IS CREDIT AVAILABILITY AND GROWTH RELATED? CASE OF BRAZIL

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ABSTRACT

The focus of the current study was to test the influence of credit availability on economic growth of Brazilian economy. The study time period was from 1951 to 2014 for overall bank credit; while, credit data at sectoral level covered the time period of 1973 to 2014. The annual overall and sectoral data for GDP is based on GDP at factor cost/GVA at basic prices at 2004-05 prices. Different metrics for credit and output is used to test the relationship at an overall as well as sectoral level. The credit growth and GDP growth variables are tested for stationarity using ADF test, PP test and KPSS test. For establishing long term relationship, we utilized Johansen test. For establishing the short-run relationship, we utilized Granger causality test. Data related to the GDP states that there is significant improvement in average growth rate during the 1990s. Co-integration test results as provided indicate that a long-term association between overall growth and overall credit exist for the period of 1952-1992, however, this relationship is not established post1992 time period. Our analysis suggests that there exist a long-term co-integration relationship between manufacturing credit and manufacturing GDP. However, we did not find the relationship between industrial credit and industrial GDP which suggest these are not co-integrated. Overall, our results show that there is correlation between Credit Growth and GDP Growth.

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INTRODUCTION

The argument in the favor of banking system is that it banking system provide growth to the economy by taking savings from the individuals and channelize it to those who need it most. Thus in this sense, banking system function as a financial intermediary. Previously, researches are conducted to test the relationship between availability of credit and economic growth in a country or region. Despite economic techniques utilized, some studies only found moderating results, and other pointed out the dual direction causality means economic growth leading to greater credit facility in a country. In this study, the focus is on understanding this relationship in the context of Brazil. The country remains very successful in terms of economic growth as it pulled out millions out of poverty and created huge employment opportunities. In Brazilian market, various types of credit are increasing such as credit card which is now increasingly used for making consumption-based transactions.

LITERATURE REVIEW

Following section present brief but relevant literature review related to the credit facility and economic growth in the developing country context. Initially, the neo-classical traditions of Harrod-Domar and Robert Solow which emerged after the second world war, did not give much importance to the financial sector. For example, Rajan and Zingales (2001) stated that an economy can develop necessary financial institutions as opportunities arise means enterprise leads and financial institutions follows it.

McKinnon (1973) was one of pioneer who emphasized the importance of financial institutions and their importance for the growth of an economy. Shaw (1973) emphasized the growth-enhancing attributes of financial capital deepening through its impact on market integration. Both Shaw and McKinnon stressed that for developing countries, financial institutions play important role in shaping country's economic growth.

Minsky (1992) stated that for provision of capital, financial institutions plays important role.

Patrick (1966) suggested that between financial institutions and economic growth, there are two types of relationship which exist. According to the "demand-following" view, as the real economy grows, demand for financial services grows. According to the "supply-leading" view, financial institutions and services are created in advance of the demand for them. According to him, in the initial stages of growth, supply-leading view becomes important. As sustained macroeconomic growth gets underway, the demand-following response becomes more dominant.

Jung (1986) conducted a comprehensive study of financial institutions and economic growth in 56 developing countries. He found some evidence that developed countries (DCs) have demand-leading causality pattern; while, developing countries have supply-driven causality pattern for economic growth and financial institutions relationship. Other studies such as Levine et al. (2000), Calderon and Liu (2002) and Hassan et al. (2011) investigated the

relationship between financial growth and financial institutions relationship in several countries.

The main finding states that there is indeed a strong relationship between financial sector development and economic growth of a country. Demetriades and Hussein (1996) investigated this relationship in 16 countries context and showed that there is less evidence for relationship between financial institutions and economic growth of a country.

A key factor to note in the GDP growth history of Brazil is that the Brazilian economy had experienced a turnaround in growth in the early 1990s. In the context of this study it is important to separate the change in GDP caused because of structural reasons. However, there has been a lot of debate on the specific years which define a structural break in the Brazilian economic growth.

The Relationship Between Banking Credit and Growth In Brazil

Brazilian economy has seen large growth during last decades along with high variation and political variations. Generally speaking, banks remains the main lending financial institutions in the economy. The country saving rate and interest remains higher in order to boost economic growth. Government is aiming to monitor and regularize the financial institutions in order to overcome the financial issues such as inflation and economic variations. Usually, the banks credit is found to be associated with growth in economy.

