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ORIGINAL ARTICLE

The incidence of impairment of non-current assets in the face of the covid-19 crisis

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ABSTRACT

This papers aims to investigate whether the incidence of impairment of non-current assets increased with the advent of the covid-19 crisis. The Brazilian accounting literature on the impact of covid-19 on businesses still lacks empirical evidence, especially on the impact of the crisis on long-term accounting variables, for which the effect of covid-19 is more difficult to determine. The topic is relevant because it provides investors, regulators, preparers, and auditors with insights into the impact that a future crisis similar to covid-19 could have on businesses. The work is also relevant to academia, as it is one of the first to analyze the effect of the pandemic on long-term assets. The findings allow us to reflect on how companies and sectors are more or less exposed to the risk of impairment in crises, providing inputs for investment decision making in these scenarios. We studied 383 Brazilian publicly traded companies registered with the Brazilian Securities and Exchange Commission (CVM) between 2016 and 2020. To test the hypothesis of this research, we manually collected the recognitions and reversals of impairment losses in 1,805 financial statements and, then, estimated a set of linear regression models with using fixed effects panel data. We found a positive and significant relationship between the effects of the covid-19 crisis and the incidence of impairment of non-current assets in Brazilian firms, which persisted even after controlling for various economic and financial factors. By separating the impairment of fixed and intangible assets, the findings suggest that intangible assets were more exposed to the covid-19 crisis than fixed assets. The results remained robust to various econometric analyses, including industry patterns, sub-samples, and the effect of the audit firm. This research contributes to the academic and professional debate by confirming the correlation between this crisis and the impairments recorded in financial statements, studying their effects on the accounting of non-current assets and on the long-term returns of the companies and sectors analyzed.

Keywords: asset impairment, non-current assets, covid-19, Brazilian companies.

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1. INTRODUCTION

At the end of December 2019, the World Health Organization (WHO) was alerted by the Chinese government about cases of pneumonia of unknown etiology in the city of Wuhan, Hubei province. On January 30, 2020, the WHO declared that the outbreak of this disease was a public health emergency of international concern, and 40 days later, on March 11, 2020, the coronavirus disease (covid-19) was already classified as a pandemic, the first case of which was recorded in Brazil on February 26, 2020 (Pan American Health Organization, 2020).

This disease rapidly affected the entire planet, significantly transforming societies and economies (Baker et al., 2020; Silva et al., 2020), resulting in a 3.5% drop in global gross domestic product (GDP) in 2020 (World Bank Group, 2021) and a 4.1% drop in Brazil's GDP, the largest decline in 30 years (Brazilian Institute of Geography and Statistics [IBGE], 2021). The seriousness of this scenario is confirmed by the Brazilian Securities and Exchange Commission (CVM, 2020), through Circular Letter CVM/SNC/SEP 02/2020 addressed to publicly traded companies and independent auditors, which emphasizes the importance of publicly traded companies carefully considering the impacts of covid-19 on their business and reporting in the financial statements the related risks and uncertainties, especially those related to operational continuity and accounting estimates, such as the recoverability of assets (asset impairment) and provisions for expected losses. According to KPMG (2020), this panorama of economic instability contributed to the emergence of indicative impairment in 2020, creating the need for companies to perform the impairment test on their assets. However, Martins (2020) questioned whether the effects of the covid-19 pandemic would persist over a long-term horizon to the extent that the present value of the chances of recovering fixed assets, intangible assets, and other non-current assets would require an impairment to be recorded.

The accounting literature on the impact of covid-19 on businesses still lacks empirical evidence (Barbosa et al., 2021; Qin et al., 2020). This aspect indicates the need for more research on the impact of this crisis on accounting variables, especially on long-term accounting variables, where the effect of covid-19 (at present value) is more difficult for companies in general to measure and confirm with certainty, due to the high level of uncertainty. In this sense, and precisely because the 2020 events resulting from covid-19 point not only to a public health crisis, but also to an economic and social crisis, this study aims to investigate the relationship between the effects of the covid-19 crisis and the incidence of impairment of fixed and intangible assets in Brazilian companies. To this end, we manually collected and analyzed the recognition and reversal of impairment losses in 1,805 consolidated financial statements of Brazilian companies, before and during the pandemic, in order to investigate, through regression analysis with panel data, whether or not there was an increase in the incidence of asset impairment with the covid-19 crisis.

The analysis shows that the most significant impairment losses and reversals of impairment losses scaled by the average total assets were concentrated in smaller companies and were more frequent in publicly traded companies listed on the B3 S.A. – Brasil, Bolsa, Balcão (B3) than in non-listed publicly traded companies. In 2020, we identified 18 companies with records of impairment losses of non-current assets related to covid-19, with a strong concentration in the cyclical consumption sector. We found statistically significant evidence of a positive and significant relationship between the effects of the covid-19 crisis and the incidence of impairment of non-current assets for Brazilian companies listed on the B3. In addition, we found that impairment losses were mainly allocated to intangible assets and less often to fixed assets, suggesting that intangible assets are more exposed to the effects of the covid-19 crisis.

The results of this paper have three main contributions. First, the research contributes to academia by adding new empirical evidence on the determinants of impairment recognition and by revealing the effects of a health crisis of international economic proportions on impairment records. Second, the research contributes to the users of accounting information, as the analysis and evidence can be used to build expectations about the possible effects of economic crises on non-current assets, thus contributing to their decision-making process. Finally, the research also contributes to companies by providing relevant information for initial analyses of the impacts of a scenario with a high level of uncertainty (such as that arising from the covid-19 pandemic) on financial statements, as we bring examples of companies that suffered accounting losses due to the unfavorable situation, which caused, for example, business interruptions and a drop in demand for products and services.

In addition to this introductory section, the paper is organized as follows: section 2 presents the theoretical framework that underpins the relevant aspects of the study and the research hypothesis; section 3 presents the methodological procedures; section 4 reports and analyzes the results obtained; and finally, section 5 presents the concluding remarks.

2. THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESIS

As noted by Yamamoto (2008), accounting for asset impairment has been a global issue since the 1990s, with the appearance of Statement of Financial Accounting Standards (SFAS) 121 in 1995 by the Financial Accounting Standards Board (FASB) and the publication of International Accounting Standard (IAS) 36 (International Financial Reporting Standards Foundation [IFRS], 1998) by the International Accounting Standards Committee (IASC). This section first presents the literature on the determinants of asset impairment, followed by a discussion of asset losses in economic crisis situations and the research hypothesis.

2.1 Determinants of the Recognition of Impairment of Non-Current Assets

The accounting literature has repeatedly explored the determinants of asset impairment. For Zhuang (2016), the book-to-market ratio of equity is readily observable for the researchers of the topic studied in this paper and is even specified in IAS 36 (IFRS Foundation, 1998) as an external indicator of impairment, i.e., when the book value of the company's equity is higher than the value of its shares in the market. In the literature, it is possible to find studies that have confirmed the statistical significance of the book-to-market variable for the occurrence of asset impairment (Abughazaleh et al., 2011; Alves & Silva, 2020; Vogt et al., 2016).

