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The impact of economic instability on credit concessions: the case of the Covid-19 pandemic

El impacto de la inestabilidad económica en la concesión de créditos: el caso de la pandemia de la Covid-19

O impacto da instabilidade econômica na concessão de crédito: o caso da pandemia da Covid-19

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Abstract

Purpose: This research aims to analyze the impacts of the economic instability caused by Covid-19 on the volume of credit issuance in Brazil.

Methodology: The research methodology employed time series regression models in the Brazilian market and was based on historical values of macroeconomic variables. The study period spans from February 2013 to April 2023, divided into pre-pandemic (02/2013-02/2020) and pandemic (03/2020-04/2023) periods.

Results: It was observed that the impact of the Covid-19 pandemic on credit issuance volume was minor when controlling for other macroeconomic characteristics. There are indications that only the year 2020 exhibited more significant variations, with the average during the 2020 to 2023 period being not so different from the pre-pandemic period.

Contributions of the Study: This study suggests that the crisis had only a temporary effect and that the economic measures taken during this period may have contributed to the recovery, indicating preparation for future pandemics that experts expect to occur.

Keywords: Covid-19; Credit Issuance Volume; Economic Impact.

Resumen

Objetivo: Esta investigación tiene como objetivo analizar los impactos de la inestabilidad económica causada por Covid-19 en el volumen de concesión de créditos en Brasil.

Metodología: La metodología de investigación empleó modelos de regresión de series temporales en el mercado brasileño y se basó en valores históricos de variables macroeconómicas. El período de estudio abarca desde febrero de 2013 hasta abril de 2023, dividiéndose en períodos previos a la pandemia (02/2013-02/2020) y de pandemia (03/2020-04/2023).

Resultados: Se observó que el impacto de la pandemia de Covid-19 en el volumen de concesión de créditos fue menor al controlar otras características macroeconómicas. Hay indicios de que solo el año 2020 presentó variaciones más significativas, siendo el promedio durante el período 2020-2023 poco diferente al período previo a la pandemia.

Contribuciones del Estudio: Este estudio sugiere que la crisis tuvo solo un efecto transitorio y que las medidas económicas tomadas durante este período pueden haber contribuido a la recuperación, lo que indica una preparación para futuras pandemias que los expertos esperan que ocurran.

Palabras clave: Covid-19; Volumen de Concesión de Crédito; Impactos Económicos.

Resumo

Objetivo: Esta pesquisa tem o objetivo de analisar os impactos da instabilidade econômica causada pela Covid-19 no volume da concessão de crédito no Brasil.

Metodologia: A metodologia utilizada na pesquisa foi realizada a partir de modelos de regressão de séries temporais no mercado brasileiro e com base nos valores históricos de variáveis macroeconômicas. O período estudado é de fevereiro de 2013 até abril de 2023, sendo divididos períodos pré-pandemia (02/2013-02/2020) e de pandemia (03/2020-04/2023).

Resultados: Foi verificado que o impacto da pandemia da Covid-19 foi pequeno no volume de concessão de crédito ao controlar-se por outras características macroeconômicas. Há indícios de que apenas o ano de 2020 tenha tido maiores variações, sendo a média do período de 2020 a 2023 pouco diferente do período anterior à pandemia.

Contribuições do Estudo: Esse estudo traz indícios de que a crise teve um efeito apenas transitório e que as medidas econômicas tomadas nesse período podem ter ajudado na recuperação, o que indica uma preparação para futuras pandemias que especialistas esperam que venham a acontecer.

Palavras-chave: Covid-19; Volume de Concessão de Crédito; Impactos Econômicos.

1 Introduction

The Brazilian market has shown a growing evolution in the last two decades. With greater monetary stability in the country from 2003 to 2014, there was an increase in the overall credit dynamics. The disruptions in the financial and capital markets have been constant in recent years. The research by Ivashina and Scharfstein (2010) found that during the subprime crisis, the level of credit provided to large borrowers dropped by 47% at the peak of the financial crisis.

