Causality between Credit Market Development and Economic Growth in India: Toda and Yamamoto Approach

Mr. P.K. Mishra*

KEY WORDS:
Credit Market, Economic Growth, India, Inflation,

Abstract: The issue of causal relationship between credit market development and economic growth is very crucial in an emerging market economy like India especially in the after-math of the global financial crisis. A developed credit market efficiently allocates resources for higher economic growth and higher economic growth by stimulating investment opportunities spurs economic growth. This necessitates the investigation of the causality between credit market development and economic growth. It is with this objective, this paper investigated the causal relationship between credit market development and economic growth using the Toda and Yamamoto non-causality test. The results provide the evidence in support of the feedback causal relation between credit market development and economic growth in India over the period 1980 to 2009. It means credit market development leads to economic growth and economic growth spurs the credit market development.

Introduction:

In the aftermath of the global financial crisis, the study of the relationship between credit market development and economic growth has become a moot point in the financial empirical literature. The question that whether credit market development precedes or follows the economic growth has been an extensive subject of empirical research since last few years. This paper is, thus an attempt to contribute to the empirical literature on the dynamics of the relationship between credit market development and economic growth. Such a study is significant in the sense that a relatively developed credit market improves the efficiency of resource allocation thereby contributing to higher economic growth of a country. Conversely, a growth push makes credit markets more valuable for participants, stimulates financial development and strengthens the initial growth effect.

The literature on financial economics provides support for the argument that countries with better/efficient credit systems grow faster while inefficient credit systems bear the risk of bank failure (Kasekende, 2008). Credit institutions intermediate between the surplus and deficit sectors of the economy. Thus, a better functioning credit system alleviates the external financing constraints that impede credit expansion, and the expansion of firms and industries (Mishkin, 2007). The financial intermediaries although regulated, still determine the strategies for allocating funds, and as such they play a significant role in determining the type of investment activities, the level of employment generation, and the distribution of income (Gross, 2001). The availability of credit function optimistically allows the realization of this role which is often essential and significant for the growth of an economy.

Arguably, better functioning credit system tends to reduce the transaction costs involved in the process of financial intermediation. A developed credit system assists in collecting and processing information about investment opportunities more efficiently and at lesser cost (King and Levine, 1993). Efficient credit system minimises the problems of asymmetric information such as adverse selection and moral hazard between borrowers and lenders which often prevent optimal allocation of resources, through screening and monitoring of potential borrowers, information gathering and special contract design (Gross, 2001). As a consequence, economies of scale are enjoyed and this is a pre-condition of economic growth. Conversely, a low level of financial development pulled by inefficient credit system distorts economic growth.

In essence, financial intermediation is a vital function of banks that accounts for a significant share in their operational activities. In this context, it is worthwhile to study how relevant is the performance of this function to the growth of the economy of a country in line with available theories and evidences in the field.

Indian credit market is, now well developed and catering efficiently to the need for institutional credits both by private and public sectors. The system has been strengthened in line with the international best practices, improved credit delivery, corporate governance practices, and the customer service. Indian credit market is dominated by the bank credit. Credit by scheduled commercial banks from early 1990s witnessed three distinct phases in India. In the first phase (1990-91 to 1995-96), bank credit growth showed erratic behaviour with the growth rate varying between 8 per cent and 29 per cent. In the second phase (1996-97 to 2001-02), bank credit growth decelerated sharply and ranged between 10 and 18 per cent. In the third phase (2002-03 to 2008-09) credit growth generally remained high. The major

* The author is Sr. Lecturer in Economics, Siksha O Anusandhan University, Orissa, India, and he can be reached at : pkmishra1974@gmail.com

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factors behind this substantial growth of bank credit are improved asset quality, reduction in banks' gross/net NPAs, a pick-up in economic growth, moderation in inflation and inflation expectations, decline in real interest rates, rising income of households and increased competition with the entry of new private sector banks. Besides, the sharp growth in bank credit in recent years could also be attributed to factors such as financial deepening from a low base, structural shifts in supply elasticities, rise in efficiency of credit markets and policy initiatives to improve the flow of credit to sectors such as agriculture and small and medium enterprises. However, due to the impact of global financial crisis the growth rate of credit of scheduled commercial banks has been declined in India. At the end of March 2008 gross outstanding credit of scheduled commercial banks amounted to Rs. 24,17,007 crore registering an increase of 24.1 per cent as against an increase of 28.6 per cent in the previous year. The number of borrowal accounts increased to 10.70 crore in 2008 from 9.44 crore in 2007, i.e. by 13.3 per cent.

