

## **ECONOMIC DETERMINANTS OF COMPANY MORTALITY IN BRAZIL IN THE RECENT PERIOD**

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### **Resumo**

Resumo: Em 2020, foi declarada a pandemia ocasionada pelo “novo coronavírus 2019 (2019-nCoV)” (OMS, 2020<sup>a</sup>). As medidas de isolamento social apesar de mais eficazes para conter a disseminação do vírus, causam consequências socioeconômicas. Sendo assim, é esperado que o número de empresas insolventes volte a crescer em 2021. Este trabalho objetiva verificar os determinantes econômicos da mortalidade de empresas nas cinco macrorregiões brasileiras entre os anos de 2019 e 2020, capturando o efeito da pandemia. Para empreender a análise bibliográfica foi realizada uma busca no periódico Capes, utilizando as técnicas de pesquisa de rede e anzol para mapear o máximo de artigos resultantes da pesquisa pelas palavras-chaves e realizar o levantamento do ano de publicação, autores e quantidade de citações. Para estimação de resultados, foi utilizado um painel de dados mensal entre janeiro de 2019 a dezembro de 2019, totalizando 120 observações. Após a realização dos testes de Breusch-Pagan e Hausman concluiu-se que o modelo mais apropriado para analisar os determinantes da solvência das empresas em âmbito regional foi o estimador de efeitos fixos.

**Palavras-chave:** Determinantes Econômicos, Mortalidade de Empresas, Pandemia.

### **Abstract**

In 2020, the pandemic caused by the “new coronavirus 2019 (2019-nCoV)” was declared (OMS, 2020a). Social isolation measures, although more effective to contain the spread of the virus, have socioeconomic consequences. Therefore, the number of insolvent companies is expected to grow again in 2021. This work aims to verify the economic determinants of company mortality in the five Brazilian macro-regions between 2019 and 2020, capturing the effect of the pandemic. To undertake the bibliographic analysis, a search was carried out in the Capes journal, using the net and hook search techniques to map the maximum number of articles resulting from the search by keywords and carry out a survey of the year of publication, authors and number of citations. To estimate the results, a monthly data panel between January 2019 and December 2019 was used, totaling 120 observations. After performing the Breusch-Pagan and Hausman tests, it was concluded that the most appropriate model to analyze the determinants of solvency of companies at a regional level was the fixed effects estimator.

**Keywords:** Determinants, Company Mortality, Pandemic.

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## **ABSTRACT**

In 2020, the pandemic caused by the “new coronavirus 2019 (2019-nCoV)” was declared (OMS, 2020a). Social isolation measures, although more effective to contain the spread of the virus, have socioeconomic consequences. Therefore, the number of insolvent companies is expected to grow again in 2021. This work aims to verify the economic determinants of company mortality in the five Brazilian macro-regions between 2019 and 2020, capturing the effect of the pandemic. To undertake the bibliographic analysis, a search was carried out in the Capes journal, using the net and hook search techniques to map the maximum number of articles resulting from the search by keywords and carry out a survey of the year of publication, authors and number of citations. To estimate the results, a monthly data panel between January 2019 and December 2019 was used, totaling 120 observations. After performing the Breusch-Pagan and Hausman tests, it was concluded that the most appropriate model to analyze the determinants of solvency of companies at a regional level was the fixed effects estimator. The dependent variable of the analysis is the companies' mortality rate. The economic variables used as explanations are: demand for credit by the entrepreneur, cost per m<sup>2</sup>, value of the average electricity tariff, number of jobs and average salary of workers. It can be concluded that the findings for the variables demand for credit, cost of m<sup>2</sup> and electricity tariff were similar to those presented in the literature, that although the literature uses the level of economic activity to explain the mortality of companies, the results found revealed that , at the regional level, this is not valid, that the pandemic impacted the mortality of companies and that the provisional measures contributed significantly to the maintenance of Brazilian companies during this period.

Keywords: Economic Determinants, Company Mortality, Pandemic.

## 1. INTRODUCTION

In 2016, the number of bankruptcies peaked at 1.8 thousand companies (SERASA, 2021) and the population unemployment rate was 13.7% (IBGE, 2021). In 2017, 1,700 companies filed for bankruptcy (SERASA, 2021) and the unemployment rate reached 13.1%. Between 2018 and 2019, the number of bankruptcies showed a relative small improvement, despite reaching a high level of 1.4 thousand companies (SERASA, 2021). However, when comparing the unemployment rate, it fell from 12.7% in 2018 to 11% in 2019 (IBGE, 2021). Based on these data, it is possible to infer that as of 2018 the business environment in Brazil had been showing signs of improvement.