METHODOLOGY

The methodology is based on testing the financial institutions and economic growth relationship using the Granger Casuality test and Co-Integration. We used natural logarithm of the level series. Augmented Dickey Fuller test, Phillips Perron unit root test is used for testing the stationarity of the credit and GDP times seris data. We also employed Johansen test of co-integration. In order to test the time series for co-integration, it is necessary that they all be integrated of first order, i.e. I(1).

Variables

The study period for overall bank credit is from 1951 to 2014 while, credit data at sectoral level is for the period of 1973 to 2014. Based on this annual data, it is segregated based on sectors including quarrying, mining, manufacturing, allied activities, agriculture, and industry and services. As credit is in nominal terms, it has been converted to real terms by adjusting it using GDP deflator. Utilizing a methodology similar to Levine et al. (2000), the credit over years 't' and 't-1' has been averaged and expressed as a fraction of real GDP. The natural logarithm of this variable has then been used for further study. The GDP deflator is calculated for each year using GDP at constant 2004-05 prices to deflate the nominal GDP at current prices. This GDP deflator is subsequently used to deflate the nominal credit data to obtain real credit.

The annual overall and sectoral data for GDP is based on GDP at factor cost/GVA at basic prices at 2004-05 prices. Despite the base year being revised to 2011-12, the 2004-05 base year data has been considered for this study due to the inherent structural break in the revised base

year time series of GDP. For the purpose of sectoral analysis, data from 1973 to 2014 has been captured. For the study at a macro-level, overall GDP data has been used from 1951 to 2014. Our initial results shows that there is correlation between Credit Growth and GDP Growth. A pattern of similar movement in both series can be observed in the figure given. Some variations are easily observable and can be ascribed to factors including policy changes, political stability, and more. Privatization, globalization policies, and trade liberalization can also be associated with economic growth during the 1990 era. The variables considered for subsequent analysis are tabulated in Table 1.

Table 1
List of variables and their descriptions

Variable Name	Description
LTOTC, LTOTGVA	Log of total credit, total GVA
LAGC, LAGGVA	Log of agricultural credit, agricultural GVA
LSERC, LSERGVA	Log of services credit, services GVA
LINC, LINGVA	Log of industrial credit, Industrial GVA
LMANC, LMANGVA	Log of manufacturing credit, manufacturing GVA
D(Variable name)	First difference of variable under study
DD(Variable name)	Second difference of variable under study

RESULTS AND FINDINGS

Sectoral Study

Stationary Tests

The credit growth and GDP growth variables are tested for stationarity using ADF test, PP test and KPSS test. The results of the tests are shown (Table 2).

Table 2
Stationarity tests for variables under consideration

Variable	ADF Test			PP Test	KPSS Test	
	C	CT	NC		Level	Trend
LAGC	0.8464	0.8026	0.0268**	0.8482	0.02***	0.01***
DLAGC	0.222	0.4682	0.2424	0.02***	0.2	0.01***
DDLAGC(*)	0.02***	0.02***	0.02***	0.02***	0.2	0.1
LAGGVA	0.8482	0.0408**	0.88	0.02***	0.02***	0.1
DLAGGVA(*)	0.02***	0.02***	0.02***	0.02***	0.2	0.1

LINC	0.88	0.8602	0.2222	0.8864	0.02***	0.01***
DLINC(*)	0.0286**	0.0284**	0.0208**	0.0282**	0.0482**	0.1
LINGVA	0.8282	0.2082	0.88	0.266	0.02***	0.01***
DLINGVA(*)	0.02***	0.0242**	0.2222	0.02***	0.2	0.1
LMANC	0.8022	0.266	0.0682*	0.6022	0.02***	0.0158**
DLMANC(*)	0.02***	0.0262**	0.02***	0.0224**	0.2	0.1
LMANGVA	0.8662	0.2286	0.88	0.6248	0.02***	0.01***
DLMANGVA(*)	0.02***	0.02***	0.0642*	0.02***	0.2	0.1
LSERC	0.4204	0.2408	0.2202	0.8422	0.02***	0.01***
DLSERC(*)	0.02***	0.02***	0.02***	0.0822*	0.2	0.0389**
LSERGVA	0.88	0.8882	0.88	0.8628	0.02***	0.01***
DLSERGVA	0.2022	0.2682	0.4422	0.02***	0.02***	0.1
DDLSERGVA(*)	0.02***	0.02***	0.02***	0.02***	0.2	0.1

(*) – Stationary Variables; Level of Significance: *** - 1%, ** - 5%, * - 10%

For achieving the condition of stationary series, ADF and PP test are utilized. We conducted stationary testing using the guidelines. Our analysis is based on the relationship between total credit availability in the Brazilian economy and GDP, industrial credit and industrial GVA, manufacturing credit and manufacturing GVA.