Abughazaleh et al. (2011) investigated the extent to which financial proxies for impairment, earnings management incentive variables, and effective corporate governance mechanisms explain managers' propensity to recognize goodwill impairment losses in UK companies in 2005 and 2006. The results showed that, among the financial proxies, book-to-market was positive and significant, and return on assets (ROA) and change in operating cash flow (OCF) were negative and significant. Among the variables that encourage earnings management, the big bath variable was negative and significant, and the income smoothing and change of chief executive officer (CEO) variables were significantly positive. Finally, in terms of corporate governance, all variables were statistically significant and positively correlated with impairment recognition, with the exception of the proxy for separation of duties between the CEO and the Chairman of the Board, which was not statistically significant.

In a related study, Peetathawatchai and Acaranupong (2012) examined whether the amount of impairment losses recognized by listed companies in Thailand between 1999 and 2004 was related to economic indicators and earnings management. The results showed that impairment losses were associated with the three levels of economic loss indicators described in Thai Accounting Standard (TAS) No. 36 (Federation of Accounting Professions, 2010), which is equivalent to IAS 36 (IFRS, 1998), i.e., macroeconomic indicators, industry-specific performance measures, and company-specific performance measures. It was also observed that managers recognized impairment losses in order to smooth earnings when they increased.

Similarly, Wrubel et al. (2015) studied the determinants of the recognition of impairment losses in Brazilian companies between 2010 and 2012. Using the same econometric model as Peetathawatchai and Acaranupong (2012), the authors found that the determinant economic factor that stood out the most in the analysis was the variation in the company's cash flow. Wrubel et al. (2015), when regressing the econometric model individually for each year (2010, 2011, and 2012), found more variables in the model to be significant, such as the variation in revenue, OCF, and indebtedness. One difference between Peetathawatchai and Acaranupong (2012) and Wrubel et al. (2015) was that for Brazilian firms, the effect of the variation in the sector's ROA on impairment losses was not significant for the years analyzed. However, in the study in Thailand (Peetathawatchai & Acaranupong, 2012), the results indicated that companies in shrinking sectors tended to record more impairment losses than those in expanding industries.

Another study conducted in Brazil in the same period was by Vogt et al. (2016), which sought to identify the determinants of the recognition of goodwill impairment losses in Brazilian companies in the period from 2011 to 2014. The variables change of management, book-to-market, number of cash-generating units (CGUs), change in ROA, and goodwill (value of goodwill recognized in the accounts) were significant in determining goodwill

impairment losses. The authors warned that there was evidence of earnings management as the change of management variable was positively related to losses. Thus, it could be concluded that the new manager would recognize the impairment and blame the previous management in order to pave the way for a future with fewer losses and better news for shareholders. Therefore, it is important to consider variables that may indicate earnings management practices in the econometric model of this study, as managers may overestimate or underestimate the impairment value depending on the motivations and incentives that exist in the firm (Zhuang, 2016).

Zang (2008) analyzed whether managers of firms that adopted SFAS No. 142 (goodwill and other intangible assets) used discretion in determining goodwill impairment and found that more leveraged firms would have lower goodwill impairment to avoid violating debt covenants. Gonçalves et al. (2019) analyzed the relationship between goodwill impairment and the big bath strategy for companies with securities traded on the Lisbon and Madrid stock exchanges from 2007 to 2015. Their results suggest that the recognition of impairment losses could play an important role in big bath practices in companies with already negative current earnings. Souza et al. (2015) investigated the significant factors that explain the level of disclosure of asset impairments in Brazilian public companies. The results showed that big companies audited by the Big Four tend to be more in line with the disclosure requirements of Technical Pronouncement CPC 01 (R1) (Accounting Pronouncements Committee [CPC], 2010).

Finally, Alves and Silva (2020) used a logit model to test the determinants of the recognition of impairment losses on fixed assets, intangible assets, and goodwill in Brazilian companies listed on the B3 between 2009 and 2017. The results showed that the variation in return on equity (ROE), book-to-market ratio, change of management, big bath, and ownership control were statistically significant and had positive coefficients in the test for recognizing impairment losses.

2.2 Crisis Environment and Asset Impairment Records

Prior to the covid-19 crisis, the last major global economic crisis was the subprime crisis, which showed its first signs at the end of 2007, caused by the collapse of the real estate market and the financial system in the United States (Teodoro & Scherer, 2013). In the fourth quarter of 2008 alone, the subprime financial crisis caused non-financial US firms to record approximately $311 billion in asset impairments, more than the total recorded in the four years prior to the crisis (Gunn et al., 2018). In the midst of this scenario, some sectors were more heavily affected by the subprime crisis. Teodoro and Scherer (2013) found that impairment recognition was more intense for international airlines in 2008 compared to 2007 and 2009, indicating that economic conditions in 2008 affected the recording of impairments in these firms.

This crisis was so severe that in several countries, the incidence of impairment of fixed and/or intangible assets in publicly traded companies was higher in the year of the subprime crisis than in the years immediately before or after 2008 (Glaum et al., 2015; Souza et al., 2015). However, firms in countries with strong enforcement systems recognized impairments in a timely manner before, during, and after the subprime crisis, while firms in countries with weak enforcement systems delayed the recognition of goodwill impairments (Glaum et al., 2015).

Brazil's recent history was marked by a severe economic recession in 2015 and 2016 (Brito et al., 2021), with GDP shrinking by 3.5 and 3.3 percent, respectively (IBGE, 2021). The period was also characterized by great political instability, leading to the impeachment of Dilma Rousseff as president of Brazil on August 31, 2016.

Twelve years after the subprime crisis, a new global crisis affected the lives of billions of people around the world. The 2020 crisis was caused by the economic, political, and social fallout from the covid-19 pandemic, and the social distancing required by governments and widespread panic changed consumer behavior and forced companies to reduce or cease operations altogether (Zameeruddin, 2020). The June 2021 edition of Global Economic Prospects (World Bank Group, 2021) revealed that the global economic contraction observed in 2020 was 3.5%, and in Latin America and the Caribbean, the result was a decline of 6.5%. Data from the World Bank Group (2021) and the IBGE (2021) point to a 4.1% contraction in the Brazilian economy in 2020, which is the largest contraction in 30 years, surpassing the economic crisis years of 2015 and 2016.

