Examining the Relationship between Bank Credit and Economic Growth: The Case of India

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Abstract: Bank credit forms a critical part of the finance-growth nexus and understanding how it affects economic growth can have deep ramifications in policy making pertaining to financial liberalization. While bank credit and economic growth have been shown to be closely related, whether credit expansion induces economic growth or is a result of it is disputed in literature, with several studies suggesting that this relationship is country specific. Existing studies of the finance-growth relationship in India show mixed results, and most use annual data which overlooks the possibility of causality on a short time scale. Those that consider more frequent observations use small time intervals (<10 years), which reduces the power of statistical tools used. To account for these shortcomings, this paper uses quarterly data from 1997Q1 – 2014Q2 from the Reserve Bank of India's database on the Indian Economy for measures of bank credit sector size and development. A Vector Autoregressive model-based approach using the Johansen Cointegration test and Granger Causality test is used to assess the long-term and short-term relationship between bank credit and GDP. The study finds that there exists no long-run equilibrium between outstanding bank credit and GDP or financial sector depth (as measured by the ratio of bank credit to GDP) and GDP. Causality analysis found evidence of bidirectional short-run causality running betweeneconomic growth to bank credit and unidirectional causality running from Economic growth to financial sector depth.

Keywords: Economic growth, bank credit, financial development

JEL Classification Codes: C10, E51, G21

1. Introduction

The relationship between the growth and development of the financial sector and economic growth is a source of great disagreement. While most existing literature agrees on the empirical and theoretical existence of a positive relationship between indicators of financial development and economic growth, the direction of causality is widely disputed.

Numerous studies have applied a variety of econometric tools to investigate this relationship. The results have been mixed, indicating causality running in either direction, as well as bidirectional causality in some cases. Most notably, several studies have suggested that this relationship varies by region and circumstances, with variables such as the institutional structure of

the financial system, the policy regime and the degree of effective governance playing an important role in governing this relationship (Arestis&Demetriades, 1997).

This empirical relationship has been explored in the context of India in previous papers, however results have been mixed. Most papers consider annual values of financial development or bank credit and economic growth. Those that use quarterly values use a small sample series (<10 years), which reduces the power of econometric methods used. This study aims to mitigate these problems by using a suitable sample size while ensuring that the possibility that economic growth is realized in bank credit or vice versa within a short period is not lost.

The extensive body of literature focused on the relationship between the financial sector and economic growth is not sourced simply from interest amongst researchers, and rather is due to the potent implications of understanding the nexus. It is important to understand the relationship between banking credit and economic growth because it can be very useful in informing economic policy. A situation in which bank credit leads GDP growth could suggest that growth-inducing policies should focus on financial liberalization, whereas oppositely directed causality would suggest that other growth-enhancing policies should be considered (Caldéron& Liu, 2002).

The paper will be structured as follows: Section 2 will provide an overview of literature examining the relationship between financial development and economic growth, including documentation of such a relationship in India. Section 3will provide a brief outlook on bank credit, financial depth and GDP in India. Section 4will detail the variables and econometric methods used in this study. Section 5 will present the results of the analysis, and Section 6 will briefly present a conclusion and policy implications of this study.

2. Review of Economic Theory and Empirical Findings

The theoretical foundations of the relationship between economic growth and the financial sector are still widely disputed. Patrick (1966) distinguishes between the "demand-following" view, where financial institutions and services are created in advance of the demand for them, and the "supply-leading" view, in which the growth of the financial sector stimulates real economic growth. The "supply-leading" view is largely based on Schumpeter (1934), which posits that Financial services aid in the mobilization of savings, diversification of risk, and facilitating transactions, thus acting as stimulators of economic growth. Schumpeter further argued that bank credit serves as money-capital, which allows the realization of the innovation of entrepreneurs in economic growth. King and Levine (1993), in accordance with Schumpeter (1934), argue that the development of financial services stimulates economic growth by increasing the rate of capital accumulation and allocating capital efficiently. The opposing "demand-following" view is reflected in the works

of Harrod-Domar and Robert Solow, who greatly diminished the importance of the financial sector in stimulating economic growth. As described in Rajan and Zingales (2001), neoclassical economists at best held the view that when opportunities arise in an economy that require financing, the economy will develop the necessary markets and institutions to finance these opportunities, i.e. as Robinson (1952) states, "where enterprise leads, finance follows".

