



Relationship between credit availability and economic growth: A case study of Brazil

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Abstract

This study examines the impact of credit availability on Brazil's economic growth. The analysis covers the period from 1951 to 2014 for total bank credit, while sector-specific credit data spans from 1973 to 2014. Annual GDP data, both overall and sectoral, is measured using GDP at factor cost or GVA at basic prices, based on 2004-05 prices. Various credit and output indicators are employed to assess the relationship at both aggregate and sectoral levels. The stationarity of credit growth and GDP growth variables is tested using the ADF test, PP test, and KPSS test. To determine long-term relationships, the Johansen test is applied, while short-term relationships are analyzed using the Granger causality test. GDP data indicates a notable improvement in the average growth rate during the 1990s. Results from the co-integration test suggest a long-term link between overall economic growth and total credit from 1952 to 1992, but this relationship does not persist beyond 1992. Additionally, our findings indicate a long-term co-integration relationship between manufacturing credit and manufacturing GDP. However, no such relationship is observed between industrial credit and industrial GDP, implying a lack of co-integration. Overall, the findings highlight a correlation between credit growth and GDP growth.

Keywords: Bank Credit, Granger Causality, Johansen Test, Credit and Economic Growth.

INTRODUCTION

The banking system plays a crucial role in economic growth by collecting savings from individuals and directing them toward those in need of financial resources. In this way, banks act as financial intermediaries. Previous studies have explored the relationship between credit availability and economic growth across different countries and regions. While various economic techniques have been employed, some studies have yielded mixed results, while others have identified a bidirectional causality—where economic growth leads to an

expansion in credit availability. This study focuses on examining this relationship within the Brazilian context. Brazil has achieved significant economic progress, lifting millions out of poverty and generating substantial employment opportunities. In the Brazilian market, different forms of credit, such as credit cards, have been on the rise and are increasingly being used for consumption-based transactions.

LITERATURE REVIEW

The following section provides a concise yet relevant review of the literature on credit facilities and economic growth in the context of developing countries. Initially, post-World War II neo-classical economic models, such as those proposed by Harrod-Domar and Robert Solow, did not place significant emphasis on the financial sector. For instance, Rajan and Zingales (2001) argued that financial institutions tend to develop as economic opportunities arise, suggesting that enterprises drive growth while financial institutions follow.

McKinnon (1973) was among the first to highlight the critical role of financial institutions in economic growth. Similarly, Shaw (1973) emphasized the positive impact of financial capital deepening on market integration, underscoring the importance of financial institutions in fostering economic development in developing countries.

Minsky (1992) also recognized the crucial role of financial institutions in providing capital for economic activities. Patrick (1966) further proposed two perspectives on the relationship between financial institutions and economic growth. The "demand-following" approach suggests that as the real economy expands, the demand for financial services increases. In contrast, the "supply-leading" perspective posits that financial institutions and services emerge ahead of demand, facilitating economic development. Patrick argued that in the early stages of growth, the supply-leading approach is more relevant, whereas, in periods of sustained economic expansion, the demand-following mechanism becomes dominant.

Jung (1986) conducted an extensive study on financial institutions and economic growth across 56 developing countries. His findings suggest that developed countries tend to exhibit a demand-leading causality pattern, whereas developing nations primarily follow a supply-driven causality pattern in the relationship between financial institutions and economic growth.

Several other studies, including those by Levine et al. (2000), Calderon and Liu (2002), and Hassan et al. (2011), have explored the connection between financial sector growth and economic development in various countries. Their research generally supports the idea of a strong correlation between financial sector expansion and a country's overall economic growth. However, Demetriades and Hussein (1996), in their analysis of 16 countries, found limited evidence supporting a direct relationship between financial institutions and economic growth.

A significant aspect of Brazil's economic history is the notable shift in GDP growth that occurred in the early 1990s. For this study, it is essential to distinguish GDP changes driven by structural factors. However, there has been considerable debate regarding the exact years that constitute a structural break in Brazil's economic growth trajectory.

The Relationship between Banking Credit and Growth in Brazil

In recent decades, Brazil's economy has experienced significant growth, albeit with considerable fluctuations and political changes. Banks continue to serve as the primary lending institutions within the financial system. To stimulate economic growth, the country maintains relatively high savings rates and interest rates. The government aims to regulate and oversee financial institutions to address economic challenges such as inflation and market volatility. Generally, bank credit is closely linked to economic expansion.

METHODOLOGY

The methodology employed in this study examines the relationship between financial institutions and economic growth using the Granger Causality test and Co-Integration analysis. The level series data is transformed using the natural logarithm. To assess stationarity in credit and GDP time series data, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) unit root test are applied. Additionally, the Johansen co-integration test is utilized to determine long-term relationships. For a valid co-integration analysis, all time series variables must be integrated of the first order, denoted as I(1).

Variables

The study examines overall bank credit from 1951 to 2014, while sector-specific credit data is analyzed for the period between 1973 and 2014. The annual data is categorized by sectors, including mining, quarrying, manufacturing, agriculture, allied activities, industry, and services. Since credit data is originally in nominal terms, it has been converted into real terms using the GDP deflator. Following the methodology outlined by Levine et al. (2000), the credit values for years 't' and 't-1' are averaged and expressed as a proportion of real GDP. The natural logarithm of this variable is then used for further analysis.

The GDP deflator is computed annually using GDP at constant 2004-05 prices to adjust nominal GDP at current prices. This deflator is also applied to nominal credit data to obtain real credit values. The overall and sectoral GDP data is based on GDP at factor cost or GVA at basic prices, measured at 2004-05 prices. Although the base year was later revised to 2011-12, the study retains the 2004-05 base year due to the structural break introduced in the revised GDP time series.

