database provided information on different segments of the financial sector, including banks, non-bank financial intermediaries and stock markets.

The publication of this detailed cross-country database was followed by a number of influential papers using panel regression techniques. These papers again focussed on the issues covered by the earlier literature, i.e., the impact of financial deepening on growth rates and the impact of financial structure on the growth process. An important additional contribution of these papers was the recognition that financial services may affect the growth process through multiple channels, some of which depend on the size of these segments while others depend on the level of activity in them. Thus, in the context of stock markets, for example, these studies tested both market capitalization (size variable) and the rate of turnover (activity variable) as independent sources of growth. The results from a number of these studies gave strong support to a few propositions about the finance–growth relationship:

- i. financial deepening has a strong impact on the growth process (Beck and Levine 2000; Beck, Levine and Loayza 2000; Levine, Loayza and Beck 2000);
- ii. measures of financial “activity” play more significant roles in the growth process compared to measures of “size” of financial segments (Levine and Zervos 1998; Beck, Demirguc-Kunt, Levine and Maksimovic (2000); and Rousseau and Wachtel 2000); and
- iii. financial structure has no impact on the growth process, i.e., stock market-based financial systems and bank-based financial systems affect growth the same way (Beck, Demirguc-Kunt, Levine and Maksimovic 2000; and Levine 2002).

A number of other studies have since used cross-country and panel regression techniques to analyze these propositions. These include Calderon and Liu (2003), Christopoulos and Tsionas (2004), Rioja and Valev (2004), etc. Most studies have found a robust relationship between finance and growth, although some of them have questioned the impact on financial structure, stressing that either banks or stock markets have played a more significant role in the growth process of different economies (Luintel et al 2008 and Arestis et al 2010). Other studies have supported Gershenkron’s hypothesis that banks are more important in economies with less developed financial sectors while markets play a greater role in more developed economies (Rajan and Zingales 1999).

Most recent studies in the literature have adopted panel regression techniques to address the problems of unobserved country effects that affect pure cross-section regressions. However, several studies have shown that the panel-based studies may be suffering from

significant parameter heterogeneity (Luintel et al 2008; Arestis et al 2010). This means that the aggregate estimates based on a large number of countries may not represent the experience of an important subgroup of countries. Luintel et al (2008) showed that studying the impact of financial structure by pooling the time series data for developing countries gives misleading results. They demonstrated that the single country time series-based estimates for a large number of countries in their sample were (statistically) significantly different from the panel-based estimates. Extending this argument, all three propositions related to the finance–growth relationship may be questioned as they have been established using panel data from a group of heterogeneous countries—both developed and developing. In particular, one can be sceptical about their robustness and usefulness for a typical developing country. This suggests that an analysis of these issues based on developing-country experiences might provide additional insight.

Apart from parameter heterogeneity, there is another reason why these panel-based cross-country studies may not capture the “true” finance–growth relationship for many developing countries. It can be argued that the channels through which finance affects the growth process in the theoretical literature (see Allen and Gale 2000) are not effective in a financially repressed economy. Hence, the “true” finance–growth relationship is established only in those economies that have liberalized their financial sectors. Now, countries in the cross-country panels have liberalized their financial sectors at different times. However, the data used in the panel-based studies is for a common period, which implies that the panel includes significant periods of pre-liberalization data for many of these countries. This clearly biases the estimates of the finance–growth relationship as emphasized in the theoretical models. This again underlines the importance of analyzing individual developing countries as it allows the researcher to focus on the period following financial liberalization in the economy. In this context, a number of studies have found that time series analysis of individual developing countries provided useful insights into these issues (Luintel and Khan 1999; Masih and Khan 2011).

Mindful of the problems of the panel-based studies discussed above, we reexamine the nature of the finance–growth relationship for a developing economy by studying a single developing nation, i.e., India, following its adoption of financial liberalization. In particular, our objective is to test whether the three propositions established by the cross-country studies hold true for an important emerging economy like India. To capture the “true” relationship between finance and growth, we focus on the period following the adoption of significant financial sector reforms in the Indian economy. Banks have traditionally dominated the financial sector in this economy. However, following the financial sector reforms, stock markets have become more important. To capture this structural aspect of the financial sector, we have included variables from both segments of

the financial market. Following the approach discussed earlier, we have included both “size” and “activity” measures of financial development, to understand whether the policy needs to focus on increasing the size of the financial sector or on removing the impediments to higher activity. Moreover, we add to this literature by examining whether “size” and “activity” measures can be considered to be independent contributors to the growth process.