In 2020, the World Health Organization (WHO) declared public health emergency of international concern for the global outbreak of the new coronavirus 2019 (2019-nCoV)" (WHO, 2020a), also known as "Coronavirus Disease 2019 (Covid-19)" (BAE, 2020; WHO, 2020b). Social isolation measures (i.e. "Lockdowns"), despite being more effective to contain the large-scale dissemination of Covid-19, cause short, medium and long-term socioeconomic consequences, due to reduced demand and interruption of production processes. Like other global economies, the Brazilian economy, which had been fragile since 2014, suffers from the significant impacts of Covid-19 (CUNHA, 2020; BEZERRA, 2017). Seeking to mitigate the impacts of the pandemic, the states and federal governments launched some aid/relief measures for companies (suspension of employment contract, workload reduction, salary reduction or collective vacations). In this sense, in 2020 the number of bankruptcies decreased to 972 companies (SERASA, 2021), but the number of unemployed exceeded the number in 2016, reaching 13.9% (IBGE, 2021). In 2021, the number of unemployed at the end of the first quarter reached a level of 14.7% (IBGE, 2021). Thus, with the increase in the number of unemployed, with the end of aid measures for companies and the reduction of emergency aid, it is expected that the number of insolvent companies will increase again in 2021.

Knowing that business bankruptcies can be determined either by factors intrinsic to companies (financial distress) and/or economic determinants (economic distress), it is important to carry out studies that seek to highlight to the market the factors that contributes to a reduced liquidity. As the factors inherent to companies are very diverse and depend on its economic sector, most studies focus their analysis on macroeconomic determinants (SILVA, 1983; SANVICENTE, 1998; FERREIRA, 2012; SILVA, 2017; SILVA, 2018; ANDRADE , 2018; FIIRST, 2020, among others). Works of this nature help companies in decision making and can contribute to the prevention and reduction of company mortality. Ultimately, by better understanding the economic determinants, it is possible to contribute to the country's economic growth.

Given the above, this study aims to verify the economic determinants of mortality of companies in the five Brazilian macro-regions between the years 2019 and 2020. The justification for undertaking the analysis for these years is due to the fact that, in the aforementioned period, it is possible to capture previous and post COVID-19 data. To achieve the proposed objective, the econometric data panel method will be used. Thus, this work contributes to the literature in at least three aspects: i) by carrying out, in a pioneer way, a work at a national level subdivided for the five Brazilian regions; ii) by using the method of panel data and finally, iii) by verifying the impact of the pandemic on the mortality of companies in Brazil.

The present work is structured as follows: section 2 will present the literature review of the studies that served as the basis for the work, section 3 will describe the methodology and

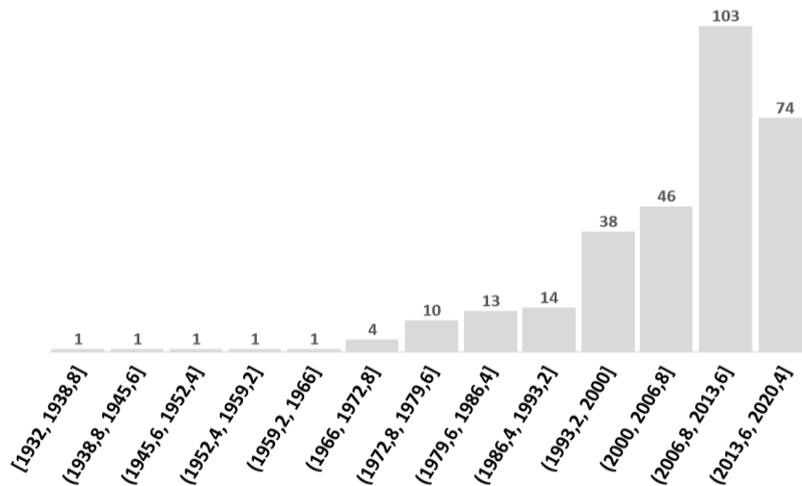
database used, section 4 will address the results found and, finally , section 5 will present the conclusions of the work.

