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The impact of COVID-19 on Portuguese firms' capital structure

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Acknowledgement

Moving to Portugal and choosing to pursue my master's degree in Católica SBE was one the most important decision that I made during the last few years. So far, it has been an amazing journey in which I had the opportunity to meet and interact with people with different backgrounds and from all around the world. Reaching the final steps of this challenging chapter of my life makes me feel proud and happy. For that, I will forever carry a feeling of gratitude towards the university and its teachers who have contributed to the person I am today. Thank you all

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Abstract

This dissertation studies the effect of COVID-19 on Portuguese firms' capital structure. This paper finds that the pandemic has had a statistically and economically significant effect on the capital structure of Portuguese companies. Findings show that companies seem to have increased their leverage ratio and long-term debt during the pandemic years, 2020 and 2021. The results of this study contrast with previous literature about other crises, such as the global financial crisis of 2008-2009, and previous studies on the impact of economic uncertainty on capital structure behavior. This possibly reflects the widespread fiscal, monetary, and prudential support throughout the pandemic.

Esta dissertação estuda o efeito do COVID-19 na estrutura de capital das empresas portuguesas. Este artigo conclui que a pandemia teve um efeito estatisticamente e economicamente significativo na estrutura de capital das empresas portuguesas. Os resultados mostram que as empresas parecem ter aumentado seu índice de alavancagem e dívida de longo prazo durante os anos de pandemia, 2020 e 2021. Os resultados deste estudo contrastam com a literatura anterior sobre outras crises, como a crise financeira global de 2008-2009 e estudos anteriores sobre o impacto da incerteza económica no comportamento da estrutura de capital. Isso possivelmente reflete o amplo apoio fiscal, monetário e prudencial durante a pandemia.

JEL Classification: G32

Keywords: Leverage, Capital Structure, Pandemic

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I. Introduction

Since it has started in the late year of 2019, Covid-19 had quickly spread around the globe and continued to do so until the World Health Organization declared a global health emergency on the 30th of January 2020. By March 2020, eastern Europe became a hotspot for the epidemic and Portugal was one of the countries affected. To mitigate the impact of this global health crisis, governments around the world introduced different measures that have changed the life of billions of people. Traveling became restricted and airline companies and tourism activities were deeply affected. Given the importance of tourism and its value chain for the Portuguese economy, lockdowns, curfews, and social distancing rules were one of the measures that have had severe economic effects on individuals as well as firms. This created sudden and large supply and demand shocks that could make an economy of any country go through a recession period. Consequently, governments faced the challenge of finding a balance between the economic or the health consequences for almost 2 years.

In the Portuguese context, the pandemic came in a phase of economic recovery following the global financial crisis of 2008 and of the euro area sovereign debt crisis of 2010-2012. To help the economy recover from it, the Portuguese economy relied on exports, growth in the tourism sector, and budget cuts. In this sense, the Portuguese economy had to absorb the consequences of two major crisis during a short period of a decade. Furthermore, the initial measures that helped Portugal recover from the first crisis have lost their efficiency in a context where the tourism sector was hit the most, exports had plummeted due to the supply chain disruptions and the mobility restrictions imposed on goods and people, and the heightened pressure on the fiscal budget to help private and public companies in distress.

These types of events offer a great opportunity to study how such crisis affects the capital structure of firms. Since Modigliani and Miller (1958) introduced the irrelevance theory, capital structure has always been one of the cornerstones of research papers in finance. This study will also try to analyze the impact of the pandemic on the capital structure of Portuguese firms. How did firms react during the crisis? Were all firms equally affected? Or were small and medium enterprises hit the most? To answer these questions, this study distinguishes between two sets of firms: large enterprises and SMEs. After examining all available firms, companies that had no long-term debt

prior to the health crisis will be excluded from the sample. It is important to do this division, because the firms that used long-term financing before the pandemic are more likely able to enjoy better access to external financing. The underlying assumption is that these sample firms are most likely to be affected by this event than those who did not need any long-term financing during 2019.

Because of the unprecedented economic impacts of COVID-19, this paper will investigate its impact on the Portuguese companies' capital structure, using a unique firm-level data set that includes information on more than 150,000 businesses between 2015 and 2021. The research will follow Demirguc-Kunt, Martinez-Peria and Tressel (2015) empirical study on the effect of the global financial crisis on firms' capital structure. This paper quantify leverage as the ratio of total debt to total assets, long-term leverage as the total long-term debt to assets and the maturity composition of debt as long-term debt to total debt ratio. Thus, capital structure evolution is examined after considering the standard firm characteristics that have proven their significance in previous literature studies as important determinants of capital structure.