While a few recent studies (Chakraborty 2008; Pradhan 2009) have analyzed the finance–growth relationship in post-reform India, these are concerned only with the first proposition, i.e., whether financial deepening has a strong effect on growth. Thus, none of them studies the relative significance of banks and stock markets in this relationship. Nor do they differentiate between the size of the financial sector and the level of activity in this sector as alternative sources of growth. To address these issues, we have adopted the VECM framework (Johansen and Juselius 1990; Garret et al 2003) that allows both real and financial variables to be simultaneously determined.

The following sections discuss the variables and data used for the study and the VECM methodology (Section 2), presents the model and results (Section 3) and draws conclusions and discusses policy implications (Section 4).

## **2. DATA AND METHODOLOGY**

The first step in the empirical exercise is to identify the variables that will be used to estimate the finance–growth relationship. The aggregate GDP per capita is the standard measure of real output used in the cross-country studies of financial development. In this paper, however, we use the constant price index of industrial production (IIP)—used earlier by Gupta (1984) to study the same issue—as a proxy for real output because (i) the availability of IIP at the monthly frequency gives a larger sample size for the given period of analysis and (ii) since this measure does not include output from the financial sector, we are able to capture the impact of finance on the non-financial sector.

Since IIP is an index, we choose not to convert it to per capita terms, since it would not be economically meaningful as a variable. It may also be noted that the primary reason for using output in per capita terms in cross-country studies is to ensure comparability of output between countries with different population sizes. Since this is not relevant in a study based on a single country, it is not necessary to normalize output with population in such cases.

The banking sector and the stock market are the most significant parts of the Indian financial sector. Thus, our study includes variables for both these segments. Moreover, as

we have discussed earlier, we distinguish between measures of the size of a financial sector and measures of the level of activity in the same sector. Thus, there are four financial sector variables in our analysis.

- i. The size-variable for the banking sector is the value of outstanding assets of the banking sector vis-à-vis the non-banking sector. This includes bank credit as well as other investments of the banking sector.
- ii. Since the principal activity of commercial banks is to provide credit to the non-banking sector, the activity variable for the banking sector is bank credit.
- iii. The size-variable for stock markets is market capitalization at the Bombay Stock Exchange.
- iv. The activity variable for stock markets is the total monthly value traded at the Bombay Stock Exchange.

These variables are almost identical to those used in the cross-country studies, although we do not normalize them by output, which is the standard practice in those studies. Since output data are not available at the monthly frequency, we choose to use the above variables—and not their ratio to output—as appropriate proxies for financial development. Cross-country studies normalize financial variables by output to compare between financial sectors of countries with different levels of output. This study has not done so since this is not relevant for a single country. To convert the nominal values of the financial variables to their real values, these variables are each normalized by the monthly Wholesale Price Index (WPI). The data for the IIP, the two banking sector variables and the WPI are taken from the Handbook of Statistics of the Indian Economy published by the Reserve Bank of India. The data for the stock market variables are taken from the Handbook of Statistics of the Indian Securities Market published by the Securities and Exchange Board of India. Since the current study focuses on the period following the financial sector reforms, most of which were undertaken in the early 1990s, we use monthly data from April 1994 to March 2008, giving a sample size of 168.

The next step is to de-seasonalize the monthly data. We use the X-12 techniques pioneered by the US Federal Bureau of Census to seasonally adjust all the variables. Since the VECM model (in the next section) is estimated using the logarithms of the variables, we convert the (de-seasonalized) data to their natural logarithm. Thus, the output variable used for the VECM analysis is the log of the real index of industrial production (LIIP), while the alternative measures of financial development are the log of real banking sector assets (LBA), the log of bank credit (LBC), the log of stock market capitalization (LMC) and the log of value traded at the stock market (LVT).

In the VECM approach, the model captures the long-run as well as the short-run relationships between the variables. The long-run equilibrium relationship between the variables is represented by a cointegrating vector that in the present study captures the long-run relationship between real output and a financial sector variable. The VECM framework also includes estimates of the short-run effect of finance on output, which may be interpreted as wealth effects. Of course, given that the framework treats both real and financial variables endogenously, any reverse impact from the real to the financial sectors (both short-run and long-run) will be captured as well.