## 2. LITERATURE REVIEW

This section aims to carry out a bibliographical review, both in the national and international literature, of the works that sought to examine the importance of the economic determinants of corporate insolvency. For that, a bibliographic review was carried out in the main databases [1]. It is noteworthy that, despite being able to conduct a broad research by the approach taken in this bibliographic review, this section will not seek to exhaust the proposed theme. This section will serve to present the main authors of the theme, possible gaps to be filled, highlight the contributions of the present work, in addition to helping to define the variables used and helping to interpret the results obtained in the econometric application.

The result of the application of the search tool found 307 publications, of which 187 (61%) covered studies carried out in Brazil and 120 (39%) abroad. The theme of survival and prediction of insolvency of companies became more frequent from the 1990s onwards, both in Brazil and worldwide. As of 2005, there was an increase in the number of publications, coinciding with the enactment of the Judicial Reorganization law, replacing the former bankruptcy in Brazil. Figure 1 presents an analysis of the evolution of the subject from 1930 to 2020.

**Figure 1:** Number of Publications by year



**Source:** Prepared by the author, 2020.

Through the analysis performed, it was possible to map the authors who obtained the highest citations in the analyzed period. From this, it was possible to select the most cited works, among the most recent and oldest, to compose the bibliographical review of this study. Table 1 presents a schematic summary of these works.

**Table 1:** Summary of most cited works that encompass Economic Determinants of Company Mortality.

Author/year	Region/period	Methodology	Variables	Main Results
Silva (1983) Citations: 6	Regional Period was not disclosed	Discriminant analysis	Indebtedness Profitability	The study's conclusion was that liquidity is justify business insolvencies, as it is a consequence and/or other financial decisions, and not the cause. In addition, the authors emphasize that geographic location is decisive for the health of companies, as well as how they financed its growth. Finally, it was found that companies become insolvent, if corrective measures are taken in time are avoided.
Sanvicente (1998) Citations: 79	Nationwide 1986 – 1998	Discriminant analysis	Default	The study presented an equation that allows to predict the default of Brazilian companies. Another conclusion was that discriminant analysis is a useful tool to predict corporate bankruptcy associated with credit risk to companies. Finally, it was found that the accounting indicators that best predict bankruptcy are the liquidity ratios.
Ferreira (2012) Citations: 99	Regional 2007	Multivariate statistical analysis, factor analysis statistics and correlations	Birth of companies Socioeconomic indices	The studies carried out show that there is no single factor responsible for the early closure of a company. It is necessary to see that the factors associated with mortality are largely dependent on the performance of the company. These factors greatly influence the performance of the company. The main problems detected were: concentration of market, competition essentially for price, lack of local market, high default, low purchasing power of customers, lack of advertising or marketing activities, lack of strategic planning and innovation, high level of management incompetence.

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Ferreira (2012) Citations: 99	Regional 2007	Multivariate statistical analysis, factor analysis statistics and correlations	Birth of companies Socioeconomic indices	Access to accounting and legal support did not prevent business failure, but rather a common feature. It was found that the legal environmental complexity of the environment, which entails high costs for these companies in meeting the demands that
Silva (2017) Citations: 0	Nationwide 2003 – 2006	Multivariate statistical analysis	Education level Average tax rate	The development of this study allowed evaluation of Prediction Models, Elisabetsky (1976), Minardi, Baidya and Dias (1979) and Sanvicente and Minardi (1998) for Brazilian publicly traded companies. A tendency was found in the models of Elisabetsky (1976), Sanvicente and Minardi (1998) to classify companies as solvent, even with poor economic and financial performance. Altman, Baidya and Dias (1979) proved to be the most efficient in its results, therefore more efficient than other

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Silva (2018) Citations: 0	Nationwide 2005 – 20015	Multiple Regression Econometric Model	Interest rate unoccupied population indebtedness Default	<p>They did not find empirical evidence in between the problem of economic distress a recovery.</p> <p>However, it was observed that a considerable number of companies that requested judicial reorganization pointed out the economic nature as a crucial factor for the eventual crisis.</p> <p>The results indicated the existence of a negative relationship between the credit available in the economy and the number of companies that requested judicial reorganization. The variables that aimed to capture the effect of the economic crisis beginning in 2008 and the country's growth rate were measured by the Ibovespa and the formal employment rate.</p> <p>They found a positive relationship between the real capital interest rate with the number of requested judicial reorganizations (this result was found for the exchange rate variable as a proxy for country risk).</p> <p>The contribution of the article emphasizes the importance of capital with regard to the cost of capital and the financial structure. In general, companies relate external financial problems and point out that different macroeconomic conditions affect companies of different sizes.</p>