Previous research has shown that, in times of crisis, the provision of credit by banks decreases (see De Haas & Van Horen, 2013; D'Aurizio, Oliviero, & Romano, 2015; Sääskilähti, 2016; Barros, Silva, & Oliveira, 2021; Kapan & Minoiu, 2018; Çolak & Öztekin, 2021). This happens because the higher volume of credit operations in the National Financial System follows these periods of financial crisis in the value of new credit operations. Therefore, there is an impact of the economic system on the volume of credit concessions, which according to Freitas (2009), in these contexts, banks tend to reduce credit concession in three ways: by decreasing lines and terms, increasing interest rates, and/or raising collateral requirements. According to her, this generates a vicious cycle since these attitudes contribute to the financial fragility of their clients, increasing defaults and risk aversion, thus restraining economic growth or leading to a regression in production and investments. This happened in the subprime crisis, as banks faced liquidity issues, resulting in a significant reduction in the credit provision, which proved to be an important factor in the onset of the recession (Berger & Demirgüç-Kunt, 2021).

For Mota (2020), it is possible that the worsening financial conditions caused by the economic crisis due to the Covid-19 pandemic may trigger a credit crisis or a recession in several countries. Khan (2022) understands that the Covid-19 pandemic represented an aggregate demand and supply shock for lenders and borrowers because it interrupted the revenue flows of businesses with fixed costs, making it difficult to obtain credit, since banks are reluctant to lend to borrowers with low credit quality and low asset values. Their results showed that companies that already had credit difficulties before the pandemic were more likely to delay payments on bank loans compared to companies that did not have this restriction, justifying the greater difficulty in obtaining credit during this period.

Given the scenario presented, this work seeks **to analyze the impacts of the economic instability caused by Covid-19 on the volume of credit concession in Brazil.**

To achieve this goal, we analyzed the impact of economic indicators on the volume of credit concession by Financial Institutions in Brazil between February 2013 and April 2023, including the complete period of the pandemic, as in early May 2023, the World Health Organization (WHO) declared the end of the Public Health Emergency of International Concern caused by the Covid-19 pandemic.

The results suggest that only the year 2020 impacted the volume of credit concession, with no impact observed throughout the entire period of the Covid-19 pandemic. The volume

of concession remained practically unchanged during this period, being more affected by macroeconomic variables such as GDP, unemployment rate, previous period default, etc.

Research demonstrating the impact of Covid-19 on the economy is of great importance to academia. At the beginning of the pandemic it was expected a significant impact of lockdowns and virus prevention measures on the economy, and there were several debates on whether they would harm the economy. This research provides an insight into what happened during this period and can help in future similar situations to have an idea of what to expect.

Many studies have been conducted to assess the impact of the pandemic on the stock market, but little research has been done on the credit market. The volume of credit concession is a relevant topic because it also reflects the choices made by the financial sector, which directly impact the daily lives of families and businesses of all sizes. In times of crisis, the social differences in these choices made by financial institutions can be more clearly seen, as previous research has shown that the reduction in credit concession was greater for those who needed credit the most (Çolak & Öztekin, 2021; Khan, 2022).

2 Literature Review

The emergence of the financial market arises from the need for the exchange of resources between agents who have more resources and others who need them (Andrezo & Lima, 2002). This transfer between surplus and deficit agents occurs through the financial market. According to these authors, there is a long-term relationship between the capital market and economic growth using a categorization of the financial market and a conceptual and historical analysis with data from operations carried out on the stock exchange.

The credit market can meet the cash needs of these deficit economic agents through loans, according to Assaf Neto (2001). Therefore, credit concession is essential because through this resource there is market movement favoring economic development (Segura, Molini, & Ferreira, 2016).

The reverse path is also valid, meaning that the dynamics of the economy directly affect the credit market, especially in times of economic crisis. Reed and Gill (1994) explain the causality between the volume of loans granted by financial institutions and their ability to contribute to the economic development of a society.