Despite this slow down, it appears that banks in India have been playing a crucial role in the financial deepening as well as economic development of the country. The rise in the bank credit to GDP ratio indicates increasing financial deepening of a country. Bank credit (outstanding), which constituted 20.4 per cent of GDP at end-March 1991, increased to 22.3 per cent at end-March 2000 and 46.8 per cent at end-March 2007.

It is with this backdrop, this paper is an attempt to investigate the dynamics of the relationship between credit market development and economic growth in India for the period spanning from 1980 to 2009.

Literature Review:

The relationship between the size of a country's credit market and its rate of economic growth has been the subject matter of empirical research since last two decades. Despite, there exists a substantial literature on the role of credit market frictions for economic growth (e.g. Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Marcet and Marimon (1992), Galor and Zeira (1993), Azariadis and Chakraborty (1999)). Their common view is that a higher level of financial activity spurs economic growth.

King and Levine (1993) used different measures of bank development for several countries and found that banking sector development can spur economic growth in the long run. Jayratne and Strahan (1996) showed that when individual states in USA relaxed interstate branching restrictions, bank lending quality increased significantly leading to higher growth.

Levine (2002) emphasises the critical importance of the banking system in economic growth and highlight circumstances when banks can actively spur innovation and future growth by identifying and funding productive investments.

An increasing number of recent contributions including Atje and Jovanovic (1993), Favara (2003), Beck and Levine (2004), Loayza and Rancière (2006), and Saci et al (2009) have provided evidence (for a variety of sample periods, sample of countries and techniques) in favour of a negative (and significant) impact of financial sector activity (banking activity) upon economic growth in the short-term, although the impact becomes positive and significant in the long run.

Favara (2003) found a strong relationship between domestic credit by banks and other financial institutions as a percentage of GDP and economic growth after controlling for the effect of inflation, government consumption to GDP, initial GDP per capita, domestic investment to GDP, average years of school of the population aged 15 and over, trade openness to GDP, black market premium and dummy legal origin variables. The sample consisted of 85 countries for the period 1960-1998. However, this strong relationship weakens when an instrumental variable estimation, method is applied with dummy variables of the origins of the legal system of each country used as instruments. When moving to annual data, the effect of domestic credit by banks and other financial institutions as a percentage of GDP is negative when real domestic investment as share of real per capita GDP is included. But it is still positive without the real domestic investment. However, no variables capturing the effect of financial markets were included.

Beck and Levine (2004) initially constructed a panel with data averaged over five-year intervals over the period 1986-1998 for 40 countries. The averaging was aimed at removing the effect of the business cycle. This study found that both financial markets and banks did indeed play a positive and significant role in influencing economic growth, even when selected control variables were added to the model. However, the relationship between financial variables and economic growth broke down, in particular for the banking variable when using annual data (Beck and Levine, 2004). They tentatively suggested that this was due to "credit surges" that had also been found to be good predictors of banking crises and subsequent economic slowdowns.

In a recent paper, Loayza and Rancière (2006) empirically investigated and provided supportive evidence to this apparent debate and put forward a number of possible explanations backed up by some empirical evidence. First, they empirically proved that the relationship between financial variables and economic growth is significant and positive in the long-run by means of a model with domestic credit by banks and other financial institutions as a percentage of GDP as their financial development variable and a number of other well established control variables. The technique they have used is a panel error-correction model that allows the estimation of both short and long-run effects from a general Autoregressive Distributed Lags (ARDL) model. Their sample consisted of annual data with 75 countries over the period 1960-2000. The dependent variable is rate of growth of GDP per capita, while the control variables (always included) are government consumption to GDP, volume of trade over GDP, inflation rate and initial GDP per capita. However, they incorporated only domestic credit by banks and other financial institutions as a percentage of GDP as a financial variable ignoring the stock market. Unlike Beck and Levine (2004), Loayza and Rancière (2006) do not average the data but they estimate both short- and long-run effects using a data field composed of a relatively large sample of countries and annual observations. They suggest that averaging hides the

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dynamic relationship between financial intermediation and economic activity. Loayza and Rancière (2006) suggest that the debate may be explained by the effect of financial liberalisation.