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Andrade (2018) Citations: 9	Nationwide 2004 – 2015	Insolvency Prediction Models	Indebtedness	It concluded that only two models had good predictions, that is, only two of them were as accurate as the models of Elisabethsky (1976) and Sanvicente (1976). The Kanitz (1978) and Kasznar (1986) models showed poor performances in predicting insolvency.
Silva (2018) Citations: 10	Nationwide 2006 – 2017	Logistic Regression Model	Indebtedness	It analyzed which financial factors are decisive for the success of companies under judicial reorganization in Brazil. As a result, the variables that were statistically significant were general liquidity, stock on assets, dry liabilities, and indebtedness and degree of risk to third parties.
Fiirst (2020) Citations: 3	Nationwide 2003 – 2014	KS Model	Results Management (RM)	The results show that the RM of insolvent companies four years before the formalization of the bankruptcy, managers try to mask the firms' financial situation with discretionary accumulations. Closer to the bankruptcy, they are mostly negative discretionary accumulations, which are exposing the financial suffering of organizations before judicial recovery or bankruptcy. In addition, when comparing the RM of insolvent companies (control group), it was observed that they tend to use discretionary accumulations with positive values before the request for judicial recovery or bankruptcy. Therefore, they concluded that the financial reporting results resulted in incentives for managers to manage the company's financial situation. However, when looking at the 4-year period before the bankruptcy, it is noted that healthy companies have positive RM, while insolvent companies have negative RM.

**Source:** Prepared by the author, 2020.

Through this brief literature review, it could be seen that the economic determinants of company mortality have been addressed in the literature in studies using classical econometrics methodology (OLS), variables from BOVESPA and macroeconomic variables at national level. Thus, it is possible to point out, through this review, that the works sought to carry out analyzes on the determinants of economic distress for national economies. Therefore, this work contributes to the literature by proposing an analysis of the economic determinants of corporate mortality at a regional level, more specifically for the five Brazilian macro-regions. The importance of this type of analysis is due to the continental dimensions of Brazil and understanding how the economic distress of a particular region differs from the others. Another important contribution of the analysis lies in the fact that it is possible to verify the impact of Covid-19 on company mortality.

### 3. METHODOLOGY AND DATABASE

#### 3.1. Methodology

A data panel is a set that includes cross-sectional data over time. According to Hsiao (2003), models for panel data offer a number of advantages over cross-sectional or time-series models, namely: the data has both a temporal dimension and a cross-sectional dimension (provide more information, enabling better detection of effects); contains greater variation and less collinearity between variables; makes it possible to reduce the influence of the omission of relevant variables (either for lack of measurement or because it is not possible to observe them), in addition to allowing the study of more complex models. As Wooldridge (2002) points out, the primary motivation for using a data panel is to alleviate the omitted variable bias problem. In the data panel structure, the central question is whether the unobserved effects are (or not) correlated with the explanatory variables. Therefore, consider a linear data panel model represented by:

$$Y_{nt} = \mu_n + X_{nt}\beta + v_{nt} \quad (3.1)$$

$$v_{nt} \sim N(0, \sigma^2)$$

Where  $n=(1,\dots,N)$  are the regions observed over  $t=(1,\dots,T)$  time periods.  $Y_{nt}$  is an  $NT \times 1$  vector that denotes the dependent variable;  $\beta$  is a vector of exogenous coefficients  $K \times 1$  associated with a matrix of exogenous  $X$  covariates of dimension  $NT \times K$ ;  $\mu_n$  is an  $NT \times 1$  vector of time-constant unobserved effects, specific to each cross-sectional unit (individual effects);  $v$  is an  $NT \times 1$  dimension white noise.

The presence of unobserved effects biases estimates by Ordinary Least Squares (OLS). In this sense, the existence (or not) of unobserved effects is verified by applying the Breusch and Pagan test (1980). This test derives a statistic using the Lagrange multiplier principle in conjunction with likelihood, whose null hypothesis is the non-existence of unobserved effects.