Following from these works, various empirical studies have been published that test these theories. The rest of this section documents prominent findings.

Jung (1986) studied the causal relationship between financial development and economic growth for 56 countries using Granger Causality tests. Using this approach, Jung was able to distinguish between a supply-leading causality pattern being dominant in less developed countries, and causality running in the opposite direction in developed countries.Later, Caldéron& Liu (2002) employs a Geweke decomposition approach on pooled data of 109 industrial and developing countries from 1960 to 1994. Their analysis suggested that Financial development leads economic growth. They were further able to identify bidirectional granger causality running between financial development and economic growth. In accordance with Jung (1986), the paper also documents evidence that the supply-leading view largely holds true for developing countries.More recently, Hassan et. al (2010) through a short-term multivariate analysis finds bi-directional causality in most countries in their sample, and unidirectional causality running from finance to growth in the 2 poorest countries in the sample.

These are some of the most notable empirical papers that observe generalized patterns in the growth-finance nexus. However, there are several others that observe varying results across countries. Arestis&Demetriades (1997) use time series estimations and observe varying results across countries even when the same variables and estimation methods are used. Di Gregorio &Guidotti (1995) demonstrates a similar result, asserting that there is significant variation in the direction of causality across countries.

Various studies examining this relationship in India also exist. Bell & Rousseau (2001) study the growth-finance nexus in India using a VAR (Vector Autoregressive) and VECM (Vector Error Correction Model) based approach. They find that the financial sector in pre-industrialized India played a critical role in inducing growth and facilitating industrialisation, which aligns with the broader findings of Caldéron & Liu (2002) and Jung (1986) that have been previously mentioned. Demetriades & Luintel (1996) applies an unrestricted ECM approach to find bi-directional causality running between economic growth and financial development in India. In support of this, Pradhan (2009) also finds bi-directional causality running between bank credit and economic growth.

However, not all results are consistent with the findings of Pradhan (2009) and Demetriades&Luintel (1996). Different financial indicators and time

samples yield different results. Pradhan et. al (2009) uses a VAR framework to find evidence of unidirectional causality running from economic growth to credit market development. Chakraborty (2010) finds a stable long-run relationship between bank credit and economic growth, as well as unidirectional causality running from economic growth to financial development. More recently, Singh et. al (2016) finds that the long-run cointegrated relationship between financial sector development and economic growth (on an annual basis)breaks down after 1992. Using a VAR framework, the paper also finds short-term causality running from economic growth to financial sector development.
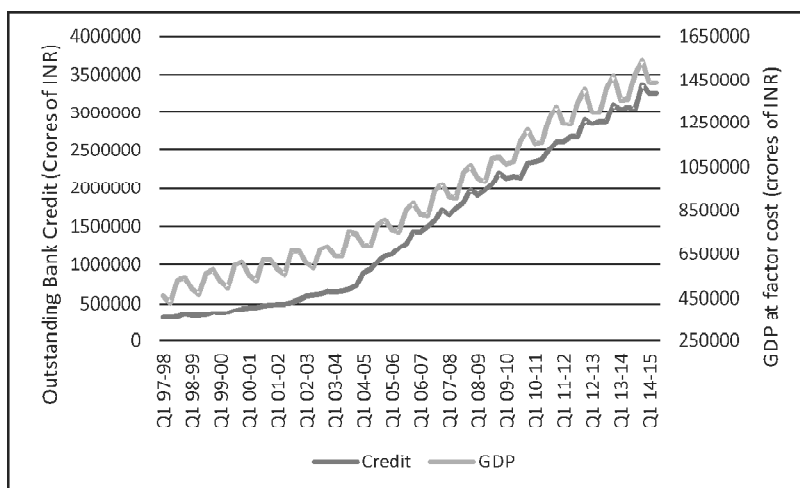
3. Bank Credit, Financial Depth & GDP in India

Figure 1: Real Bank Credit and Real GDP (at factor cost) in India from 1997Q1 to 2014Q2

Figure 1 demonstrates values of GDP at factor cost and bank credit adjusted for inflation over the time period of this study. The GDP axis has been rescaled to allow better visualization of the relationship between the variables. At a surface level, Figure 1 suggests that GDP and credit exhibit some degree of parallel movement, although the direction of causality cannot be ascertained visually.