Research indicates that the sudden reduction in aggregate demand triggered by the lockdown policies, necessitated by the lack of vaccines or available pharmaceutical treatment, led to this economic disaster (Gomes et al., 2021). With all these facts, the likelihood of an impairment indicator occurring is high, making it necessary for companies to perform an impairment test on their assets (KPMG, 2020). Some studies have identified

the effects of the covid-19 economic crisis on specific sectors of the economy. Fu and Shen (2020) examined the performance of companies in China's energy sector and found that entities with goodwill impairment were the most strongly affected by the pandemic due to the business risks associated with goodwill from company acquisitions, an accounting estimate that is highly sensitive to changes in the economic climate. Evidence of impairment of non-financial assets related to covid-19 was also found in oil and gas companies with shares traded on the New York Stock Exchange (NYSE), such as Petrobras (2021), which recognized a multi-billion reais loss in the first quarter 2020 results related to the assessment of the recoverable value of its exploration and production assets (Pereira et al., 2021).

Pereira et al. (2021) also confirm that the recoverable amounts of assets, assessments of operational continuity, and the uncertainties created by the pandemic were the most recurring themes in corporate disclosures after the onset of the pandemic. Silva et al. (2021) found reflections of the pandemic in the financial statements of travel and leisure companies listed on the Johannesburg Stock Exchange (JSE) in South Africa. According to the authors, 90% of these companies provided financial statement users with information on asset impairment, and 60% of the companies disclosed information on the impact of covid-19 on the assessment of asset recoverability, in some cases triggering the recognition of impairment.

In the case of Brazil, the evidence found by Nascimento et al. (2022) suggests that in 2020 the relevant impairments were concentrated in segments that were more sensitive to the restrictions imposed by governments, such as education and tourism, which is consistent with the findings of this study. However, the authors point out that they did not find results (based on a comparison of the asset impairment records of 15 companies from different segments listed on the B3) that would justify stating that the pandemic generated more asset impairments in the Brazilian economy in 2020 than in 2019.

From this body of research, one can see that both crises created high levels of uncertainty and reduced global economic activity, leading companies to recognize losses on their assets. However, the subprime crisis originated in the financial market and covid-19 originated in public health, triggering subsequent lockdown policies. Thus, seeking to contribute to the debate on the impacts of an economic crisis on Brazilian companies, the hypothesis of this study is that there is a positive relationship between an economic crisis, such as that caused by covid-19, and the accounting impacts expressed by the recognition of impairment losses.

3. METHODOLOGY

3.1 Sample and Data Collection

The research sample consists of all publicly traded companies actively registered with the Superintendence of Corporate Relations of the CVM (656 companies as of April 28, 2021) with financial statements available for the years 2016 to 2020 (leaving 502 publicly traded companies, or 2,510 observations). The following were excluded: (i) 34 companies (170 observations) for not reporting fixed and intangible assets in their consolidated financial statements; (ii) 85 companies (425 observations) for not having data available in Economatica or Refinitiv to measure all the variables used in the analysis; and (iii) 110 observations for having negative equity. Thus, the main research sample comprises 383 companies with a total of 1,805 observations, constituting an unbalanced panel.

This sample was further divided into two subsamples: one consisting only of companies listed on the B3 (235 companies, 1,055 observations) with data available for the calculation of the book-to-market control variable (172 observations were lost due to the unavailability of "market value" data for the calculation of this explanatory variable; this meant that 22 listed companies were completely excluded from this sample, while another 29 listed companies lost at least one observation in the panel), and another consisting only of companies not listed on the B3 (126 companies, 578 observations).

We manually collected the impairment amounts for fixed assets (including right-of-use assets) and intangible assets (including goodwill) from the impairment test notes to the financial statements and charts of changes in fixed assets, intangible assets, and right-of-use assets and of expenses and costs by nature in all the consolidated financial statements of the sample to determine the amount of the recognition and/or reversal of impairment losses for the period. For 2020, the notes to the financial statements

on the effects of the pandemic in the operational context of each company were analyzed to identify the disclosures that linked the impairments, among other factors, to the covid-19 economic and health crisis. We also consulted the Economatica and Refinitiv databases to build the research data.

3.2 Empirical Model

To test the research hypothesis, panel data regressions were estimated using Gretl and R software in the form of equation (1).

$$lnIMP_{it} = \beta_0 + \beta_1 CovidRel_{it} + \beta_2 CrisisYear_{it} + \beta_3 \Delta REV_{it} + \beta_4 \Delta ROA_{it} + \beta_5 \Delta ROE_{it} + \beta_6 \Delta OCF_{it} + \beta_7 BtM_{it} + \beta_8 lnSIZE_{it} + \beta_9 LEV_{it} + \beta_{10} Smooth_{it} + \beta_{11} BigBath_{it} + c_{it} + e_{it} \quad (1)$$

In equation (1), the dependent variable of the study ($lnIMP_{it}$) is the sum of the recognitions (expressed as positive numbers) and/or the reversals (expressed as negative numbers) of impairment losses on fixed, right-of-use, intangible, and goodwill assets for company *i* in year *t*, scaled by the average total assets. In addition, we transformed the measure into a natural logarithm (to normalize it). The explanatory variable of interest is the $CovidRel_{it}$ dummy, which takes the value of 1 if the disclosure of impairment in 2020 was related to the covid-19 pandemic, among other factors, and 0 otherwise. Table 1 shows the definition of these and the other variables used in the model of equation (1), including their expected sign and their theoretical basis. To avoid the problem of outliers that could affect the estimated coefficients, all the continuous variables, including the dependent variable, were winsorized by 1% on each side of their distribution. And for greater analytical rigor, the data used to construct the variables is corrected by the Broad National Consumer Price Index (IPCA), and all variables in the equation are in constant 2020 currency.

Table 1
Model variables

Abbreviation	Description	Formula	Expected sign (coefficient)	Theoretical basis
*ln*IMP	Dependent variable	Natural logarithm of (recordings of impairments – reversals of impairments) $t/[(TA_t + TA_{t-1})/2]$	-	Peetathawatchai & Acaranupong (2012), Wrubel et al. (2015)
CovidRel	Binary variable	1 for disclosure of impairment related to the covid-19 crisis, among other factors, and 0 otherwise	(+) Covid-19 would cause more impairment (disclosure).	-
CrisisYear	Binary variable	1 for years with negative growth of the Brazilian GDP (2016 and 2020) and 0 otherwise	(+) The economic crisis scenario (negative GDP) would cause more losses.	Gunn et al. (2018)
ΔREV	Change in net revenue over average total assets	$(REV_t - REV_{t-1})/[(TA_t + TA_{t-1})/2]$	(-) Companies with a negative change in revenue would be more susceptible to impairment.	Abughazaleh et al. (2011), Alves & Silva (2020), Peetathawatchai & Acaranupong (2012), Vogt et al. (2016), Wrubel et al. (2015)
ΔROA	Change in return on total assets	$(Net\ Prof_t / TA_t) - (Net\ Prof_{t-1}/TA_{t-1})$	(-) Less profitable companies would be more likely to record impairments.	Abughazaleh et al. (2011), Alves 7 Silva (2020), Vogt et al. (2016)
ΔROE	Change in return on equity	$(Net\ Prof_t / Net) - (Net\ Prof_{t-1}/Net\text{-}1)$	(+) Companies with a positive change in return on equity would be more likely to record impairments.	Alves & Silva (2020)
ΔOCF	Change in operating cash flow over average total assets	$(OCF_t - OCF_{t-1})/[(TA_t + TA_{t-1})/2]$	(-) Companies with a negative change in cash flow would be more susceptible to impairment.	Abughazaleh et al. (2011), Alves & Silva (2020), Peetathawatchai & Acaranupong (2012), Vogt et al. (2016), Wrubel et al. (2015)
Book-to-Market	Book-to-market ratio	(NE + IMP*0.66)/market value	(+) Companies with higher book-to-market ratios would be more susceptible to impairment.	Abughazaleh et al. (2011), Alves & Silva (2020), Vogt et al. (2016),

Table 1
Cont.