If the unobserved effects are part of the process that generates the analyzed data, they must be treated using the fixed effects (FE) or random effects (RE) models, as the choice indicated by the Hausman test (1978). The estimation by RE (between) assumes that  $X$  and  $\mu_n$  are independent, so  $E[\mu_n | X] = E[\mu_n] = 0$  (orthogonality between  $\mu_n$  and  $X$ ), and the term  $\mu_n$  is treated as a random variable i.i.d. distributed with zero mean and variance  $\sigma_\mu^2$ . The consistent and efficient estimation of the parameters of Equation 3.1 is performed by the Generalized Least Squares (GLS) method as follows:

$$\hat{\beta} = (X^T \Omega^{-1} X)^{-1} (X^T \Omega^{-1} Y) \quad (3.2)$$

Where  $\Omega$  is the positive definite variance-covariance matrix for this error structure.

When the presence of omitted, non-observed and time-invariant variables is detected that are correlated with the explanatory variables, it is necessary to estimate the parameters of Equation 3.1 by fixed effects (FE). In this case,  $E[\mu_n | X] \neq 0$ . To estimate the parameters consistently and efficiently, an within transformation is applied in Equation 3.1 to remove the unobserved effect ( $\mu_n$ ) as follows:

$$(Y_{nt} - \bar{Y}_{nt}) = (\mu_n - \bar{\mu}_n) + (X_{nt} - \bar{X}_{nt})\beta + (v_{nt} - \bar{v}_{nt}) \quad (3.3)$$

Knowing that the unobserved effect ( $\mu_n$ ) in the FE model is fixed in time, the within transformation manages to remove it. After that, it is necessary to guarantee the identification hypothesis that the error term of the transformed equation (3.3) is not correlated with the explanatory variables and the non-observed effects:  $E[v_{nt} | X, \mu_n] = 0$ . With the hypothesis of identification guaranteed, the parameters of Equation 3.3 are estimated by OLS as follows:

$$\hat{\beta} = (\bar{X}^T \bar{X})^{-1} (\bar{X}^T \bar{Y}) \quad (3.4)$$

### 3.2 Database

In order to achieve the proposed objective and based on the economic distress literature, monthly data for the years 2019 and 2020 were collected for the five regions of Brazil: north, northeast, midwest, southeast and south, totaling 120 observations. As previously mentioned, this period was chosen because this is the most recent period with available data and the analysis was able to capture a period before and after the onset of the Covid-19 pandemic.

The dependent variable of the analysis is the companies' mortality rate. This variable was calculated by dividing the number of extinct companies and the number of companies in stock in the same period. The economic variables used as explanations are: demand for credit by the entrepreneur, real estate cost per square meter, value of the average electricity tariff, number of jobs and average salary of workers. It is noteworthy that all variables selected for analysis follow both national and international literature. To capture the impact of the pandemic, the variables index of social isolation and number of deaths caused by Covid-19 will be used.

A schematic summary containing the descriptions and sources of the variables is presented in Table 2.

**Table 2:** Summary of variables considered

(to be continued)

<b>Variable Type</b>	<b>Variable</b>	<b><i>X<sub>i</sub></i></b>	<b>Objective</b>	<b>Description</b>	<b>Data Source</b>
Control Variables	Demand for credit by the entrepreneur	X1	Check how difficult is to access credit and indebtedness would impact the mortality of companies	Measures the demand for credit by companies for a month.	SERASA
	Real estate cost per square meter	X2	Observe the impact of cost of living on company mortality	Square meter value of a construction site.	IBGE
	Average electricity Price	X3	Assess the impact of cost of living on company mortality	Average supply Prices obtained through market values declared by energy concessionaires and licensees in the Market Information Monitoring System for Economic Regulation.	ANEEL
	Number of Jobs	X4	Observe the impact of social development on corporate mortality	Stock of jobs per month	CAGED
	Minimum Wage	X5	Check the impact of social development on corporate mortality	Average real income from all jobs, usually earned per month, by people aged 14 or over, occupied in the reference week, with work income	IBGE

**Quadro 2:** Resumo das variáveis utilizadas

(conclusão)