Another explanation also suggested by Dell'Ariccia and Marquez (2006) and Rajan (1994) is that credit expansions tend to be pro-cyclical (i.e., rates of growth in GDP tends to induce a high rate of growth in credit). Usually, if in the "good times" banks relax their criteria and lend to both good and bad projects, then when the "bad times" arrive most loans become non-performing and the source of credit dries up, rationing out even good projects.

Ivie (2008) analysed the composition of credit markets in the United States and the extent to which financial markets contribute to economic growth. In the study a Granger Causality test is designed to test if credit issued in the private sector causes economic growth. The study identified a significant causal relationship between credit and economic growth.

Saci, Giorgioni and Holden (2009) estimated the relationship for 30 developing countries with annual data over the period 1988-2001 applying two-step GMM. They found that the variable, domestic credit by banks and other financial institutions as a percentage of GDP has a significantly negative coefficient with stock market traded value over GDP. When stock market traded value over GDP is replaced by, stock market turnover ratio, the effect of domestic credit by banks and other financial institutions as a percentage of GDP became insignificant. However, in each case the effect of the stock market variables on growth is positive and significant.

Vazakidis and Adamopoulos (2009) investigated the relationship between credit market development and economic growth for Italy for the period 1965-2007 using a Vector Error Correction Model (VECM). The empirical results indicated that economic growth had a positive effect on credit market development, while inflation rate had a negative effect. Bank development was determined by the size of bank lending directed to private sector at times of low inflation rates leading to higher economic growth rates.

Notwithstanding the substantial literature, the issue of the relationship between credit market development and economic growth is still a moot point. The extant empirical studies do not provide any concluding evidence on this issue. Besides, the empirical literature is very thin regarding similar studies including Indian economy. Furthermore, the financial literature is impaired in not having the studies covering the period of recent global financial crisis. Therefore, this paper is an attempt to fill such gaps in the finance-growth nexus literature.

Data and Methodology:

The objective of this paper is to analyse the dynamics of the relationship between the credit market development and economic growth in India by taking into account the effect of inflation on credit market development for the period 1980 to 2009. The variables of this study are: Real Gross Domestic Product (GDP), Bank Credit (BC) and Consumer Price Index (CPI).

First, Real GDP as measured by gross domestic product at factor cost and at constant prices is considered to represent the real economic growth of the country. Second, BC as measured by the domestic bank credits to private sector as a percentage of GDP is taken to capture the credit market development of the country. De Gregorio and Guidotti (1995) argue that BC is a reasonable measure of the level of credit development. This measure has an important merit over any other monetary aggregate as a proxy for credit market development as it represents more accurately the role of financial intermediaries in channelling funds to private market participants (Levine et al, 2000). Third, CPI as a measure of inflation is included in the study because it is believed that a rise in inflation has a weak positive effect when initial rate of inflation is low and a negative effect at initially high inflation on financial depth of a country (Ball and Mankiw, 1995).

The data that are used in this study are annual covering the period from 1980 to 2009 for India. All the time series data are obtained from International Financial Statistics Yearbook (IMF, 2010) and, data are taken in their levels.

Unlike most of empirical studies applying Granger Causality test, this study is carried out in a multivariate framework using CPI as a control variable. This mediating variable is related meaningfully to the rate of economic growth in traditional growth models and therefore, mitigates the possibility of distorting the causality inferences due to the omission of relevant variables (Lutkepohl, 1982). India. To this end, the Granger causality test procedure as proposed by Toda and Yamamoto (1995) has been used.

The Toda and Yamamoto (1995) method of Granger causality test is relatively more efficient in small sample data sizes and is particularly appropriate for time series for which the order of integration is not known or may not be necessarily the same, or the order of integration is more than two. Another advantage of this procedure is that it does not require the pre-testing of the time series for cointegration properties so long as the order of integration of the process does not exceed the true lag length of the model. Toda and Yamamoto (1995) methodology of Granger causality test by directly performing the test on the coefficients of the levels VAR, minimises the risk associated with possibly wrongly identifying the orders of integration of the series and the presence of cointegration relationship (Galies, 1997; Mavrotas and Kelly, 2001).