2.1 Credit and Financial Crisis

Several studies have analyzed the relationship between the reduction in loans and the 2008 crisis (De Haas & Van Horen, 2013; D'Aurizio et al., 2015; Säskilahti, 2016; Kapan & Minoiu, 2018). De Haas and Van Horen (2013) examined how large international banks reduced their cross-border loans after the collapse of Lehman Brothers. The authors found, however, that banks reduced credit to a lesser extent for markets that were geographically close, where they had more experience, operated a subsidiary, or were integrated into a network of domestic co-lenders.

D'Aurizio et al. (2015) analyzed the difference in access to bank loans between Italian family and non-family businesses in the context of the crisis. The results indicated that there was a reduction in loan uptake, but in family businesses this decrease was less abrupt.

Säskilahti (2016) studied whether the effects of the 2008 financial crisis on volumes and prices of loans to small businesses depended on the pre-crisis local competitive environment. Finnish cooperative banks were studied between January 2004 and October 2010.

The author found that monthly volumes of new commercial loans decreased and average loan margins increased with the crisis, being higher in local banking markets that were more competitive before the crisis due to competition leveling.

Kapan and Minoiu (2018) also analyzed the 2008 financial crisis, but they studied the relationship between the financial health of banks and the strength of the transmission of shocks from the financial sector to the real economy. Their results indicated that banks with stronger balance sheets, particularly higher levels of common equity, were able to maintain credit supply more effectively when faced with liquidity shocks during the crisis.

In Brazil, Barros et al. (2021) found that private banks significantly reduced the loans granted during the most acute phase of the 2008 crisis, unlike public banks, which increased the volume of concessions in the same period. They concluded that the latter contributed to mitigating the impact of the crisis on credit concession in Brazil.

All previous research indicates that in times of crisis there is a reduction in the level of credit, with this reduction being greater or lesser depending on the aspect analyzed. This may be related to the study by Monteiro and Teixeira (2009), who, through interviews, sought to study the confidence of managers of creditor companies in providing credit to companies in financial recovery. They found that this will depend on specific attributes of the managers of companies in this situation, such as capacity, quality, behavioral aspects, and citizenship. Thus, it is possible to understand that credit supply will be reduced in periods of widespread crises, but different companies and individuals will have different credit reductions given the analysis of the creditor.

2.2 Studies on the impact of Covid-19

In early 2020, at the beginning of the Covid-19 pandemic, there was a slowdown in the economies of Asia and Europe, impacting Brazil's main trading partners (Comexstat, 2020). This culminated in one of the largest demand shocks in recent years. With uncertainty in the economic scenario increasing as economic activity decreased with the decrease in imports and exports. There were mass layoffs, business bankruptcies, and, consequently, a retraction in credit supply by the banking sector, as a result of increased investment risk.

Çolak and Öztekin (2021) studied the influence of the pandemic on bank credit in 125 countries and identified banking and country characteristics that amplify or weaken the effect of the disease outbreak on bank credit. They found that bank credit is weaker in countries more affected by the crisis.

Khan's (2022) research studied whether financing constraints affected the ways in which small and medium-sized enterprises (SMEs) faced the economic disruptions caused by the Covid-19 pandemic, using data from the Covid-19 Business Impact Surveys conducted in 19 countries by the World Bank Enterprise Analysis Unit. He found that companies with previous credit problems before the pandemic were more likely to replace bank credit with government assistance as the main source of financing to deal with liquidity shortages and credit risk induced by the pandemic.

Both of the aforementioned studies demonstrate that individuals and companies facing greater difficulties, and likely with the greatest credit needs, tended to have even more difficulty obtaining loans and financing during the pandemic. The origin of the Covid-19 crisis, however, is considerably different from the 2008 financial crisis, as the former is related to a public health crisis and the latter is a banking crisis (Berger & Demirgüç-Kunt, 2021). However, there were significant government interventions that incurred costs to the economy.