For sectoral analysis, data from 1973 to 2014 is utilized, while macro-level analysis relies on overall GDP data from 1951 to 2014. Preliminary results indicate a correlation between credit growth and GDP growth, as evidenced by a similar movement in both series. Observable variations can be attributed to factors such as policy changes, political stability, and economic reforms. Additionally, policies related to privatization, globalization, and trade liberalization in the 1990s appear to have contributed to economic growth. The variables selected for further analysis are summarized 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 stationarity of credit growth and GDP growth variables is assessed using the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The results of these tests are presented in 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
DDLSEGVVA(*)	0.02***	0.02***	0.02***	0.02***	0.2	0.1

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

To ensure the series are stationary, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test were employed, following established guidelines for stationarity testing. This analysis examines the relationship between total credit availability in the Brazilian economy and GDP, as well as the links between industrial credit and industrial GVA, and manufacturing credit and manufacturing GVA.

Both the PP test and ADF test were conducted simultaneously to determine the necessary differencing level for achieving stationarity. However, inconsistencies were observed in the case of agricultural variables, as credit and GVA attained stationarity at different levels of differencing.

Johansen Co-integration Test

To examine long-term relationships, the Johansen test was applied. This test requires that all series be integrated of order 1, meaning they must be I(1). Since the industry and manufacturing sector series meet this requirement, they were considered for the Johansen test. The results, presented in Table 3, indicate a long-term linkage between manufacturing credit and economic growth. However, no evidence of co-integration was found for industrial variables.

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

To analyze short-run relationships, the Granger causality test was employed. This test requires that both series exhibit zero-mean stationarity and follow a trend. To meet this condition, the series were first made stationary, and the mean value was deducted to achieve zero-mean stationarity. The appropriate number of lags for the Granger test was determined using the Final Prediction Error (FPE) and Akaike Information Criterion (AIC), as proposed by Akaike (1969, 1974). The results of the test are presented in Table 4, while Table 5 displays the outcomes of the Granger causality tests conducted 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:

GDP data indicates a significant improvement in the average growth rate during the 1990s. The year 1992 was selected as the breakpoint, and a dummy regression was conducted on the difference in log levels of GDP to validate this choice. The results of this analysis, which support the selection of 1992 as the breakpoint, are presented in Table 6.

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 D₀ = 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 stationarity of credit growth and GDP growth variables was examined using the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The results of these tests are presented in 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

The results of the co-integration test indicate that a long-term relationship between overall economic growth and total credit existed from 1952 to 1992. However, this association is not observed in the post-1992 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 results of the Granger causality test are presented in Table 9. Additionally, Table 10 provides the outcomes of the causality tests conducted on the zero-mean stationary variables and trends.

Table 12
Series 2 – 1993 – 2014

Variables	Number of Lags	
	AIC	FPE
DDLTOTGVA 6 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 \rightarrow DLTOTC	0.000	2.209x10 ⁻⁵ ***
DLTOTGVA \leftarrow 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 \rightarrow DDLTOTC	0.0623**	0.0623**
DDLTOTGVA \leftarrow DDLTOTC	0.697	0.697

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

Analysis

Our analysis reveals a long-term co-integration relationship between manufacturing credit and manufacturing GDP; however, no such relationship was found between industrial credit and industrial GDP, indicating that these variables are not co-integrated. The Granger causality test further suggests that GDP leads credit in both the industrial and manufacturing sectors. Additionally, the GDP data confirms a structural break in 1992, prompting the division of credit and GDP data into two distinct periods:

Series 1 (1951–1992) and Series 2 (1993–2014). The findings indicate that while Series 1 exhibits a long-term co-integration relationship between credit and GDP, Series 2 does not. Moreover, for both periods, the results of the directional Granger causality tests suggest that GDP Granger-causes credit. A summary of these findings is presented in Table 15.

Table 15
Summary of Conclusions: Test for Granger Causality

Annual : 1973 -2014				
No.	Null Hypothesis	Lags	p-value	Conclusion
1	Industrial GVA \rightarrow Industrial Credit	7	0.0193**	Yes
2	Industrial Credit \rightarrow Industrial GVA	1	0.9558	No
3	Manufacturing GVA \rightarrow Manufacturing Credit	1	0.0158**	Yes
4	Manufacturing Credit \rightarrow Manufacturing GVA	1	0.8881	No
Annual : 1952 – 1992				
5	Total GVA \rightarrow Total Credit	2	2.209x10 ⁻⁵ ***	Yes
6	Total Credit \rightarrow Total GVA	2	0.3232	No
Annual : 1993 - 2014				
7	Total GVA \rightarrow Total Credit	1	0.0413**	Yes
8	Total Credit \rightarrow Total GVA	1	0.498	No

CONCLUSION

The study aimed to examine the impact of credit growth on the economic growth of the Brazilian economy by testing the long-term co-integration between credit and GDP. Additionally, it sought to determine whether a causal relationship exists between credit and GDP and to identify the direction of causality. The Johansen test and Granger causality test were employed to analyze the relationship between these variables. The empirical findings indicate a long-term co-integration relationship between credit and GDP in the manufacturing sector. Furthermore, this relationship was also observed in the overall GDP and credit data during the early phase of Brazil's economic growth. However, this long-term association breaks down after 1992. Despite this, a short-term causal relationship persists, with GDP leading credit for both sectoral and overall data.

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Conflict of Interest

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