Tipo de Variável	Variáveis	$X_i$	Objetivo	Descrição	Fonte dos Dados
Variável de Controle	Social Isolation Index	X6	Assess the impact of the pandemic on company mortality	Number of users who have not left their place of residence, inferred from proprietary technology, on a given day in relation to the total number of users in that same region	Inloco – Índice de Isolamento Social
	Number of deaths per Covid-19	X7	Assess the impact of the pandemic on company mortality	Number of people who died from the Covid-19 virus	Brazilian Public Healthcare system (SUS)
Dependent Variable	Business mortality rate	Y	Measures the mortality of companies in the regions of Brazil	calculated by the number of extinct companies divided by the number of companies in stock in the same period	Brazilian Ministry of Economy – Business Map Panel

**Source:** Prepared by the author, 2020.

#### 4. RESULTS AND DISCUSSIONS

The closure of a company's activities due to financial difficulties brings social and economic impacts, which expand and affect employees, partners, creditors, consumers and the government (SILVA, 2017). Faced with these multidirectional impacts, as described in the literature review, several works were dedicated to verifying the determinants of corporate insolvency.

Given the above, this paper seeks to carry out an analysis of the economic determinants of corporate mortality in the five Brazilian macro-regions between 2019 and 2020 using the econometric data panel method. The results of the models for the five Brazilian regions are described in Table 3.

In order to define the appropriate estimator for the proposed analysis, the Breusch-Pagan and Hausman tests were performed. Through the Breusch-Pagan test, it was possible to conclude that there are effects not observed in the proposed model and, therefore, the OLS analysis is biased. In the event of unobserved effects, it must verify through the Hausman test whether such effects would be adequately modeled through fixed effects or random effects. The Hausman test rejected the null hypothesis that random effects would be consistent and, thus, the fixed effects model is the best estimator to analyze the economic determinants of company mortality in the five Brazilian regions.

**Table 3: Results (to be continued)**

VARIABLE	(1) OLS	(2) RE	(3) FE
Credit	0.5027** (0.043)	0.5028** (0.010)	0.3372** (0.017)
Cost	1.0529** (0.022)	1.053* (0.050)	0.5693* (0.054)
Energy Price	0.7757** (0.018)	0.7758** (0.011)	1.9322** (0.017)
Number of Jobs	0.0221 (0.500)	0.0222 (0.508)	0.1325 (0.376)
Salary Mass	0.1001 (0.258)	0.1002 (0.243)	0.1839 (0.164)
Deaths by Covid-19	0.0180* (0.075)	0.0180*** (0.000)	0.0242** (0.002)
Lockdown	-0.0863*** (0.0006)	-0.0864*** (0.000)	-0.0697*** (0.005)
Constant	-8.0605*** (0.004)	-8.061*** (0.000)	-15.1373** (0.012)
Pseudo R <sup>2</sup>	0.2166	0.2627	0.2860
Teste de Breusch-Pagan		10.42***	
Teste de Hausman			20.74***
N <sup>o</sup> of observations	120	120	120

Source: Prepared by the author, 2021.

Notes: (1) OLS - Pooled Model; (2) RE - random effects model; (3) FE - Fixed Effects Model

\* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.01.  
p-value between parenthesis.

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It is noteworthy that all models were estimated following a functional form of the log-log type. Thus, the estimated coefficients can be understood as elasticities. Thus, based on the fixed effects model (FE:3), it is possible to infer that a 1% increase in the demand for credit increases company mortality by 0.33%. Knowing that access to credit in Brazil is not trivial for small investors and this variable only captures access to credit, this result, despite being efficient from a statistical point of view, may be underestimated. In other words, how small investors raise funds on behalf of the individual and/or invest their own funds. But this result is important as it reveals that the most indebted companies have a higher probability of insolvency. Similar results were also found by Silva (1983), Sanvicente (1998), Silva (2017), Silva (2018).

Knowing that fixed and variable costs vary greatly between Brazilian regions, the variables cost of real estate square meter and electricity prices were included in the analysis. With regard to the cost of square meter, an increase of 1% in this variable increases the mortality

of companies by about 0.57%. On the other hand, when the electricity price is analyzed, it is elastic and an increase in the price of 1% causes an increase in mortality in the order of 1.93%.

Seeking to analyze the importance of the level of economic activity in the mortality of companies, the number of jobs and regional wages were included in the analysis. These two variables were not statistically significant, revealing that perhaps the level of economic activity is more important to explain the birth of companies. Since in times of crisis and economic strength, the number of births of companies is boosted.