Abbreviation	Description	Formula	Expected sign (coefficient)	Theoretical basis
SIZE	Size	Total assets (natural logarithm of total assets) for year *t*	(+) Big companies would be more susceptible to the risk of impairment.	Souza et al. (2015)
Control variables (incentives for earnings management)				
LEV	Leverage	$(CL_t + nCL_t)/[(TA_t + TA_{t-1})/2]$	(-) More leveraged companies would be less inclined to record impairments.	Vogt et al. (2016), Zang (2008)
Smooth	Binary variable (income smoothing)	1 if the profit before current impairment for year *t* is positive and greater than the net profit in t-1, and 0 otherwise	(+) Companies with high profits would be more inclined to record impairments.	Abughazaleh et al. (2011), Alves & Silva (2020)
BigBath	Binary variable (negative current income)	1 if the profit before current impairment for year *t* is negative and less than the net profit in t-1, and 0 otherwise	(+) Companies with negative earnings would be more inclined to record impairments.	Abughazaleh et al. (2011), Alves & Silva (2020), Gonçalves et al. (2019)

covid-19 = coronavirus disease 2019; GDP = gross domestic product.
Source: *Prepared by the authors.*

4. RESULTS

4.1 Incidence of Impairment of Non-Current Assets

In absolute values, the impairment losses on non-current assets of the Brazilian companies amounted to R$145 billion (adjusted for inflation and net of reversals), with 63% of this amount (R$92 billion) concentrated in the years in which Brazil had negative GDP growth (2016 and 2020). Table 2 shows the total number of companies observed in each year, the number of companies with impairments, and the percentage of companies with asset losses among the total number of companies observed in each year. The data is segregated into three samples: (i) B3 and CVM, with the total number of companies; (ii) B3, consisting only of companies listed on the B3; and (iii) CVM, consisting of publicly traded non-listed companies. As can be seen in Table 2, the listed companies reported more impairments in 2016 and 2020, but the same is not true for the non-listed publicly traded companies. One possible explanation is that non-listed companies are subject to less scrutiny by market agents and therefore delay the recognition of losses, in line with the findings of Glaum et al. (2015).

Table 2
Share of observations of companies with impairment in total annual observations

Year	Listed and non-listed companies (B3 & CVM)			Listed companies (B3)			Non-listed companies (CVM)		
	No. of obs.	No. of obs. With impairment	%	No. of obs.	No. of obs. With impairment	%	No. of obs.	No. of obs. With impairment	%
2016	358	63	17.60	200	57	28.50	111	6	5.41
2017	367	58	15.80	213	47	22.07	118	11	9.32
2018	364	52	14.29	214	45	21.03	116	7	6.03
2019	361	55	15.24	213	45	21.13	118	10	8.47
2020	355	57	16.06	215	52	24.19	115	5	4.35
Total	1,805	285	15.79	1,055	246	23.32	578	39	6.75

B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).
Source: *Prepared by the authors.*

Table 3 presents the descriptive statistics of the impairment loss on non-current assets recorded by the Brazilian companies, weighted by average total assets. In panels A and B of Table 3, we can see that 2017 is the year with the highest average losses for Brazilian companies' investments, scaled by average total assets. Overall, the Brazilian companies that reported impairments had average losses equal to 2.27% of their average total assets in that year. However, when interpreting these results, it is important to recognize the existence of extreme values, as the standard deviation of the impairment values shown in Table 3 is high and above average in all years and for both groups. Moreover, the results show that the highest standard deviations are found in the group of non-listed companies.

Table 3
Descriptive statistics of asset impairment losses weighted by average total assets

Panel A: Listed and non-listed companies (B3 & CVM)					
	2016	**2017**	**2018**	**2019**	**2020**
No. of companies	63	58	52	55	57
Mean	1.38%	2.27%	1.30%	1.19%	1.34%
St. deviation	2.90%	7.21%	5.10%	3.80%	4.97%
Minimum	-4.23%	-6.61%	-5.35%	-4.49%	-11.23%
Maximum	16.73%	36.31%	31.33%	25.48%	28.05%
Panel B: Listed companies (B3)					
	2016	**2017**	**2018**	**2019**	**2020**
No. of companies	57	47	45	45	52
Mean	1.15%	2.02%	1.14%	0.86%	1.62%
St. deviation	2.23%	6.56%	4.84%	1.80%	5.02%
Minimum	-4.23%	-6.26%	-3.82%	-1.02%	-11.23%
Maximum	10.32%	36.31%	31.33%	9.53%	28.05%
Panel C: Non-listed companies (CVM)					
	2016	**2017**	**2018**	**2019**	**2020**
No. of companies	6	11	7	10	5
Mean	3.59%	3.33%	2.29%	2.64%	-1.61%
St. deviation	6.48%	9.85%	6.91%	8.23%	3.52%
Minimum	0.05%	-6.61%	-5.35%	-4.49%	-7.85%
Maximum	16.73%	31.60%	16.20%	25.48%	0.56%

B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).
Source: *Prepared by the authors.*

Regarding the maximum (impairment recognition) and minimum (impairment reversal) values in Table 3, one can note that the big companies in the sample, such as Petrobras or Vale, are not present. For example, the impairment loss of R$34.3 billion recorded by Petrobras (2021) in the 2020 fiscal year, despite being the largest amount recognized by a Brazilian company in the historical series of this study, represented only 3.51% of the company's average total assets. The largest weighted loss (maximum value) was reported by Dommo Energia S.A. (2018) in the oil, gas, and biofuels sector for the 2017 fiscal year. According to the company, the updating of the business plan for its Atlanta & Oliva CGU was the main reason for the recognition of approximately R$630 million as an impairment of fixed and intangible assets related to exploration and production, which reduced the company's average total consolidated assets by 36.31%. In turn, with regard to the minimum amounts (reversals of impairment losses) shown in Table 3, the one that stood out the most (11.23%) was that recognized by Eternit S.A. (2021), a company in the industrial goods sector. On June 30, 2020, the company reviewed the recoverable value of its relevant assets and concluded that it would partially reverse losses in the Fiber Cement CGU in the amount of R$ 72 million.