The basic idea in the Toda and Yamamoto (1995) procedure is artificially augmenting the correct VAR order, k with d extra lags, where d is the maximum likely order of integration of the time series in the empirical system. Thus, at the outset, it is required to determine the maximum order of integration of time series, say, d_{max}. Then the optimal lag length of the VAR model is to be determined using Akaike Information Criteria (AIC), say, k. In the third step, the $(p = k + d_{max})^{th}$ order of VAR is to be estimated with Seemingly Unrelated Regression(SUR). At last, the null hypothesis of no-causality is to be tested using a standard Wald statistic, say, W. The implementation of the Toda and Yamamoto approach to Granger causality necessitates linking the three variables of the study in a trivariate system as follows:

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$$Y_t = A_0 + AY_{t-1} + \ldots\ldots + A_k Y_{t-k} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (1)$$

$$Y_t = \begin{bmatrix} Y_{1t} \\ Y_{2t} \\ Y_{3t} \end{bmatrix} = \begin{bmatrix} GDP_t \\ CPI_t \\ BC_t \end{bmatrix}$$ $\varepsilon_t \sim i.i.d\ N(0,\mu)$; and A's are 3x3 matrices of coefficients.

The following augmented levels *VAR (p = k + d)* shall be estimated to test the null hypothesis of no-causality:

$$Y_t = a + A_1 Y_{t-1} + \ldots\ldots + A_k Y_{t-k} + A_{k+1} Y_{t-k-1} + \ldots\ldots + A_p Y_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (2)$$

This augmented VAR system is to be estimated using the Seemingly Unrelated Regression (SUR) technique.
The null hypotheses of the study are:

H_{01}: Y_{3t} does not cause Y_{1t}, i.e. $a_{13}^1 = a_{13}^2 = \ldots. = a_{13}^p = 0$

H_{02}: Y_{1t} does not cause Y_{3t}, i.e. $a_{31}^1 = a_{31}^2 = \ldots. = a_{31}^p = 0$

Both the null hypotheses are to be tested by Wald test which can be formulated as follows:

Let $e_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, $e_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ and $D = I_k \otimes e_3$ with I_k being the *k x k* identity matricx. Let *vec (A)* be the column

vector obtained by stacking the rows of the matrix *A*. Then the Wald Test statistic is given by :

$W = T\left((e_1' \otimes D')\,vec(\hat{A})\right)\left((e_1' \otimes D')\hat{\Sigma}\,(e_1 \otimes D)\right)^{-1}(e_1' \otimes D')\,vec(\hat{A})$ Where $\hat{\Sigma}$ is a consistent estimator

of the asymptotic variance matrix of $\sqrt{T}vec(\hat{A}-A)$.

The Wald test statistic (W) has an asymptotic x^2cdistribution with k degrees of freedom. The reason for ignoring the remaining d_{MAX} autoregressive parameters in testing for Granger causality is that it helps overcoming the problem of non-standard asymptotic properties associated with standard Wald test for integrated variables. It has been shown that Wald test experience efficiency improvement when SUR models are used in the estimation (Rambaldi and Doran, 1996).

Empirical Analysis:

At the outset, the Pearson's correlation coefficient matrix between variables has been calculated over the sample period and its significance has been tested by the t-test. The results are presented in Table 1.

Table 1 : Correlation Matrix

Variables	GDP	CPI	BC
GDP	1	0.96	0.93
CPI		1	0.81
BC			1

The correlation matrix reports positive and high degree correlation between variables. Furthermore, such positive correlations are significant at 5% level. The scatter diagrams for all possible pairs of time series are presented in Fig.1 which indicates that the GDP and BC are positively related. Correlations, however, do not say anything about causal relationship and thus, leaves unsettled the debate concerning the causal relationship between credit market development and economic growth in India.