The VECM methodology requires that all variables be integrated of the same order. To find out the order of integration of the variables, we have put them to two different types of unit root tests, i.e. the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. From these test results, we find that all the variables are nonstationary at levels and stationary at first-differences. From this we conclude that all the variables can be treated as I(1) variables. The test results for the levels and first-differences for the variables are given in the Appendix.

Since all the variables are integrated of order one, we can test whether each of the four financial variables has a long-run cointegrating relationship with output and can be represented by a VECM. To construct the VECM, we need to determine the optimum number of lags to include in the model. In our study, the optimum lag length is determined by using the Akaike Information Criteria (the AIC), the Schwartz Information Criteria (SIC) and Likelihood Ratio Tests. After the order of the VAR is determined, we test whether there are any long-run relationships between the variables. Technically, this implies determining the number of cointegrating vectors in the system consisting of a financial variable and output. We use Johansen's Maximum Likelihood Approach to test for cointegration between the variables. As is well known in the literature, these tests are very sensitive to the assumptions made about the deterministic components (i.e., the intercept and the trend) of the model. It is usual to distinguish between five cases, namely:

- (i) no intercepts and no trends;
- (ii) restricted intercepts and no trends;
- (iii) unrestricted intercepts and no trends;
- (iv) unrestricted intercepts and restricted trends; and
- (v) unrestricted intercepts and unrestricted trends.

The five cases are nested so that case (i) is contained in case (ii) which is contained in case (iii) and so on. To choose from one of these cases, Hansen and Juselius (1995) suggest

a method called the “Pantula principle” for simultaneously determining rank and deterministic components of the system. This principle involves a number of steps. First, using the trace test, we test the null hypothesis of zero cointegrating vectors for case (i) (i.e., the most restricted model). If that hypothesis is rejected, the same hypothesis is considered for case (ii) and so on. If the hypothesis is rejected for the most unrestricted model considered (case (v)), the procedure continues by testing the null hypothesis of at most one cointegrating vector for the most restricted model considered (case (i)). If this hypothesis is rejected, the same hypothesis is tested for case (ii) and so on. The process stops when the hypothesis is not rejected for the first time.

In a recent study, however, Hjelm and Johansson (2005) has shown that the Pantula principle suffers from a major drawback, i.e., it is heavily biased towards choosing case (iii) when the correct data generating process is given by case (iv). They have instead proposed a modification, which they call the “modified Pantula principle”, which improves the probability of choosing the correct model significantly. According to them, firstly, cases that are not compatible with economic theory or the data set are to be excluded (this usually excludes case (i)). Next, the “Pantula principle” is followed and if this chooses cases (ii), (iv) or (v), then accept the result. If the “Pantula principle” chooses case (iii), test for the presence of a linear trend in the cointegrating space. If the null of no trend is rejected, choose case (iv), otherwise choose case (iii). Using this “modified Pantula principle”, we attempt to estimate four VECM models corresponding to each of the four financial sector variables.

Apart from the long-run relationship, the VECM model also indicates long-run causality in terms of the “error correction coefficient”. If the error correction coefficient for a particular variable in the VECM has the right sign and is statistically significant, it indicates that the variable is “long-run Granger-caused” by the other variables in the cointegrating vector. In the present study, we look for evidence that the financial variables Granger-cause output.

### **3. VECM MODELS AND RESULTS**

In the first part of this section, we estimate the relationship between individual measures of financial development and output. In the second part, we estimate relationships that include both size and activity variables of the financial sector, as well as output.

#### **3.1 Individual measures of financial development and their relationship with output**

The measures of financial development used here are bank assets, bank credit, stock market capitalization and stock market turnover. The first two are size and activity variables for the banking sector while the last two are corresponding measures for the stock markets.

### 3.1.1 Bank Assets and Output

Using the “modified Pantula principle”, we find that unrestricted intercepts and restricted trends is the most appropriate assumption about the deterministic components for our analysis. Table 1a gives results of the likelihood ratio tests for the number of cointegrating vectors, based on the maximum eigenvalue and the trace of the stochastic matrix respectively. Under the assumption of unrestricted intercepts and restricted trends, both these tests confirm the existence of one cointegrating vector between the variables, i.e., the existence of a unique long-run relationship between them. To identify this long-run relationship, we normalize the cointegrating vector on the output variable LIIP. Table 1b gives the long-run coefficients and the standard errors of the estimates. The coefficient for bank assets has the right sign, indicating a positive long-run relationship between the variables. Since the two variables are cointegrated, they can be represented equivalently in terms of an error correction framework. Table 1c gives the estimated coefficients of the variables in each of the two error correction equations. The last row of the table shows the error correction coefficient that captures the (one period lagged) adjustment of each variable to any disequilibrium in the long-run cointegrating relationship. We find that both output and bank assets have statistically significant error correction coefficients with the correct sign. This implies that there is bi-directional causality between the two variables. The short-run impact multiplier of the financial variable on output is significant, but has a negative sign. This result is somewhat counterintuitive, but could be because an increase in bank assets is associated with an increase in financial savings in the form of bank deposits (i.e., bank liabilities determine bank assets), which has a negative impact on consumption demand and hence on output. As far as the short-run impact of output on bank assets is concerned, the coefficient is not found to be statistically significant.