Based on the aforementioned research, the hypothesis of this study is:

Hypothesis: **The Covid-19 pandemic reduced the volume of credit concessions in Brazil.**

3 Methodological Procedures

For the purposes of this research, a multiple linear regression technique was used. The aim of this study was to analyze the relationship between the volume of credit concessions and the period of health and financial crisis caused by the Covid-19 pandemic in Brazil. The final sample consisted of a time series with 123 observations related to the Brazilian credit market.

Mendonça, Medrano, and Sachsida (2010) investigated the effects of the amount of money in circulation, credit, and interest rates on the Brazilian economy. The result of this study indicates that macroeconomic variables affect all sectors of the economy, and consequently, also the credit concession market. On the other hand, Araújo, Lustosa, and Paulo (2018) investigated the relationship between PECLD and economic crises, controlling for the effect of several macroeconomic variables, which were found to be significant. Given that various factors beyond the pandemic could impact the volume of credit concessions, control variables based on previous studies were included. The final model of this research is presented in equation (1).

$$\text{Conc}_t = \alpha + \beta_1 \text{Covid}_t + \beta_2 \text{GDP}_t + \beta_3 \text{Unem}_t + \beta_4 \text{IPCA}_t + \beta_5 \text{ICC}_t + \beta_4 \text{Default}_{t-1} + \varepsilon_t \quad (1)$$

The description of each variable in the model is presented in Table 1. It is important to note that all variables in this model have a monthly periodicity.

Equation (1) demonstrates that this study used a time series model to test the research hypothesis. The results of Nelson and Plosser (1982) show that macroeconomic variables tend to have a unit root, meaning they are non-stationary time series with a trend. On the other hand, Perron (1989) concluded that most macroeconomic time series are not characterized by the presence of a unit root and fluctuations are stationary and functions of a deterministic trend. Smith (1999) understands that the lack of consensus on the existence of a unit root is due to the fact that the tests are highly sensitive to the sample used, the number of lags, the inclusion of an intercept, etc. Nevertheless, the presence of a unit root can be a problem as it can lead to spurious correlations. Therefore, all variables were tested for a unit root using the augmented Dickey-Fuller test. When the presence of a unit root was verified, the first differences were used for transformation and new tests were performed, and none of the new variables contained a unit root.

Table 1
Presentation and Description of Variables

Variable	Descriptive	Source	Expected Sign
Dependent			
Concession (Conc)	Difference in total Credit Concessions (millions of BRL) from t to t-1.	Bacen	
Independent			

Pandemic (Covid)	Binary variable that is 1 during the Covid-19 pandemic period and 0 otherwise. The pandemic period was considered from March 11, 2020, when it was declared by the World Health Organization (WHO).	WHO	-
Year 2020	Binary variable that is 1 when the period refers to 2020 and 0 otherwise.		-
Controls			
GDP	Difference in the total Gross Domestic Product in current monthly values (R\$ millions) from t to t-1.	IBGE	+
Unemployment (Unem)	Difference in percentage points of the Unemployment Rate, calculated by the Continuous National Household Sample Survey, from t to t-1.	IBGE	-
IPCA	Difference in percentage points of the Extended National Consumer Price Index (a.k.a. IPCA, Índice Nacional de Preços ao Consumidor Amplo) from t to t-1.	IBGE	-
ICC	Difference in percentage points of the Average cost of outstanding loans (a.k.a. ICC, Indicador de Custo do Crédito) from t to t-1	Bacen	-
Default	Difference in percentage points of the Credit Portfolio Default from t-1 to t-2.	Bacen	-

Source: research data.

For the studied period, the initial dates of the historical data were made available at different times. For IPCA, for example, the first date in the Brazilian Institute of Geography and Statistics (IBGE – Instituto Brasileiro de Geografia e Estatística) had data from January 1980. On the other hand, for ICC, information has been released by the Brazilian Central Bank (Bacen – Banco Central do Brasil) since 2013. Thus, the analysis period of the study was restricted to the largest intersection available in the cross-section of all information, that is, between January 2013 and April 2023.