In the first step of the causality analysis, the order of integration for each of the three variables used in the analysis is determined. The Phillips – Perron (PP) unit root test is used for this purpose. Phillips and Perron (1988) suggested a non-parametric technique of unit root test. The PP method estimates the non- augmented Dickey-Fuller test equation:

$$\Delta Y_t = \alpha Y_{t-1} + x_t'\delta + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (3)$$
$$\& \quad \alpha = p - 1$$

Here, Y_t is the time series under consideration, x_t' are optional exogenous regressions which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and, ε_t are assumed to be white noise. The null and alternative hypotheses of this test are: $H_0: \alpha = 0$ and $H_1: \alpha < 0$ The null hypothesis that the time series is non-stationary is rejected when PP test statistic is less than the critical value at a given level of significance.

The results of PP unit root test are reported in table 2. It is quite clear that the null hypothesis of no unit roots for GDP and CPI are rejected at their second differences since the PP test statistic values are less than the critical values at 5% levels of significance. Thus, these two variables are stationary and integrated of same order, i.e. I(2). But the variable BC is integrated of order one, i.e. I(1) as the PP test statistic at the first difference form for it is less than the critical value at 5% level of significance

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Figure 1: Scatter Plot of GDP , BC & CPI in all possible pairs

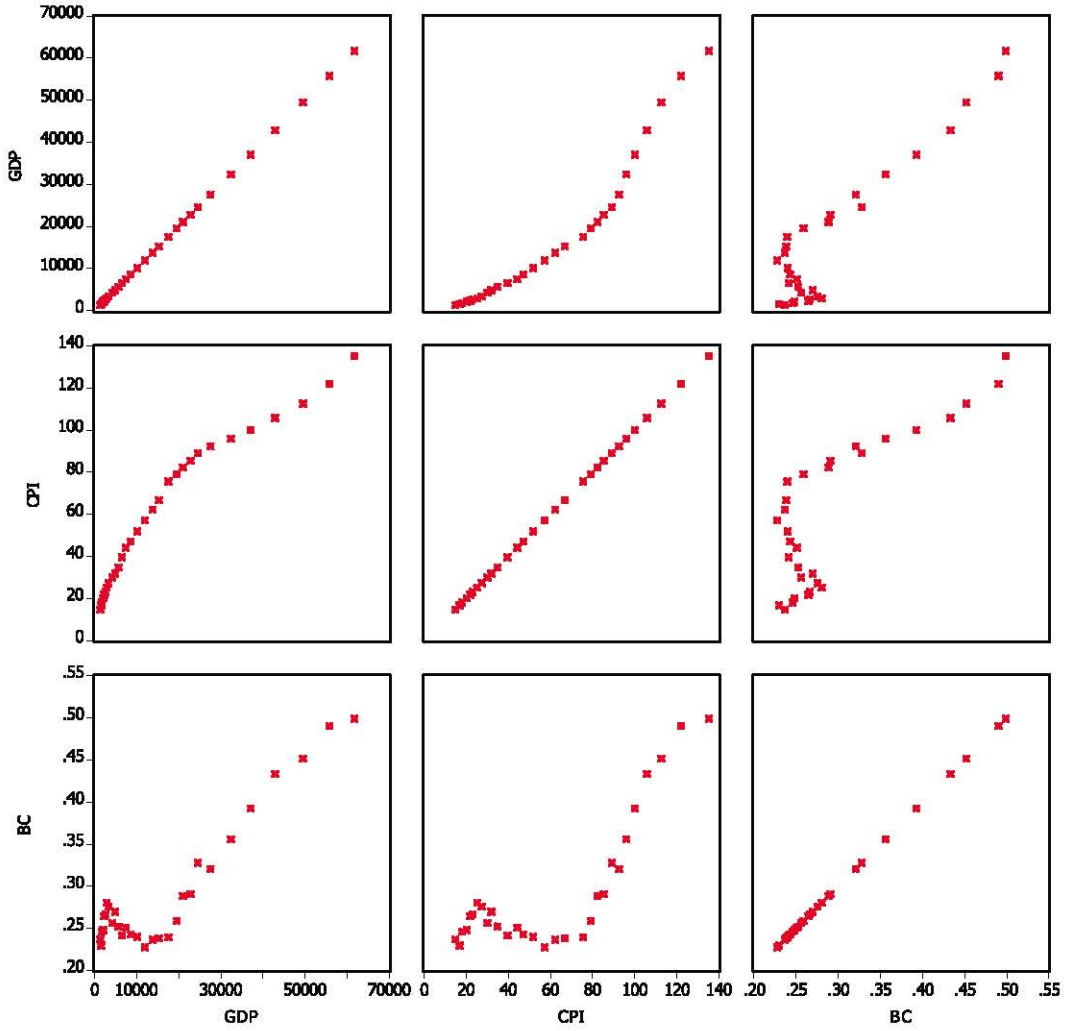

Table 2: Results of Unit Root Test

Variables	Phillips – Perron (PP) test statistic						
	Level form with intercept and linear trend		First Difference form with intercept and linear trend trend		Second Difference form with intercept and linear		Order of Integration
GDP	4.96	1%: -4.30 5%: -3.57 10%: -3.22	-1.62	1%: -4.32 5%: -3.58 10%: -3.22	-4.45	1%: -4.33 5%: -3.58 10%: -3.22	I(2)
CPI	-0.13	1%: -4.30 5%: -3.57 10%: -3.22	-1.37	1%: -4.32 5%: -3.58 10%: -3.22	-5.95	%: -4.33 5%: -3.58 10%: -3.22	I(2)
BC	0.43	1%: -4.30 5%: -3.57 10%: -3.22	-5.41	1%: -4.32 5%: -3.58 10%: -3.22	NA	NA	(1)

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Thus, the results obtained from the PP test suggest that the maximum order of integration of the series under study is two, i.e., $d_{max}=2$ Therefore, the Toda – Yamamoto test involves the addition of two extra lags of each of the variables to control for potential cointegration. Then it is required to select the appropriate lag length for the VAR in order to perform causality test. In this study, the Akaike Information Criterion (AIC) and Final Prediction Error (FPE) techniques are used to determine the optimal lag length. In small sample study (n<60), AIC and FPE are superior to other information criteria (Lutkepohl, 1991; Liew, 2004). The results of such test are presented in table 3. The optimal lag length, thus selected is 2k