We used PP test and ADF test at the same time in order to conduct the differencing level requirement for stationary series. We found conflict in case of agricultureal variables as the credit and GVA variables attain stationarity at different levels of differencing.

Johansen Co-integration Test

For establishing long term relationship, we utilized Johansen test. For Johansen tests, it is required that the series be integrated of order 1, that is all the series must be I(1). The levels of the series for industry and manufacturing sectors are considered for the Johansen test as they are both I(1). Table 3 present these results. Results states that manufacturing credit and growth are interlinked in the long term; however, industrial variables are lacking co-integration.

Table 3
Results of Johansen co-integration tests

	10 % LoS	5% LoS	1% LoS	Conclusion
LMANC – LMANGVA	Rejected	Rejected	Not Rejected	Co-integrated 5%
LINC – LINGVA	Not Rejected	Not Rejected	Not Rejected	No Co-integration

Null Hypothesis: No co-integration. r=0. LoS : Level of Significance.

Granger Causality Test

For establishing the short-run relationship, we utilized Granger causality test. The requirement for this test is that both series shows zero mean stationarity and be trend. We made these series stationary first and used this technique of deducting the mean value of stationary series in order to make it zero mean stationary. The number of lags for Granger Test is selected based on the FPE and AIC criteria given by Akaike (1969, 1974). Table 4 present the results. Table 5 lists the results of the Granger causality tests performed on the trend and zero mean stationary variables.

Table 4
Number of Lags used for Granger Causality Test

Variables	AIC	FPE
DLINGVA ó DLINC	1	1
DLMANGVA ó DLMANC	1	1

Table 5
P-value for Directional Granger Causality Test

Variables	P-Value (AIC Lags)	P-Value (FPE Lags)
DLINGVA è DLINC	0.0153**	0.0153**
DLMANGVA è DLMANC	0.0167**	0.0167**
DLINGVA ç DLINC	0.5665	0.5665
DLMANGVA ç DLMANC	0.5751	0.5751

Level of Significance: *** - 1%, ** - 5%, * - 10%

Total Credit and Total GDP Study:

Data related to the GDP states that there is significant improvement in average growth rate during the 1990s. we used the year 1992 as break point. We tested dummy regression of the difference in log levels of the GDP which justified our choice of taking this year as break point. Table 6 present these results.

Table 6
Results of regression of total GDP against a dummy variable

	Estimate	Std. Error	t-value	P-value
Intercept (C_0)	0.0491	0.0044	9.76	0.000***
Dummy Coefficient (C_1)	0.0161	0.0074	2.35	0.0008***

Note: The regression Equation was $DLTOTGVA = C_0 + C_1 * D_0.$; Where D_0 = Dummy variable à 0 for years 1952-1992, 1 for years 1993-2014.

Data has been split at breakpoint into two series as given below:

Table 7
Data Split- Breakpoints

Variable	Years
LTOTGVA – Series 1	1952 – 1992
LTOTGVA – Series 2	1993 – 2014
LTOTC – Series 1	1952 – 1992
LTOTC – Series 2	1993 – 2014

Stationary Tests

The credit growth and GDP growth variables are tested for stationarity using ADF test, PP test and KPSS test. The results of the tests are shown (Table 8).

Table 8
Stationarity tests for the variables under consideration
Series 1 – 1952 to 1992

Variable	ADF Test			PP Test	KPSS Test	
	C	CT	NC		Level	Trend
LTOTC	0.6682	0.2866	0.02***	0.5285	0.02***	0.0628*
DLTOTC(*)	0.02***	0.02***	0.02***	0.02***	0.2	0.2
LTOTGVA	0.88	0.6665	0.88	0.3625	0.02***	0.02***
DLTOTGVA(*)	0.02***	0.02***	0.0556**	0.02***	0.2	0.2

Table 9
Series 2 – 1993 to 2014

Variable	ADF Test			PP Test	KPSS Test	
	C	CT	NC		Level	Trend
LTOTC	0.604	0.4386	0.0526*	0.6263	0.02***	0.0236**
DLTOTC	0.2636	0.6865	0.2685	0.6645	0.2	0.02***
DDLTOTC(*)	0.043**	0.2222	0.02***	0.0286**	0.2	0.2
LTOTGVA	0.8362	0.6366	0.88	0.803	0.02***	0.02***
DLTOTGVA	0.322	0.6688	0.4205	0.2542	0.2	0.2
DDLTOTGVA(*)	0.0226**	0.0432**	0.02***	0.02***	0.2	0.2

(*) – Stationary Variables; Level of Significance: *** - 1%, ** - 5%, * - 10

Johansen Co-integration Test

Co-integration test results as provided indicate that a long term association between overall growth and overall credit exist for the period of 1952-1992, however, this relationship is not established post1992 time period.