The independent variable was tested in two ways: first, controlling for the entire period of the pandemic until the declaration of the end of the emergency by the WHO, and second, only for 2020. The idea of controlling for a shorter period is due to the fact that in 2020 there was no forecast for the end of the emergency situation, few public policies were in place for economic recovery, and vaccines were not yet available to combat the virus. It was expected that this year would have a greater impact than the complete period, which includes the vaccination period and the release of mask use. The variable for 2020 included January and February, since even though the WHO declaration had not yet occurred, China, whose market directly impacts the Brazilian market, was already experiencing the shocks of Covid-19.

GDP is the indicator that measures the level of economic activity in a country, so its variation is relevant for the analysis of economic stability. Fucidji and Prince (2009) found that GDP is an important determinant of bank credit in Brazil. Based on the result of this research, it was expected that the higher the GDP, the higher the volume of credit concessions.

Inflation, or IPCA, on the other hand, indicates the variations in the general prices of consumed products, which would directly impact the purchasing power of a society and the possible need for credit or investment, thus impacting the volume of credit demanded. Also included as controls were the unemployment rate, the credit cost indicator - which burdens families and companies that have taken credit in the National Financial System (Bacen, 2018) - and the delinquency of the credit portfolio from the previous period. In all of them, a negative relationship with the volume of credit concessions is expected because they indicate possible

difficulties for individuals and legal entities to comply with their credit obligations, added to a greater need for capital.

Also included as controls were the unemployment rate, the average cost of outstanding loans – which burdens families and companies that have taken credit in the National Financial System (Bacen, 2018) – and the credit portfolio default from the previous period. In all of them, a negative relationship with the volume of credit concessions is expected because they indicate possible difficulties for individuals and legal entities to comply with their credit obligations, added to a greater need for capital.

The historical data were obtained from the Credit Information System (SCR – Sistema de Informações de Crédito) of the Central Bank. The Stata® software was used for data analysis.

To ensure the adequacy of the model to Ordinary Least Squares (OLS) assumptions, several tests were conducted. The residuals were tested using the Shapiro-Wilk test (p-value 0.1915) and Shapiro-Francia test (p-value 0.1217), and neither of them found a problem of normality of the residuals at a significance level of 1%. The Breusch-Pagan and Cook-Weisberg test indicated homoscedasticity (p-value 0.8997) in the model at 1% significance level, and the Variance Inflation Factor (VIF) test of 1.09 did not indicate any multicollinearity problem. At a significance level of 1%, the hypothesis of autocorrelation is rejected (p-value 0.0323) in the LM test of Breusch-Godfrey. Furthermore, it was also verified that there are no omitted variables, according to the RESET test (p-value 0.2401), and the model is well-specified (p-value 0.596). These tests refer to the model in which Covid was controlled for the entire period of the WHO-declared emergency situation. It is worth noting that the results remain the same for the models in which the variable was used only for 2020.

4 Results

Table 2 provides a description of the behavior of the variables used in this study during the period under analysis. It is worth noting that between February 2013 and April 2023, there were atypical periods in the economic and social context.

Table 2

Descriptive Statistics of the variables in first difference

Variable	N	Mean	Standard Deviation	Median	Min	Max
Concession	123	1,591.862	39,255.29	4,567	-105,210	113,066
GDP	123	3,786.206	24,500.86	2,222.40	-68,585.10	99,613.90
Unemployment	123	0.0098	0.3250	-0.0999	-0.6999	0.7999
IPCA	123	-0.0020	0.3682	0.0300	-1.3500	0.8800
ICC	123	0.0207	0.2354	0.0399	-0.5699	0.6200
Default	123	-0.0021	0.1012	0.0200	-0.3599	0.1800

Source: research data.

The level of credit concession has been showing a nominal growth since the beginning of the analyzed period, and its first difference form has exhibited high variability around the mean. Similarly, the monthly GDP has been increasing in the historical series and has a high variability in the studied period. The unemployment rate has had variations during the period due to an increase until 2017 and a decline from 2021 onwards. The IPCA did not show an observable trend, but like the previous variables, this inflation index varied significantly, with the highest

peak in 2022. The first differences of the ICC and the default rate also showed a high standard deviation in relation to the mean, indicating high variability.