Finally, the effects of the Covid-19 pandemic on company mortality were analyzed in terms of deaths resulting from the pandemic and measures of social distancing. The results reveal that the 1% increase in deaths resulting from Covid-19 increases the solvency of companies by 0.02%. A result that deserves to be highlighted is the fact that social distancing reduces the mortality of companies. In this sense, a 1% increase in social isolation reduces mortality by 0.07%. This result at first seems to be contrary to what was expected, but when analyzing it carefully, it is possible to conclude that it is consistent. This statement can be corroborated since most municipalities and states that adopted social isolation measures sought to mitigate the effects of isolation through policies to help companies. Thus, the measures adopted by subnational entities together with the measures implemented by the federal government seem to have had the expected result in reducing the companies' mortality rate.

## **5. CONCLUSION**

This study aimed to analyze the economic determinants of company mortality in the five Brazilian macro-regions between the years 2019 and 2020. For this purpose, a monthly data panel between January 2019 and December 2019 was used, totaling 120 observations. After performing the Breusch-Pagan and Hausman tests, it was concluded that the most appropriate model to analyze the determinants of solvency of companies at a regional level was the fixed effects estimator.

Based on the fixed effects model, it was possible to verify that the demand for credit, cost of real estate square meter and electricity contribute positively to the increase in the mortality rate of companies. Among these variables, the electricity proved to be elastic to company mortality. In other words, a 1% increase in the tariff increases mortality more than proportionally. This result reveals that the electricity prices in Brazil, which is one of the highest in the world, is an important factor in determining the mortality of companies.

Although the literature points to the importance of the level of economic activity to explain the mortality of companies, the results found in this study revealed that, at the regional level, this is not valid. In other words, when the number of jobs and wages were analyzed, it was found that both variables included in the model to capture the regional economic level were not statistically significant and, therefore, did not impact the solvency of companies.

Finally, the impacts of the Covid-19 pandemic on corporate mortality were analyzed and the results were quite surprising. As expected, the number of deaths by Covid-19 increases corporate mortality. However, when analyzing the impact of social isolation measures, the result revealed that isolation reduces company mortality. This finding shows that social isolation measures combined with measures to mitigate their economic impacts, in addition to containing the advance of the pandemic, also contribute to reducing the mortality of companies. In this sense, it can be concluded that emergency aid and measures such as suspension of the employment contract, workload reduction, salary reduction or collective vacation contributed significantly to the maintenance of Brazilian companies.

## NOTES

<sup>[1]</sup>To undertake the bibliometric analysis, a search was carried out in the Capes journal using the following keywords: Economic Determinants; Insolvency; Judicial recovery; Business Survival; Business Mortality; Economic Parameters; Statistical Analysis of Companies; Financial health; Bankruptcy; Concordat; Economic Variables. The net and hook search techniques were used to map the maximum number of articles resulting from the search for keywords and to survey the year of publication, authors and number of citations.

## REFERENCES

ALVARENGA, R. A. Estudos dos Fatores Contribuintes para a Mortalidade das Micro e Pequenas Empresas do Estado do Maranhão. **International Journal of Innovation**, v. 4, n. 2, p. 106-118, 2016.

ANDRADE, J. P., & LUCENA, W. G. L. Análise de Desempenho dos Modelos de Previsão de Insolvência e a Implementação das Normas Internacionais de Contabilidade. *Revista Ciências Administrativas*, 24(2), 2018. <https://doi.org/10.5020/2318-0722.2018.6563>

BAE, J. M. A Chinese Case of Coronavirus Disease 2019 (COVID-19): Did Not Show Infectivity During the Incubation Period: Based on an Epidemiological Survey. *Journal of Preventive Medicine & Public Health*, v. 53, n. 2, p. 67-69, 2020.

BARBOSA, F., HOLANDA, F., A crise econômica de 2014/2017, *Estudos Avançados*. 31(89), 51-60, 2017. <https://doi.org/10.1590/s0103-40142017.31890006>

BEZERRA F., JUSTINO, M.. Lei de recuperação de empresas e falência: Lei 11.101/2005: comentada artigo por artigo. 12.ed. São Paulo: Revista dos Tribunais, 2017.492 p. - Localização: 347.736(81)(094.46) / B469Le / 12.ed

BREUSCH, T.; PAGAN, A., The Lagrange Multiplier test and its applications to model specification in econometrics, *Review of Economic Studies*. Vol. 47, p. 239-253, 1980.