The most recent crisis that can be compared to Covid-19 is the global financial crisis of 2008. The scale and the number of countries affected in both cases is huge. For this reason, it is relevant to highlight the main results found in papers that studied the capital structure evolution during the financial crisis. Scholars found that the use leverage and long-term financing during that period declined (Demirguc-Kunt, Martinez-Peria and Tressel 2015). Consequently, the maturity structure of debt had also decreased. This can be explained by the governmental and central banks interventions made around world and the introduction of new regulations to better regulate and monitor the banking sector. However, findings in this paper contradict the implications of the previous crisis. Sample firms responded differently to the pandemic repercussions. As a matter of fact, the use of leverage and long-term financing increased during 2020 and 2021, crisis' years. Firms resorted to borrowing to fight the economic uncertainty caused by Covid-19. Add to that, results also show that the ratio of long-term debt to total debt has increased. The findings go against literature that predicts moving toward deleveraging and shortening the maturity composition of debt in period of economic uncertainty. Finally, results show that, after controlling for unobserved firm fixed effects, the effect on SMEs was not found to be more significant than large firms.

The remainder of the thesis will proceed as follows. In section 2, the paper goes through the relevant literature regarding the main theories of capital structure. Section 3 presents the dataset and the methodology that this study follows. Results are then displayed in section 4. At the end, the main conclusion and interpretations are grouped in section 5.

II. Literature review

Studies on capital structure have always been the focus of numerous finance scholars. In this section, a summary of the previously conducted studies is presented. At first, a brief description of the most pertinent theories that try to explain the choices made for capital structure financing, such as the trade-off theory and the pecking order theory. Then, we will review the widely accepted determinants of capital structure, and finally, the effects of previous crisis on firms' choices of capital. These papers can be a good starting point for this study.

1. Trade-off theory

The trade-off theory first emerged in 1958 when Modigliani and Miller stated that, in perfectly efficient markets where there are no taxes, no asymmetric information and no bankruptcy costs, the company capital structure choice does not affect its value. However, due to the huge gap between the theory' perfect world and the real world, a second version was introduced and led to the establishment of the optimal capital structure, in which management can maximize the firm value by balancing the cost and benefit of debt.

Several empirical studies have confirmed the relevance of different factors employed by the static trade-off theory (Titman and Wessels (1988), Rajin and Zingales (1995) and Booth et al. (2001), Frank and Goyal (2009) and De Jong et al (2008)). On the other hand, evidence on the pace of adjusting towards the target debt ratio is mixed. Some papers (Flannery and Rangan (2006)) found that companies move fast towards their target leverage ratio, while others concluded that the transition occurs at a slow pace (Fischer et al., (1989) and Fama and French (2002)).

The gaps in the previous models led to the development of the dynamic trade-off theory (Fischer, Henikel and Zechner (1989)). This theory, which includes adjustment costs, implies that firms will let the debt ratio oscillate until it becomes too risky, then they will re-leverage.

2. Pecking order theory

Numerous theories have emerged since Modigliani and Miller 1958 trying to take into consideration the private information about the characteristics of firm's returns and the investment opportunities that only managers possess. This led to the establishment of pecking order theory (Myers & Majluf, 1984; Myers, 1984). According to this theory, firms would rather use their internal funds over issuing new debt or equity. The reason behind this assumption is that internal funds are considered to be the cheapest and less restraining compared to external funds. However, if internal funds are not sufficient, the second alternative will be issuing debt. Debt is considered by managers to be safer and cheaper than issuing new equity, which is the last resort option given the high return investors expect.

Ross, Westerfield and Jaffe (2002) highlighted the differences between the trade-off and the pecking order theories. The first implication is that firms do not have a target leverage ratio. Instead, each company defines its debt ratio according to its financial needs. Second, according to the pecking order theory, profitable firms will tend to issue less debt, as their first source of funds is their retained earnings. On the other hand, the trade-off theory suggests that profitable firms will use their maximum debt capacity to maximize the tax shield benefit.

3. Determinants of capital structure

Capital structure and its determinants is a well-researched topic and many studies have tried to identify what are the main firm-level variables that affect the leverage ratio. In this section, a summary of these variables, and their relationship to the level of debt a firm chooses to have, is reviewed.

Raviv and Harris (1991) summarized of the main theories and research on capital structure. The authors identify 4 different determinants of capital structure, from previous literature: asymmetric product/input market interaction, corporate control considerations, the agency approach, and information. The authors claim that although numerous capital structure variables have been empirically proven, further study is still required.