Figure 2 demonstrates the relationship between the base-10 logarithms of real credit and real GDP, which will be considered further in the study.

Figure 3 indicates an increasing trend for financial depth (the ratio of bank credit to GDP). Comparing the scales on figure 1, it becomes evident that real credit has been expanding much faster than national income. The financialization of savings and the privatisation of the banking sector that began in the 90s are likely driving forces behind the rapid expansion of bank credit relative to GDP.
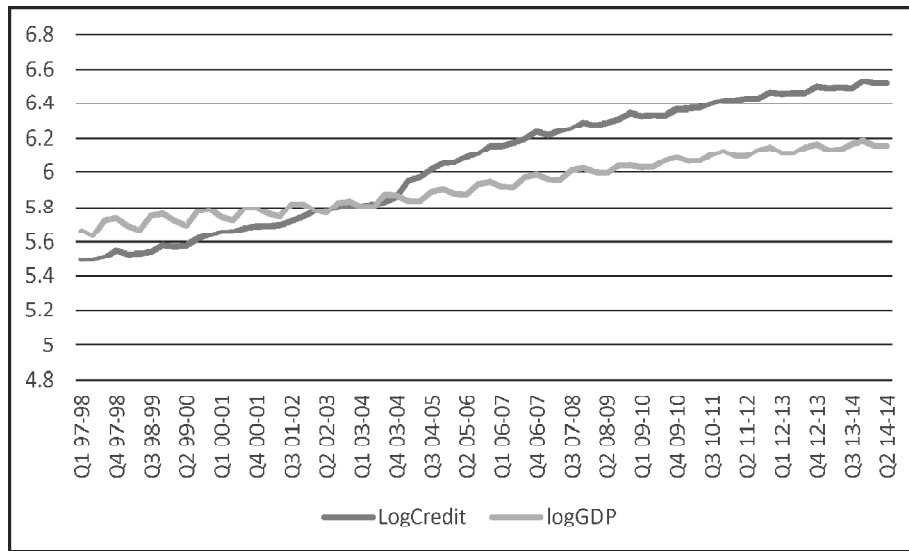
Figure 2: Log-10 Real Bank Credit and Log-10 Real GDP in India from 1997Q1 to 2014Q2
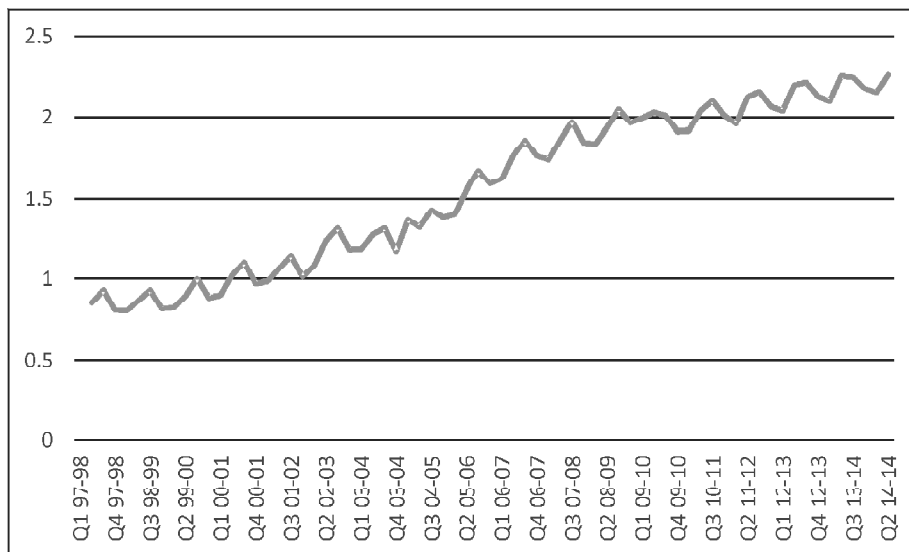

Figure 3 Financial Depth in India from 1997Q1 to 2014Q2

4. Variables and Methods

4.1. Variables

This study uses measures of size and development of the bank credit sector. Outstanding bank credit is used as a measure of the size of the sector, and financial depth is used as an indicator of development.