BRASIL. Lei 11.101 de 09 de fevereiro de 2005. Regula a Recuperação judicial, extrajudicial e falência do empresário e da sociedade empresária.

CUNHA, Leonardo Ferreira Farias da; SILVA, Alcineia de Souza; SILVA, Aurênio Pereira da. O ensino remoto no Brasil em tempos de pandemia: diálogos acerca da qualidade e do direito e acesso à educação. *Revista Com Censo: Estudos Educacionais do Distrito Federal*, [S.l.], v. 7, n. 3, p. 27-37, ago. 2020. ISSN 2359-2494. Disponível em: <<http://www.periodicos.se.df.gov.br/index.php/comcenso/article/view/924>>. Acesso em: 23 jun. 2021.

FERREIRA, L. F. F., OLIVA, F. L., SANTOS, S. A. dos, GRISI, C. C. de H. e, & LIMA, A. C. (2012). Análise quantitativa sobre a mortalidade precoce de micro e pequenas empresas da cidade de São Paulo. *Gestão & Produção*, 19(4), 811–823. <https://doi.org/10.1590/s0104-530x2012000400011>

FIIRST, C. ; PAMPLONA, E. ; BAMBINO, A. C. ; KLANN, R. C. . Gerenciamento de Resultados em Empresas Brasileiras nos Anos Antecedentes ao Pedido de Recuperação Judicial ou Falência. *DESAFIO ONLINE* , v. 8, p. 1-26, 2020.

HAUSMAN, J.A. Specification Tests in Econometrics. *Econometrica*. vol. 46, n.6, p.1251-71, 1978.

HSIAO, C. Analysis of Panel Data. Cambridge: Cambridge University Press, Second Edition, 2003.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Disponível em: <https://www.ibge.gov.br/indicadores>

LAGO, K. O Impacto da pandemia de corona vírus nos Pequenos Negócios, SEBRAE, 2020. Disponível em: [https://datasebrae.com.br/wp-content/uploads/2020/04/Impacto-do-coronav%C3%ADrus-nas-MPE-2%C2%AAedicao\\_geral-v4-1.pdf](https://datasebrae.com.br/wp-content/uploads/2020/04/Impacto-do-coronav%C3%ADrus-nas-MPE-2%C2%AAedicao_geral-v4-1.pdf)

OMS - Organização Mundial da Saúde (Org.). WHO Director-General's statement on IHR Emergency Committee on novel coronavirus (2019-nCoV). Published on January 30, 2020a.

OMS - Organização Mundial da Saúde (Org.). Novel Coronavirus (2019-nCoV): situation report, 22. Published on February 11, 2020b.

SANVICENTE, A.Z.; MINARDI, A.M.A.F. Identificação de indicadores contábeis significativos para a previsão de concordata de empresas. Instituto Brasileiro de Mercado de Capitais, Working Paper, 1998.

SERASA EXPERIAN. Indicadores Serasa Experian. Disponível em: [http://www.serasaexperian.com.br/release/indicadores/demanda\\_pf\\_credito](http://www.serasaexperian.com.br/release/indicadores/demanda_pf_credito)

SILVA, José Pereira da. Avaliação da saúde financeira das empresas. Revista de Administração de Empresas, vol. 23, n. 2, p. 41-47, 1983.

SILVA, C. L. F. da. A eficiência da aplicação dos modelos de previsão de insolvência nas empresas de capital aberto brasileiras em recuperação judicial, 2017. Disponível em: <http://hdl.handle.net/10183/172722>

SILVA, N. R. F. Fatores determinantes de recuperação judicial em empresas brasileiras de capital aberto; Trabalho de Conclusão de Curso; (Graduação em Ciências Econômicas) - Insper Instituto de Ensino e Pesquisa; 2018. Disponível em: <http://hdl.handle.net/11224/2115>

SILVA, BV. A., OLIVEIRA, S. , J., & GALLUCCI, N. H. Pedidos de Recuperação Judicial no Brasil: Uma Explicação com Variáveis Econômicas . Brazilian Review of Finance, 16(3), 429, 2018. <https://doi.org/10.12660/rbfin.v16n3.2018.69254>

WOOLDRIDGE, J. M. Econometric Analysis of Cross Section and Panel Data, MIT Press, 2002.