**Table 1a:** Testing for Cointegration between Output and Bank Assets

Null Hypothesis	Alternative Hypothesis	Test Statistic	95% Critical Value
Maximal Eigenvalue Test			
$r = 0$	$r = 1$	23.51	19.22
$r \leq 1$	$r = 2$	5.97	12.39
Trace Test			
$r = 0$	$r \geq 1$	29.48	25.77
$r \leq 1$	$r \geq 2$	5.97	12.39

Notes: Cointegration with unrestricted intercepts and restricted trends in the VAR.

**Table 1b:** The Cointegrating Vector for Output and Bank Assets

	<b>LIIP</b>	<b>LBA</b>	<b>TREND</b>
Cointegrating Vector	1.00	-1.80	0.01
Standard Error	(None)	(0.88)	(0.009)

Notes: The normalizing of the CV with respect to LIIP provides the one exactly identifying restriction.

**Table 1c:** Estimated VECM for Output and Bank Assets

<b>Regressor</b>	<b><math>\Delta</math>LIIP</b>	<b><math>\Delta</math>LBA</b>
Intercept	-0.40 (-3.61)***	0.31 (2.95)***
$\Delta$ LIIP(-1)	-0.52 (-8.10)***	-0.03 (-0.46)
$\Delta$ LBA(-1)	-0.16 (-1.99)**	-0.14 (-1.84)*
EC(-1)	-0.04 (-3.71)***	0.03 (2.84)***

Notes: The error correction term (EC) = 1\*LIIP – 1.80\*LBA +0.01\*TREND

Figures in brackets next to the coefficients are T-statistics.

\* Significance at 1% level. \*\* Significance at 5% level. \*\*\* Significance at 10% level.

### 3.1.2 Bank Credit and Output

The “modified Pantula principle” determines that in the case of bank credit, unrestricted intercepts and no trends is the most appropriate assumption about the deterministic components. Table 2a gives results of the likelihood ratio tests for the number of cointegrating vectors. Assuming unrestricted intercepts and no trends, both the tests confirm the existence of a unique long-run relationship between them. To identify this long-run relationship, we normalize the cointegrating vector on the output variable LIIP. Table 2b gives the long-run coefficients and the standard errors of the estimates. The coefficient for bank credit indicates a positive long-run relationship with output.

The cointegrating vector is next used to estimate the error correction model. Table 2c gives the estimated coefficients of the variables in each of the two error correction equations. The last row of the table shows the error correction coefficient that captures the (one period lagged) adjustment of each variable to any disequilibrium in the long-run cointegrating relationship. We find that output is the only variable that has a statistically significant error correction coefficient with the correct sign. This implies that bank credit is weakly exogenous and hence, causality runs from bank credit to output in the long run. The short-run impact multiplier of bank credit on output and of output on bank credit are both statistically insignificant.

**Table 2a:** Testing for Cointegration between Output and Bank Credit

Null Hypothesis	Alternative Hypothesis	Test Statistic	95% Critical Value
Maximal Eigenvalue Test			
$r = 0$	$r = 1$	25.95	14.88
$r \leq 1$	$r = 2$	7.48	8.07
Trace Test			
$r = 0$	$r \geq 1$	33.43	17.86
$r \leq 1$	$r \geq 2$	7.48	8.07

Notes: Cointegration with unrestricted intercepts and no trends in the VAR.

**Table 2b:** The Cointegrating Vector for Output and Bank Credit

	LIIIP	LBC
Cointegrating Vector	1.00	-0.47
Standard Error	(None)	(0.01)

Notes: The Cnormalizing of the CV with respect to LIIIP provides the one exactly identifying restriction.