Bank Credit: Bank credit is the outstanding credit of Scheduled Commercial Banks obtained from the Reserve Bank of India's Database on the Indian Economy. Quarterly observations in crores of INR are noted from Q1 1997 to Q2 2014. Values of credit are deflated to 96-97 base year prices using a GDP deflator. The base 10 logarithm of this variable is used for further study. This is referred to as LOGBC.

GDP: GDP is measured as GDP at factor cost at constant prices (in crores of INR). These values are also obtained from the RBI Database on the Indian Economy and take on quarterly values from Q1 1997 to Q2 2014. The RBI keeps a 1996-97 base year series of GDP (up to 2009) and a 2004-05 base year series. The two series are unified via rebasing. Values post 2014Q2 are not included in this study as the measurement of national income was changed to Gross Value Added, and hence inclusion of values beyond 2014Q2 would result in a structural break in the series. The base-10 logarithm of the final series has been used for further study. This is referred to as LOGGDP.

Financial Depth: Financial depth is defined as $\dfrac{credit}{GDP}$. Levine *et al.* (2000) notes that while financial intermediary balance sheet items are measured at the end of the period, GDP is measured over the period. To resolve this, Levine *et al.* (2000) suggests using an average of deflated values of bank credit over period t and $t-1$, divided by real GDP in the period. Although using a CPI deflator is more accurate, values of bank credit are deflated using a GDP deflator due to lack of CPI data over the period of the study. This variable is referred to as FD.

In further analysis, DVariable and DDVariable are used to reference the first and second difference of a variable respectively. For example, DLOGGDP refers to the first difference of the base-10 logarithm of GDP.

4.2. Methods

Stationarity Tests

The econometric tests used in this paper rely on knowledge of whether the time series under consideration have a unit root. As such, the Augmented Dickey Fuller (ADF) test is employed to determine the order of integration of the time series. The Phillips Perron (PP) test is used to consolidate the findings of the ADF test, per Arltová and Fedorová (2016).

The ADF test is conducted by estimating the following models:

$$\Delta \log(GDP)_t = \alpha + \beta t + \gamma \log(GDP)_{t-1} + \sum_{j=1}^{p} \delta_j \Delta \log(GDP)_{t-j} + \varepsilon_t$$

$$\Delta \log(BC)_t = \alpha + \beta t + \gamma \log(BC)_{t-1} + \sum_{j=1}^{p} \delta_j \Delta \log(BC)_{t-j} + \varepsilon_t$$

$$\Delta FD_t = \alpha + \beta t + \gamma FD_{t-1} + \sum_{j=1}^{p} \delta_j \Delta FD_{t-j} + \varepsilon_t$$

Where is the constant term, is the coefficient of the time trend, is the lag order of the autoregressive process, and is the white noise. For the purpose of this paper, the lag order is selected using the Schwarz Information Criterion (SIC). The ADF test then tests the null hypothesis that $\gamma = 0$ (i.e., the series has a unit root) against the alternative hypothesis $\gamma < 0$.