In total, 18 companies reported impairment losses on fixed and intangible assets due, among other things, to the effects of the covid-19 crisis (Anima, BK Brasil, Hering, Cogna, Coteminas, CVC Brasil, Natura & Co, IMC S/A, Iochp-Maxion, Restoque, Lojas Marisa, Movida,

Petrobras, Serra Azul Water Park, Simpar, T4F, Unicasa, and Valid), totaling R$40.9 billion in losses. This represents approximately 90% of the total amount of impairment losses (R$45.5 billion, net of reversals) recognized by the Brazilian companies in 2020. In addition, it was observed that 50% of these companies had not recognized any impairment of fixed and intangible assets for at least 3 years (Anima, Hering, Cogna, CVC Brasil, Iochp-Maxion, Movida, Serra Azul Water Park, Simpar, and Unicasa).

Table 4 shows the descriptive statistics of the covid-19-related impairment losses on non-current assets, scaled by average total assets. One can see that asset impairment losses related to covid-19 were concentrated in listed companies, i.e. 94.4% of the entities that reported this type of loss were listed on the B3 in 2020. On average, impairment losses represented 4.68% of the average total assets of the listed companies, but with a high dispersion between the values, as shown by the standard deviation of 7.35%. In addition, the average of the losses related to, among other things, covid-19 was higher than the general average for the Brazilian listed companies, as seen in Panel B of Table 3 (1.62% of average total assets, 2020).

Table 4
Asset impairment losses related to covid-19, weighted by average total assets

Group	n	Mean	St. deviation	Minimum	Maximum
CVM & B3	18	4.43%	7.21%	0.05%	28.05%
B3	17	4.68%	7.35%	0.06%	28.05%
CVM	1	0.05%	0.00%	0.05%	0.05%

B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); covid-19 = coronavirus disease 2019; CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).
Source: *Prepared by the authors.*

The most significant impairment loss occurred at Le Lis Blanc/Restoque Comércio e Confecções de Roupas S.A. (2021). The company recorded a goodwill impairment of R$915 million due to the negative effects of the pandemic on the future earnings projections of its subsidiary Dudalina S.A., which added to the provision for losses related to the closure of some physical stores, representing the equivalent of 28.05% of its average total assets. In turn, Marisa Lojas S.A. (2021) reported the lowest impairment loss among the listed companies, representing only 0.06% of its average total assets.

Table 5
Descriptive statistics of covid-19 impairment by Bovespa economic sector

Bovespa Economic Sector	Abbr	n	Mean	St. deviation	Minimum	Maximum
Industrial goods	IG	2	2.21%	2.84%	0.20%	4.21%
Cyclical consumption	CC	13	5.49%	8.24%	0.06%	28.05%
Non-cyclical consumption	nCC	1	0.37%	0.00%	0.37%	0.37%
Oil, gas, and biofuels	OG	1	3.51%	0.00%	3.51%	3.51%
Overall total		17	4.68%	7.35%	0.06%	28.05%

covid-19 = coronavirus disease 2019.
Source: *Prepared by the authors.*

Table 5 shows the descriptive statistics of the impairment losses by Bovespa economic sector based on the database of companies listed on the B3. Among the companies that attributed their impairments to the effects of the covid-19 crisis, there was a high concentration in the cyclical consumption sector (13 companies out of a total of 17 entities), which had the highest average impairment loss (5.49%) in relation to average total assets. This result is in line with the characteristics of the sector, since companies in the cyclical consumption sector (clothing, footwear, household appliances, construction, among others) produce or sell goods that are considered non-essential, i.e. these companies' performance is affected by fluctuations in the economy, whether due to recessions or economic expansions (Pandini et al., 2018). Thus, as expected, companies in this sector are the ones that recognized the most losses related to the pandemic, which significantly limited the operations of this type of

business, in addition to the general effect of a reduction in the income of the population. However, it is necessary to take into account other factors related to the recognition of impairment and that may have occurred at the same time as the pandemic. The next section of this article analyzes these.

4.2 Effect of the Covid-19 Economic Crisis on the Recognition of Impairment of Non-Current Assets

Table 6 shows the descriptive statistics of the variables used in the research.

Table 6
Descriptive statistics of the linear regression variables

Panel A – Continuous variables winsorized at 1% on each side of the distribution									
Variable	383 firms (B3 & CVM)			235 firms (B3)			126 firms (CVM)		
	n	Mean	St. deviation	n	Mean	St. deviation	n	Mean	St. deviation
*ln*Imp	1,805	0.0015	0.0071	1,055	0.0022	0.0096	578	0.0005	0.0036
ΔREV	1,805	0.0173	0.1681	1,055	0.0094	0.1333	578	0.0277	0.2478
ΔROA	1,805	0.0069	0.1000	1,055	0.0017	0.0726	578	0.0374	0.2726
ΔROE	1,805	-0.0664	1.0291	1,055	-0.0836	0.9541	578	-0.0251	1.7435
ΔOCF	1,805	0.0117	0.1135	1,055	0.0064	0.0730	578	0.0191	0.2308
Book-to-Market				1,055	0.9105	0.9068			
lnSIZE	1,805	14.5916	2.3072	1,055	15.2812	1.7745	578	13.5470	2.8321
LEV	1,805	0.6122	0.2432	1,055	0.5870	0.2226	578	0.6667	0.2607
Panel B – Dummy variables									
Variable	383 firms (B3& CVM)			235 firms (B3)			126 firms (CVM)		
	n	Mean		n	Mean		n	Mean	
CrisisYear	1,805	0.3950		1,055	0.3934		578	0.3910	
CovidRel	1,805	0.0100		1,055	0.0161		578	0.0017	
Smooth	1,805	0.5091		1,055	0.5280		578	0.4671	
BigBath	1,805	0.1706		1,055	0.1488		578	0.1972	

B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); covid-19 = coronavirus disease 2019; CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).
Source: *Prepared by the authors.*

Based on Panel A of Table 6, the companies in the first sample (B3 & CVM) had an average annual growth in their net revenues of 1.73%. In turn, the variation in the return on total assets (ΔROA) was low and positive at 0.69%, in line with the findings of Alves and Silva (2020), who pointed out that the average profitability of companies is relatively constant over time. However, a different scenario is found in the variation of ROE (ΔROE), which was negative at 6.64%, indicating a decline in the performance of the average company in the sample, making it more prone to impairment recognition (Abughazaleh et al., 2011). Despite the poor performance in terms of ROE, the average firm in the sample generated 1.17% more cash resources (ΔOCF).