**Table 2c:** Estimated VECM for Output and Bank Credit

Regressor	$\Delta$ LIIIP	$\Delta$ LBC
Intercept	0.23 (5.45)***	0.05 (1.01)
$\Delta$ LIIIP(-1)	-0.48 (-7.64)***	0.02 (0.24)
$\Delta$ LBA(-1)	-0.10 (-1.58)	-0.14 (-1.76)*
EC(-1)	-0.16 (-5.22)***	-0.03 (-0.74)

Notes: The error correction term (EC) =  $1 * \text{LIIIP} - 0.47 * \text{LBC}$

Figures in brackets next to the coefficients are T-statistics.

\* Significance at 1% level. \*\* Significance at 5% level. \*\*\* Significance at 10% level.

### 3.1.3 Stock Market Capitalization and Output

In the case of stock market capitalization, unrestricted intercepts and restricted trends is the most appropriate assumption about the deterministic components. Table 3a gives the results

of the likelihood ratio tests for the number of cointegrating vectors. Under the assumption of unrestricted intercepts and restricted trends, both the maximal eigenvalue and the trace tests confirm the existence of a unique long-run relationship between them. We identify this long-run relationship by normalizing the cointegrating vector with the output variable LIIP. Table 3b gives the long-run coefficients and the standard errors of the estimates. The coefficient for stock market capitalization indicates a positive long-run relationship with output.

Next, the error correction model is estimated. Table 3c gives the estimated coefficients of the variables in each of the two error correction equations. We find that output is the only variable that has a statistically significant error correction coefficient with the correct sign. This implies that stock market capitalization is weakly exogenous and hence, in the long run, causality runs from finance to output. The short-run impact multiplier of stock market capitalization on output and of output on stock market capitalization is both statistically insignificant.

**Table 3a:** Testing for Cointegration between Output and Stock Market Capitalization

<b>Null Hypothesis</b>	<b>Alternative Hypothesis</b>	<b>Test Statistic</b>	<b>95% Critical Value</b>
<b>Maximal Eigenvalue Test</b>			
$r = 0$	$r = 1$	27.79	19.22
$r \leq 1$	$r = 2$	3.77	12.39
<b>Trace Test</b>			
$r = 0$	$r \geq 1$	31.56	25.77
$r \leq 1$	$r \geq 2$	3.77	12.39

Notes: Cointegration with unrestricted intercepts and restricted trends in the VAR.

**Table 3b:** The Cointegrating Vector for Output and Stock Market Capitalization

	<b>LIIP</b>	<b>LMC</b>	<b>TREND</b>
Cointegrating Vector	1.0000	-0.10	-0.004
Standard Error	(None)	(0.01)	(0.0002)

Notes: The normalizing of the CV with respect to LIIP provides the one exactly identifying restriction.

**Table 3c:** Estimated VECM for Output and Stock Market Capitalization

<b>Regressor</b>	<b><math>\Delta</math>LIIP</b>	<b><math>\Delta</math>LMC</b>
Intercept	0.81 (5.46)***	-0.16 (-0.18)
$\Delta$ LIIP(-1)	-0.47 (-7.59)***	-0.39 (-1.04)
$\Delta$ LBA(-1)	0.01 (0.47)	0.04 (0.54)
EC(-1)	-0.20 (-5.40)***	0.04 (0.19)

Notes: The error correction term (EC) =  $1 * \Delta$ LIIP –  $0.1 * \Delta$ LMC –  $0.004 * \text{TREND}$

Figures in brackets next to the coefficients are T-statistics.

\* Significance at 1% level. \*\* Significance at 5% level. \*\*\* Significance at 10% level.

### **3.1.4 Stock Market Turnover and Output**

In the case of stock market turnover or value traded, the most appropriate assumption about the deterministic components is unrestricted intercepts and no trends.

**Table 4:** Testing or Cointegration between Output and Value Traded at Stock Market

<b>Null Hypothesis</b>	<b>Alternative Hypothesis</b>	<b>Test Statistic</b>	<b>95% Critical Value</b>
<b>Maximal Eigenvalue Test</b>			
$r = 0$	$r = 1$	8.82	14.88
$r \leq 1$	$r = 2$	0.03	8.07
<b>Trace Test</b>			
$r = 0$	$r \geq 1$	8.85	17.86
$r \leq 1$	$r \geq 2$	0.03	8.07

Notes: Cointegration with unrestricted intercepts and no trends in the VAR.