The condition $\beta = 0$ models a random walk with a drift and $\alpha = 0$ and $\beta = 0$ models a random walk. Including irrelevant regressors reduces the power of the test, so a correct model must be chosen to correctly reject the null. While choosing the correct representation of a time series can be difficult, Enders (1995) suggests an approach to carry out the ADF test as follows:
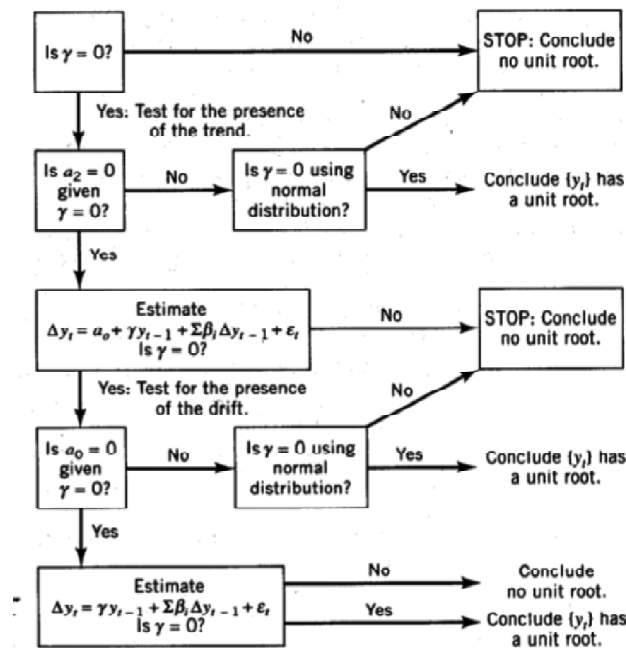
Figure 4: ADF test testing strategy

Source: Enders (1995)

An alternate test used is the Phillips Perron test. In the ADF test, a problem can arise in the selection of the lag length p. The Phillips Perron test alleviates this problem by using the standard Dickey-Fuller test with non-parametrically modified test statistics. As such, the PP test relies on the same models as the ADF test, with the exception that the lag length order does not need to be

selected and that the linear time trend variable is replaced by a centered time variable.

The Johansen Cointegration Test

The Cointegration test is used to observe the long-run relationship between bank credit and GDP and financial depth and GDP. Time series are said to be cointegrated if 1) They are integrated of order d and 2) there exists a linear combination of the time series that is integrated of order lower than d. For example, if both series being considered are I(1), they are cointegrated if a linear combination of the 2 series produces a series that is I(0) – i.e., it is stationary. The existence of a cointegrated relationship would suggest that a common non-stationary stochastic trend underlies both time series. If both series are I(1), the underlying stochastic process is also I(1) and cointegration further implies the existence of a long-run equilibrium between the variables.

The test being used to test for cointegrating relationships is the Johansen cointegration test. Although the Johansen test allows for multiple cointegrated relationships, we test for cointegration for only 2 time series.

The test is carried out by estimating a VAR of order p:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + BX_t + \varepsilon_t$$

Where y_t is a vector of non-stationary I(1) variables, X_t is a d-vector of deterministic variables, and ε_t is a vector of innovations.

The VAR can be rewritten as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \zeta_i \Delta y_{t-i} + BX_t + \varepsilon_t$$

Where:

$$\Pi = \Sigma_{i=1}^{p} A_i - I \quad and \quad \zeta_i = -\Sigma_{j=i+1}^{p} A_j$$

Cointegration is tested in this framework by testing if the matrix has reduced rank. There exist two likelihood ratio tests to test for the reduced rank of the matrix : the trace test and the maximum eigenvalue test. The trace test tests the null hypothesis of cointegrating vectors against the alternative hypothesis of cointegrating vectors (where is the number of I(1) variables). The maximum eigenvalue test, on the other hand, tests the null hypothesis of cointegrating vectors against the alternative hypothesis of cointegrating vectors.

Granger Causality

The Granger Causality test is used to test for a short-term causal relationship between bank credit and GDP and financial depth and GDP. Although the definition of causality is not agreed upon, Clive Granger developed a test for

a type of causality referred to as "Granger causality". Granger causality relies on 2 principles: 1) The cause takes place before the effect and 2) The cause has unique information about future values of its effect. A simple explanation in the words of Clive Granger himself is as follows:

"Suppose that we have three terms, X_t, Y_t, and W_t, and that we first attempt to forecast X_{t+1} using past terms of X_t and W_t. We then try to forecast X_{t+1} using past terms of X_t, Y_t, and W_t. If the second forecast is found to be more successful, according to standard cost functions, then the past of Y appears to contain information helping in forecasting X_{t+1} that is not in past X_t or W_t. In particular, W_t could be a vector of possible explanatory variables. Thus, Y_t would "Granger cause" X_{t+1} if (a) Y_t occurs before X_{t+1}; and (b) it contains information useful in forecasting X_{t+1} that is not found in a group of other appropriate variables" (Granger, 1969).