In order to control for aspects related to organizational infrastructure, we include the SIZE variable, measured as the natural logarithm of total assets. The average leverage (LEV) of the Brazilian companies was 61.22%, indicating a moderate amount of obligations to third parties (suppliers, banks, employees, among others). In addition, specifically with regard to the average company in the second sample (B3), its market value was higher than its equity value, according to the average book-to-market variable (< 1). Finally, Panel B of Table 6 describes the research dummy variables and, in this analysis, the average represents the percentage of companies with a value equal to 1.

To rule out multicollinearity in the models, we analyzed the Pearson's correlation matrices and, despite the presence of correlated variables, in no case were serious multicollinearity problems noted in the models, i.e., coefficients greater than 0.8 (Brooks, 2014).

Table 7 shows the results of the estimation of equation (1) for each of the three samples. For each variable, the coefficients, standard errors (in parentheses), and significance levels are reported. As can be seen, the coefficient of the CovidRel variable is positive and statistically significant for the full sample (Model 1) and for the B3 sample (Model 2). Thus, the results indicate that the effects of the covid-19 crisis are associated with the incidence of impairment of fixed assets (including

right-of-use) and intangible assets (including goodwill) for the samples in Models 1 and 2, even after controlling for economic and financial factors and earnings management incentives.

Table 7
Linear regressions of the effect of covid-19 on the recognition of impairment of non-current assets

	Dependent variable: lnIMP					
	Model 1 (B3 & CVM)		**Model 2 (B3)**		**Model 3 (CVM)**	
CrisisYear	-0.0000		-0.0000		-0.0003	
	(0.0003)		(0.0006)		(0.0002)	
CovidRel	0.0173	***	0.0214	***	0.0005	
	(0.0040)		(0.0053)		(0.0008)	
ΔREV	-0.0009		-0.0019		-0.0003	
	(0.0010)		(0.0026)		(0.0004)	
ΔROA	-0.0074	***	-0.0192	**	-0.0008	
	(0.0028)		(0.0079)		(0.0006)	
ΔROE	-0.0005	*	-0.0011	**	-0.0000	
	(0.0002)		(0.0006)		(0.0000)	
ΔOCF	0.0001		-0.0062	*	0.0003	
	(0.0009)		(0.0032)		(0.003)	
Book-to-market			0.0017	***		
			(0.0006)			
*ln*SIZE	-0.0017	***	-0.0034	***	-0.0005	
	(0.0005)		(0.0013)		(0.0003)	
LEV	0.0043	***	0.0067	*	0.0015	
	(0.0014)		(0.0035)		(0.0009)	
Smooth	0.0009	**	0.0019	***	0.0006	
	(0.0004)		(0.0007)		(0.0004)	
BigBath	0.0003		-0.000		0.0003	
	(0.0006)		(0.0011)		(0.0006)	
Company fixed effects	Yes		Yes		Yes	
Companies	383		235		126	
Observations	1.805		1.055		578	
R^2 within	0.1131		0.1948		0.0129	
F-statistic	3.2561	***	3.3900	***	2.1866	***

Notes: *Standard errors robust to heteroscedasticity. The study's dependent variable ($lnIMP_{it}$) is formed by the sum of the recognitions (expressed as positive numbers) and/or reversals (expressed as negative numbers) of impairment losses on fixed assets, rights-of-use, intangible assets, and goodwill for company i in year t, divided by average total assets. In addition, the measure was transformed into a natural logarithm. The definitions of the explanatory variables in the models are shown in Table 1. All continuous variables were winsorized at 1%.*
B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); covid-19 = coronavirus disease 2019; CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).
**, **, *** = p-value levels < 10%, < 5%, and < 1%, respectively.*
Source: *Prepared by the authors.*

However, it is not possible to correlate the effects of covid-19 and the control variables with the occurrence of impairment in non-listed public companies (CVM, Model 3), since none of the coefficients in Model 3 (CVM sample) were statistically significant. Consequently, the R^2 of Model 3 showed low explanatory power (1.29%) for the variance of the dependent variable based on its regressors (explanatory variables). Therefore, based on the results in Table 7, it is possible to confirm the research hypothesis for Brazilian publicly traded companies listed on the B3, but the hypothesis is rejected for non-listed Brazilian publicly traded companies (CVM).

Other variables in models 1 and 2 were also statistically significant. We observe a negative and statistically significant relationship between impairment losses and ΔROA and ΔROE, i.e., less profitable companies are more likely to incur impairment losses (Abughazaleh et al., 2011; Vogt et al., 2016). Among the listed companies,

less profitable companies are less valued by the market, reducing the fair value of their assets and increasing the likelihood of losses (Zang, 2008). Similarly, ΔOCF is marginally and negatively related to the impairment losses of listed companies (B3, Model 2), which is consistent with the literature that shows that companies with declining cash flow tend to record impairment losses (Peetathawatchai & Acaranupong, 2012; Wrubel et al., 2015). We also note that companies with higher book-to-market (BtM) ratios are more likely to record losses (positively and negatively associated at 1%). Abughazaleh et al. (2011), Alves and Silva (2020), and Zang (2008) found the same result. This finding is consistent with the IAS 36 accounting standard, since the closer the equity value is to the market value of the firm, the greater the likelihood that its assets are overvalued or no longer fully recoverable (Vogt et al., 2016; Zhuang, 2016).

The behavior of the size variable (lnSIZE) differs from the results of the specific literature, which shows a greater propensity for impairment risk in bigger companies (Souza et al., 2015). However, the analyses in section 4.1 showed that in this study, the largest impairment losses scaled to average total assets did not occur in big companies, so that the size variable had a negative and significant correlation at 1% (Models 1 and 2), i.e. smaller companies tended to have more impairment losses. Martucheli et al. (2021), studying the relationship between capital structure and profitability in Brazilian companies, found evidence that the bigger a company is, the more profitable it is, in addition to having greater negotiating power, which allows it to achieve better results, creating a less conducive scenario for the incidence of impairment.

We expected a negative relationship between financial leverage and the recognition of impairment losses (Vogt et al. 2016; Zang, 2008), but the evidence we found indicates a positive and significant relationship at 1% in Model 1 (B3 & CVM) and at 10% in Model 2 (B3). Pacheco et al. (2017) found results that the higher the financial leverage of the firms in the sample, the more they would recognize goodwill impairment losses. Therefore, the findings of this research are consistent with Pacheco et al. (2017) and contradict the arguments of Zang (2008) about entities having a management strategy of reducing impairment in order to avoid violating debt covenants.

Finally, we bring evidence on the incentives for earnings management through income smoothing (Smooth), as observed in models 1 and 2 (positive and significant relationship at 5% and 1%, respectively). This finding is consistent with Abughazaleh et al. (2011), i.e., when earnings are higher than expected, managers have an incentive to smooth earnings through accruals to reduce the pressure for high future earnings and may use impairment to do so.