Table 3 presents the correlation between the studied variables.

Table 3

Correlation

Variable	Conc	GDP	Unem	IPCA	ICC	Default
Concession	1.000					
GDP	0.7137***	1.000				
Unemployment	-0.1236	0.0343	1.000			
IPCA	0.2155**	0.1909**	-0.0687	1.000		
ICC	-0.4286***	-0.2457***	0.0003	-0.1394	1.000	
Default	0.1898**	-0.0007	-0.0248	-0.0107	0.2335***	1.000

* p<0.10, ** p<0.05, *** p<0.01

Source: research data.

According to Table 3, there is a higher correlation between the volume of concessions and the variables GDP, IPCA, ICC, and Default. It is not possible to verify the relationship with Covid-19 yet. However, it is important to note that correlation is a relationship between two variables only, which makes it necessary to verify if these relationships hold in a multivariate scenario. For this reason, a Multiple Linear Regression was performed, as shown in Table 4.

Table 4

Regression Model with concessions as the dependent variable

	Model 1 Full Period 2020-2023	Model 2 Partial Period 2020
Covid	-2,927.306 (4,689.646)	-15,878.38* (8,168.654)
GDP	1.015*** (0.0906)	0.9899*** (0.0891)
Unemployment	-17,223.73** (6,629.802)	-12,694.52* (6,671.003)
IPCA	4,575.598 (5,857.515)	4,432.6 (5,774.463)
ICC	-54,201.24*** (9,611.365)	-63,889.25*** (10,456.05)
Default	102,882*** (21,400.12)	98,168.3*** (21,203.96)
Cons.	12.3838 *** (2,554.71)	963.3906 (2,295.68)
N	123	123
R ²	0.6677	0.6771
Adjusted-R ²	0.6506	0.6604

* p<0.10, ** p<0.05, *** p<0.01

Model 1 for the full period uses a binary variable for the entire period when the WHO considered the Covid-19 pandemic a state of emergency, i.e., March 2020 to April 2023. Model 2 for the partial period considers in the binary variable only the year 2020, including January and February of that year.

Source: research data.

According to the results in Table 4, Model 1, for the full period, has an explanatory power of 65.06%, while with the binary variable only for 2020, it is 67.71%. It was found that at least one coefficient is different from zero ($F = 38.86$ for the full period and $F = 40.55$ for 2020). Therefore, at least one variable presented is statistically significant in explaining the variability of credit concessions, indicating that the regression model can be statistically significant for forecasting purposes.

It is not possible to observe the impact of the Covid-19 pandemic on the volume of credit concessions in the model that studies the full period, since the binary variable did not show statistical significance. However, when controlling only for the year 2020, it is noticed that there was a negative impact of this period on the level of credit concessions, as expected given the literature on previous crises. It is possible that the years 2021, 2022, and 2023 had little impact compared to the pre-pandemic period because the credit market was very pessimistic in 2020, which reversed for the following years.

The majority of the control variables are statistically significant at 5%. This is in line with Mendonça et al (2010), which found a significant relationship between the variation in credit concession and the variation in the unemployment rate, i.e., the higher the number of unemployed people, the greater the need for credit. GDP and IPCA also have a positive relationship with Credit Concession Volume, meaning that the greater the variation in these variables, the greater the variation in credit granting volume. On the other hand, the higher the variation in the Cost of Credit, represented by the ICC, the more difficult it is to obtain financial assistance. Interestingly, the greater the variation in the level of default from the previous period, the greater the variation in credit volume, which may indicate that the demand for credit increases for the payment of old debts.

4.1 Complementary Tests

A test was conducted comparing pre-pandemic and pandemic-period samples to verify if the average volume of credit concessions is equal. Through the non-parametric Wilcoxon/Mann-Whitney test for independent samples, it was found that there is no evidence of a difference ($p\text{-value} = 0.5508$).