The mathematical formulation for granger causality running from LOGBC to LOGGDP is provided below as an example.

First, we estimate the following linear autoregressive model:

$$LOGGDP(t) = \sum_{j=1}^{p} \alpha_j LOGGDP(t-j) + \varepsilon_1(t)$$

Next, we estimate the following bivariate linear autoregressive model:

$$LOGGDP(t) = \sum_{j=1}^{p} \alpha_j LOGGDP(t-j) + \sum_{j=1}^{p} \beta_j LOGBC(t-j) + \varepsilon_2(t)$$

Where are the vectors containing the respective coefficients of the model, p is the lag order of the autoregressive process, and ε_1 and ε_2 are the residuals. LOGBC is said to granger cause LOGGDP if the coefficients in the vector β are jointly significant according to an f-test (which tests the null hypothesis that there is no explanatory power jointly added by past values of LOGBC). In other words, LOGBC granger causes LOGGDP if the inclusion of the autoregressive process of LOGBC reduces the variance of the residuals. A similar process is carried out to determine the presence of granger causality running from LOGGDP to LOGBC, FD to LOGGDP, and LOGGDP to FD. The lag order of the autoregressive process is selected using the Akaike Information Criterion (AIC) and the Schwarz information Criterion (SIC). Granger causality must be performed on variables that are I(0) in order to reduce the risk of spurious regression.

5. Results

5.1. Stationarity Tests

The ADF and PP tests are used in conjunction to judge whether a series has a unit root. For the ADF test, the procedure detailed by Enders (1995) is followed

(see figure 4).If it is found that a variable is stationary at the nth difference by the ADF test, the PP test is used to affirm the absence of a unit root at the nth difference of the variable. As no formal testing strategy for the PP test has been established, values at all regressor specifications (constant, constant & trend, none) have been considered. Per figure 4, if a variable is found to be stationary at constant and trend, the significance of the trend coefficient is tested, and if found to be stationary at constant, the significance of the constant is tested before confirming the absence of a unit root.In every case, the null is rejected at a 5% level of significance.

Table 1: ADF unit root test results

Regressor Specification	Variable	P-value[1]	P-value[2]
C&T	LOGGDP	0.6763	0.0732
C	LOGGDP	0.9332	0.6670
None	LOGGDP	0.9988	-
C&T	DLOGGDP	0.1307	0.9615
C	DLOGGDP*	0.0337**	-
C&T	LOGBC	0.9789	0.7103
C	LOGBC	0.6975	0.1382
None	LOGBC	1.0000	-
C&T	DLOGBC*	0.0000**	-
C&T	FD	0.8970	0.0679
C	FD	0.7775	0.0550
None	FD	0.9924	-
C&T	DFD*	0.0302**	-

[1]Null Hypothesis: The series has a unit root
[2]Null hypothesis: The true coefficient of the respective endogenous variable (trend or constant) is 0.
*Stationary Variable
**Rejection at 5% LoS

Table 2: PP unit root test for Variables at 1st difference

Variable	P-value[1]		
	C&T	C	None
DLOGGDP*	0.0001**	0.0001**	0.0001**
DLOGBC*	0.0000**	0.0000**	0.0000**
DLOGFD*	0.0000**	0.0000**	0.0000**

[1]Null Hypothesis: The series has a unit root
*Stationary Variable
**Rejection at 5% LoS

All variables included in this study have been shown to be integrated of order I(1); i.e., they are difference stationary. This means that when differenced, each series has an underlying process that is fundamentally predictable. Any shocks occurring due to substantial changes in technology, policy, or other

exogenous variables are temporary in the first difference. This allows the variables to be isolated with respect to each other, thus mitigating the risk of spurious regression (as far as the unit root tests are accurate).

5.2. Cointegration Test

Since all variables under consideration are shown to be I(1), we can use the Johansen test for cointegrating relationships between these variables. The null hypothesis (that there is no cointegrating relationship between the variables) is rejected at 5% level of significance.