4.3 Further Analysis of the Effect of the Covid-19 Economic Crisis on the Recognition of Impairment of Non-Current Assets

Table 8 shows the results of additional tests we carried out. First, models 4 and 5 in Table 8 test the research hypothesis using a more restrictive explanatory variable of interest ("CovidRelStrong," which takes a value of 1 only for impairment disclosures related to the covid-19 crisis, among other factors, with the respective company not recording any impairment for at least 3 consecutive years, 2017 to 2019, and 0 otherwise). Next, in order to identify possible industry patterns in the relationship between the covid-19 pandemic ("CovidRel" and "CovidRelStrong") and the incidence of impairment in Brazilian companies listed on the B3, we estimated models 6 and 7.

Table 8
Additional linear regressions of the effect of covid-19 on the recognition of impairment of non-current assets

	Dependent variable: lnIMP							
	Model 4 (B3 & CVM)		**Model 5 (B3)**		**Model 6 (B3)**		**Model 7 (B3)**	
CrisisYear	0.0002		0.0004		-0.0000		0.0004	
	(0.0003)		(0.0006)		(0.0006)		(0.0006)	
CovidRel					0.0234	***		
					(0.0007)			
CovidRelStrong	0.0135	**	0.0186	**			0.0210	**
	(0.0060)		(0.0086)				(0.0095)	
ΔREV	-0.0010		-0.0020		-0.0014		-0.0020	
	(0.0010)		(0.0027)		(0.0026)		(0.0027)	
ΔROA	-0.0076	***	-0.0205	**	-0.0189	**	-0.0206	**
	(0.0028)		(0.0080)		(0.0079)		(0.0080)	

Table 8
Cont.

	Dependent variable: lnIMP							
	Model 4 (B3 & CVM)		**Model 5 (B3)**		**Model 6 (B3)**		**Model 7 (B3)**	
ΔROE	-0.0005	*	-0.0013	**	-0.0011	**	-0.0013	**
	(0.0003)		(0.0006)		(0.0006)		(0.0006)	
ΔOCF	0.0000		-0.0075	**	-0.0061	*	-0.0074	**
	(0.0010)		(0.0034)		(0.0032)		(0.0034)	
Book-to-market			0.0017	***	0.0017	***	0.0016	***
			(0.0006)		(0.0006)		(0.0006)	
*ln*SIZE	-0.0015	***	-0.0032	**	-0.0031	**	-0.0030	**
	(0.0005)		(0.0013)		(0.0012)		(0.0013)	
LEV	0.0040	***	0.0066	*	0.0060	*	0.0064	*
	(0.0015)		(0.0036)		(0.0035)		(0.0036)	
Smooth	0.0009	**	0.0020	***	0.0019	***	0.0020	***
	(0.0004)		(0.0007)		(0.0007)		(0.0007)	
BigBath	0.0007		0.0009		0.0001		0.0008	
	(0.0006)		(0.0012)		(0.0011)		(0.0012)	
CovidRel*IGSector					-0.0055			
					(0.0111)			
CovidRel*CCSector					-0.0007			
					(0.0067)			
CovidRel*nCCSector					-0.0146	***		
					(0.0026)			
CovidRelStrong*IGSector							-0.0187	**
							(0.0093)	
Company fixed effects	Yes		Yes		Yes		Yes	
Companies	383		235		235		235	
Observations	1,805		1,055		1,055		1,055	
R^2 within	0.0627		0.1348		0.1974		0.1389	
F-statistic	1.9540	**	2.2396	**	10.7007	***	6.6674	***

Notes: *Standard errors robust to heteroscedasticity. In Model 6, the sector variables were omitted due to exact collinearity and the interaction of the CovidRel variable with the oil, gas, and biofuels sector. In Model 7, the sector variables were omitted due to exact collinearity and the interaction of the CovidRelStrong variable with the cyclical consumption sector. The dependent variable ($lnIMP_{it}$) in the study and the explanatory variables are the same as those used in the regressions in Table 8, with the exception of the CovidRelStrong variable [=1 for impairment disclosure related, among other factors, to the covid-19 crisis and with the respective company not disclosing asset losses for at least 3 consecutive years, 2017 to 2019, and 0 otherwise] and the economic sector variables, in which the sector classifications presented in Table 5 were used. All continuous variables were winsorized at 1%. B3 = publicly traded companies listed on the Brazilian Stock Exchange (category A); covid-19 = coronavirus disease 2019; CVM = publicly traded companies not listed on the Brazilian Stock Exchange (category B).*
**, **, *** = p-value levels < 10%, < 5%, and < 1%, respectively.*
Source: *Prepared by the authors.*

The results of models 4 and 5 in Table 8, even using a more restrictive variable of interest ("CovidRelStrong"), indicate the existence of a relationship between the economic and social consequences of the covid-19 pandemic and the occurrence of impairment losses on non-current assets in Brazilian companies, confirming the hypothesis of the study. As for the control variables, the results remained similar to those obtained in models 1 and 2 in Table 7.

In the industry analysis (models 6 and 7), in line with the previous findings, we show that the variables CovidRel (in model 6) and CovidRelStrong (in Model 7) have positive signs and statistical significance at the 1% and 5% levels, respectively, showing that the increase in the incidence of impairment during the pandemic was not an isolated effect in certain sectors, although some sectors suffered more than others. The results of Models 6 and 7 also show that, among the economic sectors that

suffered impairment losses influenced by covid-19, firms in the non-cyclical consumption sector (significant at 1%, Model 6) and the industrial goods sector (significant at 5%, Model 7) tended to recognize fewer impairment losses. These findings are consistent with the data described in Table 5, which shows that these two sectors had the lowest average impairment losses compared to the events recorded in the other sectors. However, it should be noted that these results are driven by Natura & Co (2021) in the non-cyclical consumption sector, which suffered from the closure of physical stores in its retail business, and by Simpar (2021) and Valid Soluções (2021), both in the industrial goods sector, which suffered from strong impacts on the demand for their products and services, so the results do not necessarily represent industry patterns and may be specific to these companies.

Table 9 shows the results of equation (1) with the dependent variable separated between fixed assets (including the right-of-use lease assets) in Model 8 and intangible assets (including goodwill) in Model 9. The results show that the overall conclusion is mainly driven by the impairment of intangible assets, as the CovidRel variable is of greater magnitude and statistical significance in Model 9 than in Model 8. This result is to be expected, since the majority of the companies in the sample estimated the recoverable value of their assets by CGU, allocating the impairment value according to the criteria established by the standard (CPC, 2010) in the following order: first to the book value of the goodwill of the CGU and, if there is still a portion of unallocated loss, to the other assets of the CGU in proportion to the book value of each of these assets.