To further investigate the impact of the pandemic, the data was run separately for the pre-pandemic and pandemic periods. The results are presented in Table 5.

Table 5
Regression Models for Pre- and During-Pandemic Periods

	Model 3 Pre-Pandemic	Model 4 Pandemic
GDP	0.9124*** (0.1173)	1.0881*** (0.1706)
Unemployment	-10,511.49 (8,388.13)	-21,302.3 (15,955.27)
IPCA	8,256.249 (6,537.24)	193.932 (12,370.09)
ICC	-62,120.31*** (12,278.73)	-52,805.32** (22,770.78)
Default	111,468.6*** (21,484.36)	84,478.78* (51,265.08)
Cons.	85.1183	-3,639.06

	(2,097.88)	(5,579.30)
N	85	38
R ²	0.6510	0.6888
Adjusted-R ²	0.6289	0.6402

* p<0.10, ** p<0.05, *** p<0.01

Model 3, pre-pandemic, contains data from February 2013 to February 2020. Model 4 corresponds to data from March 2020 to April 2023.

Source: research data.

The signs and significances of the models in Table 5 are similar to those in Table 4. The pandemic results (Model 4) in Table 5 show that excluding the pre-pandemic period did not change the statistical significance of the variables compared to the model in Table 4. However, the explanatory power of the model showed a slight increase. This is an indication that the pandemic had little influence on the level of credit concession.

Both the volume of credit concessions and the default rate have separate information for legal entities and individuals, provided by the Central Bank. Therefore, tests were performed based on Model 1 and considering the first differences of these two variables; the results are presented in Table 6.

Table 6
Regression Models for Legal Entities and Individuals

	Model 5 Legal Entities	Model 6 Individuals
Covid	-1,096.5 (3,713.12)	-842.8787 (1,937.46)
GDP	0.6025*** (0.0718)	0.4082*** (0.0372)
Unemployment	-9,990.57* (5,248.04)	-7,569.31*** (2,726.9)
IPCA	6,403.27 (4,637.21)	-1,718.75 (2,412.51)
ICC	-36,861.96*** (7,496.90)	-13,317.6*** (3,959.99)
Default	63,145.12*** (13,276.35)	9,171.29 (8,674.44)
Cons.	-599.6981 (2,019.24)	241.6129 (1,060.17)
N	123	123
R ²	0.5793	0.5909
Adjusted-R ²	0.5575	0.5697

* p<0.10, ** p<0.05, *** p<0.01

In model 5, legal entities, the variables Volume of credit concession (dependent variable) and Default (control variable) refer to specific information for legal entities. Model 6 refers to data on individuals for these same variables.

Source: research data.

The models 5 and 6 are equivalent to model 1 since they analyze the entire period of the pandemic. The substitution for a binary variable for 2020, like in model 2, did not alter the results presented in Table 6 and therefore were not presented here.

Overall, the results remain the same. The Covid variable remains insignificant when separating the information between legal entities and individuals. However, it is observed that

the unemployment rate is less significant in explaining the volume of credit concessions for legal entities, while the variation in default rates for individuals did not prove to be significant in explaining the volume of credit concessions for individuals.

4.2 Robustness and sensitivity analysis of the model

To verify if the results remain consistent with different models, several tests were performed by altering Model 1. Firstly, considering the existence of another crisis in the analyzed period (2015-2016), two binary variables were included in Model 1 to control for these two years, and the results remained the same, both in terms of significance and signs, reinforcing the previously found results.

Furthermore, the lagged default rate variable was replaced by its current version, and all other variables remained equally significant and with the same sign. The only change observed was in the default variable itself, which became not significant. This demonstrates that the impact that can be found from default on the volume of credit concession is from the existing historical data and not from the current situation.