Table 3: Johansen Cointegration Test Results

Variables	Test Type	Hypothesized No. of CE(s)	Eigen-value	Test Statistic	5% Critical Value	Prob
LOGGDP & LOGBC	**Trace**	None	0.165330	14.05975	15.49471	0.0813
		At most 1	0.028709	1.951622	3.841465	0.1624
	Maximum	None	0.165330	12.10812	14.26460	0.1066
	Eigenvalue	At most 1	0.028709	1.951622	3.841465	0.1624
LOGGDP &FD	**Trace**	None	0.171810	12.43522	15.4971	0.1372
		At most 1	0.002794	0.181863	3.841465	0.6698
	Maximum	None	0.171810	12.25336	14.26460	0.1015
	Eigenvalue	At most 1	0.002794	0.181863	3.841465	0.6698

**Rejection at 5% LoS

The cointegration tests suggest the absence of a long run equilibrium between bank credit and GDP as well as financial depth and GDP between 1997 and 2014. This result is in agreement with Singh *et al.* (2016), who note that this cointegrating relationship in Indiaexisted from the 50s to the 90s but breaks down after 1992. Although bank credit still accounts for the majority of financing in India, the change in this relationship could be explained by the introduction of alternative sources of financing brought about by the liberalization of the private sector and the opening of the Indian economy that were a result of structural reforms in the early 90s. Moreover, the growth of private banks and the financialization of savings seen in the Indian economy in recent decades have been driving forces behind the rapid expansion of bank credit which could have caused a divergence from a common underlying processbehind bank credit and GDP that existed in India prior to the 90s.

5.3. Granger Causality

As all variables are I(1), their differenced forms are used in the causality analysis. The economic significance of using differenced base-10 logarithms of variables is that it represents the growth rate of the variable. Since there is no cointegrating relationship between the variables, a VAR model is used for the test. The lag length of the autoregressive model considered is the one for

which the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) are minimized. In case of a disagreement, the test is carried out at both lag levels. The null hypothesis of no granger causality is rejected at 5% level of significance.

Table 4: Lag Length Selection Criteria for Granger Causality Tests

Endogenous Variables in VAR	Lag Length	
	AIC	SIC
DLOGGDP & DLOGBC	6	4
DLOGGDP & DFD	4	4

Table 5: Granger Causality Test Results

Null Hypothesis	Lag Length	P-value
DLOGBC does not granger cause DLOGGDP	4	0.0481**
DLOGGDP does not granger cause DLOGBC	4	0.0438**
DLOGBC does not granger cause DLOGGDP	6	0.0296**
DLOGGDP does not granger cause DLOGBC	6	0.0023**
DFD does not granger cause DLOGGDP	4	0.3221
DLOGGDP does not granger cause DFD	4	0.0000**

**Rejection at 5% LoS

Granger causality analysis suggests bidirectional granger causality running between credit to GDP, and unidirectional granger causality running from GDP to financial depth. This suggests the existence of a feedback loop between bank credit and economic growth, with each one granger causing the other: real economic growth generates savings which banks distribute as money-capital in the form of credit. Efficient allocation of this capital then spurs further economic growth. Financial deepening, on the other hand, appears to only be a consequence of real economic growth, and should thus be looked at as an indicator of financial or economic development as opposed to a factor driving growth.

6. Conclusion

Empirical analysis of bank credit, financial depth and GDP in India suggests that there exists no long run equilibrium between bank credit and GDP or financial depth and GDP. Granger causality analysis provided evidence of bidirectional causality running between real bank credit and real economic growth, suggesting the existence of a feedback loop between the 2 variables. Evidence for unidirectional causality running from economic growth to financial depth was also found, suggesting the value of financial depth as an indicator of financial or economic development but not as a driving factor. This study thus suggests that regulated credit-expansionary and financial liberalization policies would be conducive to economic growth in India.

Although this study focuses on bank credit and GDP, future studies looking to expand on these results may consider a composite measure of various sources of financing to ascertain the nature of the relationship between the financial sector as a whole and national income.

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