Table 4 gives the results of the likelihood ratio tests for the number of cointegrating vectors. Under the assumption of unrestricted intercepts and no trends, neither the maximal eigenvalue test nor the trace test could confirm the existence of a long-run relationship between the two variables. Thus, stock market value traded—the activity variable from the stock market—does not seem to have any long-run impact on output.

### **3.2 Do “size” and “activity” have independent roles?**

In the empirical results presented above, we have estimated the individual impact of “size” and “activity” variables (from both the banking sector and the stock markets) on long-run output. Such estimations can capture the net impact of the “size” and “activity” variables, provided they are independent of each other. It can be argued, however, that these two aspects of the financial sector are not independent, since a larger “size” of the sector can sometimes lead to higher “activity”. Thus, it is important to estimate their impact on output, independently of each other. To do this, we have estimated VECMs that include both size and activity variables as well as output. This would enable us to estimate the long-run impact of each of these variables on output, after controlling for the other variable.

#### ***3.2.1 Bank Assets, Bank Credit and Output***

Using the “modified Pantula principle”, we find that unrestricted intercepts and no trends is the most appropriate assumption about the deterministic components. Table 5a gives results of the likelihood ratio tests for the number of cointegrating vectors, based on the maximum eigenvalue and the trace of the stochastic matrix respectively. Under the assumption of unrestricted intercepts and no trends, both these tests confirm the existence of a unique long-run relationship between them. Normalizing the cointegrating vector with respect to output identifies the long-run relationship. Table 5b gives the long-run coefficients and the standard errors of the estimates. The coefficients for bank assets and bank credit have the right signs, indicating a positive long-run relationship between the variables and output. However, compared to the coefficient for bank assets in the bivariate exercise (which is 1.8), the coefficient for bank assets in this case is significantly smaller. The coefficient of bank credit is, on the other hand, comparable to that in Table 2b. This indicates that most of the impact of bank assets on output works through an increase in bank credit. This result clearly shows that for the banking sector, it is the level of activity that is sustaining the growth process rather than the size of the sector. Table 5c gives the estimated coefficients of the variables in each of the three error correction equations. The last row of the table shows the error correction coefficient. We find that only output has a statistically significant error correction coefficient with the correct sign. This implies that there is unidirectional causality from financial deepening to growth. The short-run impact multiplier of the financial variables on output and the short-run impact of output on the financial variables are all statistically insignificant.

**Table 5a:** Testing for Cointegration between Output, Bank Assets and Bank Credit

Null Hypothesis	Alternative Hypothesis	Test Statistic	95% Critical Value
<b>Maximal Eigenvalue Test</b>			
$r = 0$	$r = 1$	35.57	21.12
$r \leq 1$	$r = 2$	8.67	14.88
$r \leq 2$	$r = 3$	0.18	8.07
<b>Trace Test</b>			
$r = 0$	$r \geq 1$	44.42	31.54
$r \leq 1$	$r \geq 2$	8.85	17.86
$r \leq 2$	$r = 3$	0.18	8.07

Notes: Cointegration with unrestricted intercepts and no trends in the VAR.

**Table 5b:** The Cointegrating Vector for Output, Bank Assets and Bank Credit

	<b>LIIP</b>	<b>LBA</b>	<b>LBC</b>
Cointegrating Vector	1.0000	-0.12	-0.36
Standard Error	(None)	(0.07)	(0.06)

Notes: The normalizing of the CV with respect to LIIP provides the one exactly identifying restriction.

**Table 5c:** Estimated VECM for Output, Bank Assets and Bank Credit

<b>Regressor</b>	$\Delta$ LIIP	$\Delta$ LBA	$\Delta$ LBC
Intercept	0.20 (5.18)***	-0.05 (-1.28)	0.04 (0.81)
$\Delta$ LIIP(-1)	-0.47 (-7.55)***	-0.05 (-0.79)	0.02 (0.31)
$\Delta$ LBA(-1)	-0.20 (-1.51)	-0.22 (-1.70)*	-0.26 (-1.63)
EC(-1)	0.02 (0.21)	0.08 (0.77)	0.02 (0.19)
	-0.16 (-4.92)***	0.05 (1.58)	-0.02 (-0.51)

Notes: The error correction term (EC) =  $1 * \text{LIIP} - 0.12 * \text{LBA} - 0.36 * \text{LBC}$

Figures in brackets next to the coefficients are T-statistics.

\* Significance at 1% level. \*\* Significance at 5% level. \*\*\* Significance at 10% level.