Table 9
Linear regressions of the effect of covid-19 on the recognition of impairment of fixed and intangible assets

	Dependent variable: lnIMP	
	Model 8	**Model 9**
	(Fixed assets)	**(Intangible assets)**
Crisis	0.0001	-0.00003
	(0.0001)	(0.0002)
CovidRel	0.002*	0.013***
	(0.001)	(0.004)
ΔREV	-0.0004	-0.0004
	(0.0004)	(0.001)
ΔROA	-0.001	-0.004**
	(0.001)	(0.002)
ΔROE	-0.0001	-0.0003
	(0.0001)	(0.0002)
ΔOCF	-0.0001	0.0003
	(0.0004)	(0.001)
*ln*SIZE	-0.0004**	-0.001**
	(0.0002)	(0.0004)
LEV	0.001**	0.002*
	(0.001)	(0.001)
Smooth	0.0003*	0.0005*
	(0.0002)	(0.0002)
BigBath	-0.0001	0.0002
	(0.0002)	(0.0004)
Company fixed effects	Yes	Yes
Companies	383	383
Observations	1,805	1,805
R^2 within	0.022	0.129
F-statistic	3.127***	20.878***

Notes: *Standard errors robust to heteroscedasticity. The dependent variable ($lnIMP_{it}$) in Model 8 refers only to fixed assets (including the right-of-use lease assets), while the one in Model 9 refers only to intangible assets (including goodwill). All continuous variables were winsorized at 1%.*
covid-19 = coronavirus disease 2019.
**, **, *** = p-value levels < 10%, < 5%, and < 1%, respectively.*
Source: *Prepared by the authors.*

Next, to test the robustness of the findings, we estimated equation (1) for each of the three samples, but with the dependent variable without the natural logarithm. The results remained similar to those of the original model (reported in Table 7), showing that transforming or not the dependent variable into a natural logarithm did not affect the sign or statistical significance of the CovidRel explanatory variable. We also test the robustness of the results found in Table 7 using a more balanced time series between the data before and the data during the covid-19 event. With respect to the CovidRel variable, the results were similar to those found in Table 7 for the samples of publicly traded companies (B3 & CVM) and listed companies (B3), confirming the research hypothesis even with a shorter panel (2018, 2019, and 2020).

In addition, we test the effect of the audit firm including as a control variable a dummy identifying the Big Four firms, a variable obtained from the Refinitiv database, whose data are only available for companies listed on the B3 (some of which also have missing data). Out of a total of 962 observations available, 761 refer to reports audited by Big Four firms. After controlling for the other factors in the regression, the dummy identifying the companies audited by the Big Four was not statistically significant, and the CovidRel variable remained positive and statistically significant, maintaining the previous conclusions. As with the Big Four audit, we also tested whether there is an effect of a CEO change on impairment, as suggested by previous literature (Abughazaleh et al., 2011), by adding a dummy indicating whether there was a CEO change in each year, constructed using information from the Refinitiv database. For the period from 2016 to 2020, 46 CEO changes were identified and, after controlling for other factors, the CEO change dummy was positive and statistically significant at 10%, and the CovidRel variable remained positive and statistically significant at 1%, maintaining the previous conclusions.

Finally, we also tested the role of multinational companies, as it is the local and international impact of covid-19 may have been different. To this end, equation (1) was re-estimated, including a dummy identifying multinational companies (based on the classification available on Refinitiv), both individually and interacting with the CovidRel variable. The results show that the 384 observations referring to multinationals did not show a statistically different level of impairment from the others, and the effect of the pandemic on the level of impairment was not statistically different from that of companies operating only locally. These robustness test results are not reported due to space limitations, but are available upon request.

5. CONCLUSION

Based on the literature, and considering the economic crisis scenario in 2020, this research evaluated the hypothesis that there is a positive and significant relationship between the effects of the covid-19 crisis and the incidence of impairment of fixed and intangible assets in Brazilian companies. We took three steps to test this hypothesis. The first one was to determine the incidence of impairment from 2016 to 2020. In absolute values, the losses amounted to R$ 145 billion (adjusted for inflation and net of reversals), with 63% of this amount (R$ 92 billion) concentrated in the years when Brazil had negative GDP growth (2016 and 2020). The second step was to analyze the content of the notes to the 2020 consolidated financial statements and to identify the records of impairment losses of assets resulting from, among other factors, the effects of the covid-19 crisis. In total, 18 companies reported impairment of fixed, right-of-use, intangible, and/or goodwill assets that, according to their disclosures, were related to the effects of the pandemic, totaling R$40.9 billion in losses in the first year of the crisis.

Given the need to analyze the effect of covid-19 along with other factors that, according to the accounting literature, are associated with the recording of impairment and that may have occurred concurrently with the pandemic, the third step was to estimate nine linear regression models with panel data to test the research hypothesis. The results of the analysis confirmed the research hypothesis regarding the correlation between the economic and social consequences of the covid-19 pandemic and the occurrence of impairment losses on non-current assets in Brazilian companies, especially those with high market exposure (companies listed on the B3). During this period, it was possible to observe several factors (such as size, profitability, book-to-market, leverage, among others) that help explain the incidence of impairment of non-current assets in the companies observed in this research; however, even with these other factors, the pandemic was still relevant to explain the recognition of these losses. Furthermore, by separating the impairment of fixed and intangible assets, the results suggest that intangible assets were more exposed to the

impacts of the covid-19 crisis than fixed assets. These findings alert users and preparers of financial statements to the effects of a social and economic crisis on accounting figures, particularly in relation to the impairment of non-current assets, and provide historical information (from the period of the covid-19 pandemic) for future analyses of the impacts of an adverse scenario with a high degree of uncertainty on the business of Brazilian companies. However, it is important to consider these results and understand that they cannot be generalized to all companies in Brazil and that, with respect to the analyses by economic sector, some companies were more affected by covid-19 than others, so they do not necessarily represent industry patterns (and may be specific to these companies).

Finally, given the limited time horizon and variables used in the econometric model of this study, it is necessary to continue examining the effects of covid-19 on accounting variables (both those with short-term and long-term biases) in order to corroborate or refute the findings of this study. We suggest investigating these effects in cross-listed companies to highlight possible differences depending on the level of market scrutiny to which companies are exposed, as well as examining the effects of the pandemic on the incidence of asset impairment on stock exchanges in other countries. In addition, according to the Central Bank of Brazil (2022), GDP grew by 4.6% in 2021 compared to 2020, signaling a scenario of economic improvement that, depending on the specific performance of each company, would make it possible to reverse part of the impairments recorded in 2020 and in previous years, with the exception of the impairment portion related to goodwill. Or, even in a more favorable economic scenario, it is possible that managers recorded impairments because they delayed their recognition in previous years (Cappellesso & Niyama, 2022). This aspect in itself presents an opportunity for future research, as the incidence of asset impairment in the years after 2020 has still barely been explored by the academic community.

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