Additionally, a control for the Target for federal funds rate (Selic) was added, which proved to be significant at 1%, but caused the unemployment variable to lose its significance (p-value = 0.114). It is worth noting, however, that this model did not pass the tests for normality of residuals and serial correlation. Furthermore, the model was tested with the average monthly interest rate for credit operations provided by Bacen, and all results remained consistent, with this variable being significant at 10% (p-value = 0.06).

To verify the relationship between the model variables and Covid, interactions between the binary and all control variables were included. None of the interactions were significant, and the main pandemic variable remained non-significant.

Replacing the lagged total default variation with its versions for individuals and legal entities also maintained the results, with both being significant (p-value for Legal Entity = 0.055 and for Individual = 0.024).

Analyzing the robustness of the results of model 2, the aforementioned tests were also performed for model 1. Including binary variables for 2015 and 2016 did not alter the results of model 2, and the 2020 variable remained significant at 10% (p-value = 0.079).

Replacing the lagged default variable with its current version also maintained the significances, except for the unemployment variable, which ceased to be significant. On the other hand, the significance of the 2020 variable increased (p-value 0.024). Similarly to the analysis of model 1, here the current default variable also did not show significance.

Adding the Selic rate maintained the results, but model 2 failed the test for normality of residuals and serial correlation. As an alternative, the average monthly interest rate for credit operations was applied, which was significant and did not alter the results regarding the influence of 2020 on the volume of credit concessions, which remained significant at 10% (p-value = 0.095).

Finally, when including the interactions, the same results were found, and none of them were significant in explaining the volume of credit concessions.

5 Final Remarks

In this study, we analyzed the impacts of economic instability caused by Covid-19 on the volume of credit concession in Brazil.

The proposed purpose was achieved, and the results show that the overall period of the pandemic did not have an impact on the volume of credit granted, but when analyzing only 2020, there are indications of a reduction in this level.

The results indicate that there was economic pessimism during the year of 2020 due to lockdowns and other measures adopted by municipal, state, and federal governments, even before the WHO declared the pandemic, as the Chinese economy had already been affected by the disease since December 2019. To reduce the economic impact that prevention measures could bring, actions such as the reduction of the basic interest rate by the Monetary Policy Committee (Copom – Comitê de Política Monetária), adoption of monetary easing policies and credit incentives by the Central Bank, among others, may have helped prevent greater negative impacts of the crisis on the Brazilian economy.

These actions, combined with the application of vaccines, led to a relaxation of sanitary measures in the following years to prevent the spread of the contagion, which reduced pessimism and allowed for an economic recovery, thus returning to pre-pandemic levels of credit granting.

The results also allowed for the identification of the factors that most influence the volume of credit granting, contributing to policymakers in times of financial crisis. It was found that significant impacts of the crisis can be avoided when there is control over production, unemployment, and the cost of credit.

The results also allowed for the identification of the factors that most influence the volume of credit granting, contributing to policymakers in times of financial crisis. It was found that significant impacts of the crisis can be avoided when there is control over production, unemployment, and the cost of credit.

The results obtained fill the research gap regarding the impact of Covid-19 on the Brazilian economy, as it was initially expected that these impacts would be negative and highly significant due to preventive measures. Research on the impacts of crises, whatever their nature, is important to be prepared for future crises, especially given the ease with which the virus spread, leading to a pandemic just a few months after the contagion began, and experts' assertions that there may be others in the future (CNN Brazil, 2023).

This study complements previous research that investigated the impact of crises on the volume of credit concession, being useful for the market as it demonstrates that there was an overestimation of economic impacts, at least in relation to what was studied. Furthermore, as measures were taken to prevent greater consequences, this research provides indications that they were effective. However, this research did not aim to analyze the individual effectiveness of each measure adopted, which is a limitation of the findings. Another limitation is that the results can only be applied to Brazil, and cannot be generalized to other countries since the economic context is different, as well as the measures adopted for disease prevention and economic control.

Therefore, it is suggested that future research should study other countries to compare with the results obtained in Brazil, to verify if different measures or timing of their implementation had different effects. Another suggestion is to continue the research using data after the pandemic, which is not yet possible, given the amount of available periods for study.

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