### 3.2.2 Stock Market Capitalization, Stock Market Turnover and Output

The “modified Pantula principle” indicates that unrestricted intercepts and restricted trends is the most appropriate assumption about the deterministic components. Table 6a gives the results of the likelihood ratio tests for the number of cointegrating vectors. Under the assumption of unrestricted intercepts and restricted trends, both maximal eigenvalue and trace tests confirm the existence of a unique long-run relationship between three variables. Normalizing the cointegrating vector with respect to output identifies the long-run relationship. Table 6b gives the long-run coefficients and the standard errors of the estimates. The coefficient for stock market capitalization has the right sign, indicating a positive long-run relationship between this variable and output. Moreover, the coefficient is comparable to that in Table 3b. This implies that the impact of stock market capitalization on output is independent of the volume of value traded. The coefficient of Stock Market Value Traded is very small and has the wrong sign. Moreover, the standard error seems to indicate that the coefficient could be statistically insignificant. These results show that for the stock market, it is the size of the sector that is sustaining the growth process rather than the level of activity. Table 6c gives the estimated coefficients of the variables in each of the three error correction equations. We find that only output has a statistically significant error correction coefficient with the correct sign. This implies that there is unidirectional causality from financial deepening to growth. The short-run impact multipliers affecting output and stock market capitalization are all statistically insignificant. However, the short-run impact of output and stock market capitalization on Stock Market Value Traded are statistically significant.

**Table 6a:** Testing for Cointegration between Output, Stock Market Cap and Value Traded

Null Hypothesis	Alternative Hypothesis	Test Statistic	95% Critical Value
Maximal Eigenvalue Test			
$r = 0$	$r = 1$	28.24	25.42
$r \leq 1$	$r = 2$	11.95	19.22
$r \leq 2$	$r = 3$	7.00	12.39
Trace Test			
$r = 0$	$r \geq 1$	47.19	42.34
$r \leq 1$	$r \geq 2$	18.95	25.77
$r \leq 2$	$r = 3$	7.00	12.39

Notes: Cointegration with unrestricted intercepts and restricted trends in the VAR.

**Table 6b:** The Cointegrating Vector for Output, Stock Market Cap and Value Traded

	<b>LIIP</b>	<b>LMC</b>	<b>LVT</b>	<b>TREND</b>
Cointegrating Vector	1.00	-0.10	0.005	-0.004
Standard Error	(None)	(0.01)	(0.01)	(0.0002)

Notes: The normalizing of the CV with respect to LIIP provides the one exactly identifying restriction.

**Table 6c:** Estimated VECM for Output, Stock Market Cap and Value Traded

<b>Regressor</b>	$\Delta$ <b>LIIP</b>	$\Delta$ <b>LMC</b>	$\Delta$ <b>LVT</b>
Intercept	0.81 (5.50)***	0.21 (0.23)	-1.31 (-0.45)
$\Delta$ LIIP(-1)	-0.48 (-7.59)***	-0.35 (-0.94)	-3.17 (-2.55)**
$\Delta$ LMC(-1)	0.003 (0.23)	0.05 (0.57)	1.27 (4.34)***
$\Delta$ LVT(-1)	0.001 (0.37)	-0.01 (-0.43)	-0.34 (-4.40)***
EC(-1)	-0.20 (-5.44)***	-0.05 (-0.21)	0.34 (0.45)

Notes: The error correction term (EC) =  $1*LIIP - 0.1*LMC + 0.005*LVT - 0.004*TREND$

Figures in brackets next to the coefficients are T-statistics.

\* Significance at 1% level. \*\* Significance at 5% level. \*\*\* Significance at 10% level.

#### 4. CONCLUDING REMARKS

The cross-country empirical literature on the finance–growth relationship has debated three propositions: (i) financial deepening has a strong impact on the growth process; (ii) measures of financial “activity” rather than the “size” of the sector plays a more significant role in the growth process; and (iii) financial structure (bank-based versus stock market-based) has no impact on the growth process at all. The present study—focussing on one of the major emerging economies, i.e., India, following the adoption of significant financial sector reforms—attempts to reexamine the validity of these widely accepted propositions for a developing economy. The research strategy involves the estimation and analysis of a VECM of real and financial sector variables.