Table 3: Selection of Lag Length

Lag	FPE	AIC
0	838.92	24.45
1	178.06	13.68
2	94.76*	13.03*

*indicates lag order selected by the criterion at 5% level

In the next step, the augmented VAR of order 4 ($p = k + d$) is estimated with Seemingly Unrelated Regression (SUR) and the Wald test is carried out using standard chi-square distribution. And, the results of Toda and Yamamoto Ganger non-causality test are reported in table-4. The results show that the null hypothesis that "BC does not Granger Cause GDP" "GDP does not Granger Cause BC" are rejected at 5% level of significance. This means BC and GDP cause each other, i.e. a feedback causal relationship exists between credit market development and economic growth in India over the sample period. Credit market development leads to economic growth of the country and economic growth spurs credit market development at times of low inflation rates.

Table 4: Results of Toda and Yamamoto Granger Non-Causality Test

Null Hypothesis	Chi-Square statistic (d.f)	Critical values	Decision
BC does not Granger Cause GDP	12.116 (4)	1%: 13.276 5%: 9.487 10%: 7.779	Reject
GDP does not Granger Cause BC	21.980(4)	1%: 13.276 5%: 9.487 10%: 7.779	Reject

Conclusion:

In this paper we investigated the dynamics of the causal relationship between credit market development and economic growth in India using annual data for the period 1980 to 2009. The application of Toda and Yamamoto procedure of Granger causality test suggests the evidence of bi-directional causality between credit market development and economic growth in India. The empirical result that credit market expansion as measured by bank credit to private sector leads to economic growth may be interpreted in the sense that with the expansion of bank credit to private sector, more innovative projects are to be undertaken and thus, investment, employment and output will increase putting the country's economy in a high growth trajectory. But the most recent global financial crisis is there to remind us that banking sector is the most cyclical and risk-prone sectors of an economy and private sector is the most irresponsible and unaccountable sector. Therefore, for the sustainable economic growth of a developing country like India utmost caution is to be taken on the part the Govt., credit rating agencies and other regulators in the form of strict supervision and monitoring of credit market activities in line with international standards and best practices. On the other side of the coin, economic growth is found to spur the credit market development. As the economy will grow, the private sector would be encouraged to undertake more risky investments to explore the opportunities of producing innovative products and services through bank financing. This may ultimately cause the credit market to develop while accelerating the pace of economic growth.

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