Table 10
Results of Johansen's co-integration test
 Series 1 – 1952 to 1992

	10 % LoS	5% LoS	1% LoS	Conclusion
LTOTC – LTOTGVA	Rejected	Rejected	Rejected	Co-integrated

Table 11
Series 2 – 1993 – 2014

	10 % LoS	5% LoS	1% LoS	Conclusion
DLTOTC –D LTOTGVA	Not Rejected	Not Rejected	Not Rejected	Not Co-integrated

Note: Null Hypothesis: No co-integration, r=0. LoS: Level of Significance.

Granger Causality Test

The Granger causality test is provided in the Table 9. Table 10 further provides the causality tests performed on the zero mean stationary variables and trends.

Table 12
Series 2 – 1993 – 2014

Variables		Number of Lags
	AIC	FPE
DDLTOTGVA ó DDLTOTC	1	1

Table 13
P-value for Directional Granger Causality Test
Series 1 – 1952 to 1992

Variables	P-Value (AIC Lags)	P-Value (FPE Lags)
DLTOTGVA è DLTOTC	0.000	2.209×10^{-5}***
DLTOTGVA ç DLTOTC	0.546	0.565

Level of Significance: *** - 1%, ** - 5%, * - 10%

Table 14
Series 2 – 1993 – 2014

Variables	P-Value (AIC Lags)	P-Value (FPE Lags)
DDLTOTGVA è DDLTOTC	0.0623**	0.0623**
DDLTOTGVA ç DDLTOTC	0.697	0.697

Level of Significance: *** - 1%, ** - 5%, * - 10%

Analysis

Our analysis suggest that there exist a long term co-integration relationship between manufacturing credit and manufacturing GDP. However, we did not find the relationship between industrial credit and industrial GDP which suggest these are not co-integrated. GDP leads credit for the industrial and manufacturing sectors as per Granger causality test. Overall, GDP data confirms a structural break at 1992 break point. The credit and GDP data has been split into two series – Series 1 (1951-1992) and Series 2 (1993-2014)

Series 1 exhibits a long term co-integration relationship between credit and GDP, while Series 2 exhibits no co-integration. For both Series 1 and Series 2, GDP granger causes credit according to the directional Granger causality tests. Summary results are provided in Table 15.

Table 15
Summary of Conclusions: Test for Granger Causality

No.	Null Hypothesis	Lags	p-value	Conclusion
	Annual : 1973 -2014			
1	Industrial GVA è Industrial Credit	7	0.0193**	Yes
2	Industrial Credit è Industrial GVA	1	0.9558	No
3	Manufacturing GVA è Manufacturing Credit	1	0.0158**	Yes
4	Manufacturing Credit è Manufacturing GVA	1	0.8881	No
	Annual : 1952 – 1992			
5	Total GVA è Total Credit	2	2.209×10^{-5}***	Yes
6	Total Credit è Total GVA	2	0.3232	No
	Annual : 1993 - 2014			
7	Total GVA è Total Credit	1	0.0413**	Yes
8	Total Credit è Total GVA	1	0.498	No

CONCLUSION

The focus of the study was to test the influence of the credit growth on economic growth of Brazilian economy. We tested the long term co-integration between credit and economic growth. The study also attempts to identify if a causal relationship exists between credit and GDP and the direction of the causality. Johansen test and Granger causality test was used to study the relationship between the variables. The empirical findings suggest that a long term co-integration relationship exists in the manufacturing sector between credit and GDP. Furthermore, this co-integration relationship is also exhibited in the overall GDP and credit data during the initial period of Brazilian economic growth. This long term relationship breaks down post 1992. However, a short term causal relationship with GDP leading credit exists for the sectoral as well as overall data.

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Conflict of Interest

The author declares that there are no known conflict of primary or any secondary author with any other organization or publisher regarding the publication of this paper.

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