The first proposition that this study reexamines pertains to the existence of a causal relationship from financial deepening to the growth of real output. We find that financial deepening has a long-run impact on growth. In the banking sector, both the size and activity variables contribute independently to growth, while in the stock market it is the size that contributes to the growth process. The existence of a cointegrating relationship between the

financial sector variables and real output implies that there is an equilibrium relationship between them. This implies that an adverse shock in the financial sectors not only brings down output in the short-run but also diminishes productive capacity in the long run. Thus, even if the economy recovers its long-run growth rate after the shock dissipates, it will not move along its original trend-path but on a lower one. The results also indicate that the finance-growth relationship is not based on any reverse causality from growth to financial deepening. The only financial sector variable that is found to be Granger-caused by real output is the size of the banking sector. However, this result is not very robust since the inclusion of the activity variable for this sector changes the result to Granger non-causality. Thus, real output is the equilibrating or adjusting variable and hence “causality” is unidirectional, from financial intermediation to real output.

The second proposition that we examine relates to the role of the size of the financial sector vis-à-vis the level of activity in the sector. Here, we find that the evidence is mixed. Thus, the activity level seems to be much more significant for the banking sector but for the stock markets, it is only the size of the sector that is significant.

The third proposition compares the relative contribution of banks and stock markets. We find that the long-run coefficients of banking sector variables in the cointegrating relationships are significantly higher than those for the stock market. This indicates that even though stock markets have become important after financial reforms, banks continue to play a dominant role in facilitating the growth process.

The results described in the above sections indicate that the widely accepted propositions of the finance-growth relationship may not all be as robust as they are believed to be, particularly for a developing economy. The strong relationship between financial deepening and growth is confirmed by the results. However, there is no strong evidence that the activity levels of financial sectors are better sources of growth than their size. On the other hand, the evidence indicates that stock markets are yet to reach the level of maturity where their contribution to growth rates is comparable to those of the banking sector. Thus, it is a transition period for the Indian financial sector during which financial structure would have an impact on the growth rates.

There are a number of policy lessons that follow from these conclusions. Firstly, stabilization policies—boosting demand by fiscal or monetary measures—are not sufficient to deal with recessions resulting from shocks in financial markets. Since financial shocks have a long-run impact on output, policies will have to directly intervene in the process through which financial intermediation takes place to ensure that the shocks are minimized. Such policies would have to bring down the cost of financial intermediation, enabling

banks and financial markets to increase their capacity for supplying more finance to the real sector. Secondly, policies that are adopted to boost the growth process have to pay sufficient attention to the development of financial markets in order to sustain a high rate of growth. Since financial intermediation causes or leads to real output but there is no reverse causality, there is no scope for a virtuous cycle of cumulative causation between these two sectors. Thus, growth in output will be constrained by the financial sector, and hence growth policies will have to focus on the development of this sector. Finally, the relatively smaller long-run coefficients associated with the stock markets indicate structural weaknesses in this sector. This is doubly reinforced by the lack of any impact of the activity variable in this sector (i.e., stock market liquidity) on growth. This implies that the economy is not being able to achieve its potential growth rate due to the weakness in this sector. This clearly underlines the need for structural reforms in the stock markets so that they become more efficient and play a complementary role to the banking sector.

## Appendix

### Results of unit root tests

<b>LIIP</b>	<b>Level</b>		<b>ADF</b>	<b>PP</b>
		Test statistics	-1.62	-2.34
		Critical value	-3.44	-3.44
	First difference	Probability	0.78	0.41
		Test statistics	-22.7	-22.9
		Critical value	-2.88	-2.88
LBA	Level	Probability	0.00	0.00
		Test statistics	-2.62	-2.53
		Critical value	-3.44	-3.44
	First difference	Probability	0.27	0.31
		Test statistics	-14.71	-14.88
		Critical value	-2.88	-2.88
LBC	Level	Probability	0.00	0.00
		Test statistics	-0.34	-0.21
		Critical value	-3.44	-3.44
	First difference	Probability	0.99	0.99
		Test statistics	-3.04	-14.42
		Critical value	-2.88	-2.88
LMC	Level	Probability	0.03	0.00
		Test statistics	-0.68	-0.7
		Critical value	-3.44	-3.44
	First difference	Probability	0.97	0.97
		Test statistics	-12.25	-12.28
		Critical value	-2.87	-2.88
LVT	Level	Probability	0.00	0.00
		Test statistics	-2.48	-2.69
		Critical value	-3.44	-3.44
	First difference	Probability	0.34	0.24
		Test statistics	-7.19	-16.63
		Critical value	-2.88	-2.88
		Probability	0.00	0.00

ADF: Augmented Dickey-Fuller; PP: Phillips-Perron; Test critical values at 5% level of significance.

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