One of the most agreed-upon determinants is profitability. The pecking order theory (Myers, 1984) suggests that companies that want to raise funds will start by using their internal resources before

seeking external finance, such as debt that comes in second place and issuing equity as a last resort, which is explained by the high return investors expect to get. The intuition behind this ranking is that internal funds are considered to be the cheapest source of funds (no interest) and they come with no restrictions whatsoever. Issuing debt, which comes second, is less expensive and fewer restrictions are imposed compared to issuing new equity, which is seen as the last alternative a firm might go to when raising funds. Therefore, profitable firms will tend to have lower debt level, thus a negative relationship between leverage and profitability is expected. Guney and Paudyal (2005) studied a sample of firms from the United Kingdom and France and confirmed the negative relationship between profitability and leverage. On the other hand, the trade-off theory predicts a positive relation between profitability and leverage. Highly profitable firms have higher borrowing capacity than other firms. Higher debt translates into higher interest payments that are tax deductible, thus a higher tax shield.

The second determinant of capital structure is the size of the firm. It is one of the most widely accepted determinants in capital structure literature. However, findings about the relationship between size and leverage is mixed. According to the trade-off theory, large firms have a higher debt capacity compared to smaller firms, and lower transaction costs. Rajan and Zingales (1995) state that "larger firms tend to be more diversified and fail less often, the size is an inverse proxy for the probability of bankruptcy". On the opposite side, the pecking order theory suggests a negative relationship between size and leverage (Bevan and Danbolt (2000), Kester (1986)).

Existing literature supports the idea that managers strive to match the maturity of their liabilities and of their assets (Rajan et al,2001). (Hart and Moore 1995) suggested that firms try to balance the debt payment schedule with the timing of investments returns. This goes with the view that short-term investments and working capital requirements should be financed with short-term debt while long-term investments, such as building and machinery, need to be associated with long-term financing. Firms that fixed assets constitute an important share of its total assets, can easily raise long-term debt, as these fixed assets can serve as collateral and ease the borrowing costs. Thus, assets tangibility is the third determinant of firms' capital structure.

The last determinant to consider is the turnover to total assets ratio. Some researchers find positive relationships between sales growth and debt ratios (Titman & Wessels, 1988; Cassar & Holmes 2003). On the other hand, the evidence presented by Rajan & Zingales (1995), Long & Maltiz

(1985), and Akhtar & Oliver (2009) suggests firms with high turnover to total assets ratio use less debt. This is due to the fact that the realized returns from new investments financed with risky debt will be given to the debtholders, instead of the existing shareholders. Another explanation can be that such measures are intangibles and cannot be used as a collateral, companies are therefore less likely to issue debt.

4. Crisis impact on a firm capital structure

Before covid-19, the most recent crisis that had a universal negative impact is the 2008 global financial crisis. Numerous studies have been conducted since then to try to examine the crisis effects.

Graham, Leary, and Roberts (2014) concluded that firms' debt ratios decrease during periods of uncertainty (crisis period) due to the lack of investment opportunities, thus leading to a fall in the demand for external funds. According to Campello, Graham, and Harvey (2010), due to the high cost of funds during periods of economic downturns, demand for external funds decrease.

D'Amato, A. (2020) shows how the current global financial crisis affected SMEs capital structure decisions and their drivers using a unique dataset of small and medium-sized Italian firms (SMEs) from 2006 to 2016. Credit supply shocks had a substantial influence on the leverage ratio of Italian SMEs. In comparison to the pre-crisis period, Italian SMEs dramatically reduced their leverage, particularly their short-term loan exposure, during and after the crisis. He finds that the short-term debt channel is more volatile than the long-term debt channel to credit conditions. In addition, during the crisis, riskier and more valuable companies reduced their debt more than they did before the crisis. Iqbal et al. (2015) examine the influence of the previous financial crisis on capital structure decisions of UK, French, and German companies. They find that overall leverage ratios rise from pre-crisis to crisis years, then fall in post-crisis years. They show that firms with lower than industry average capital structure ratios in the pre-crisis period see a progressive increase in leverage during the crisis and post- crisis eras. On the other hand, firms having greater capital structure ratios than the industry average in the pre-crisis period saw a considerable fall in leverage ratios in the post-crisis period, given the difference in their equity levels.

Brunnermeier and Krishnamurthy (2020) research paper tries to examine the macroeconomics of corporate debt in the US market after the pandemic. Through integrating corporate finance into

macroeconomic models and highlighting previous research studies' results, the authors try to answer the following questions: What is the macroeconomic impact of COVID-19 on aggregate demand and aggregate supply of corporate debt? How should monetary and fiscal policies best deal with the credit dimension of the COVID-19 recession? They found that the lessons learned from the 2008 financial crisis do not carry over to the pandemic situation. They state that until July 2020, the banking sector and the capital markets continued to function smoothly. Thus, the focus shifts to credit demand and to credit frictions in the corporate sector. They conclude that the COVID-19 recession is very different from the 2008 global financial crisis.

III. Data & Methodology

1. Data

This study employs a dataset that covers the period 2015-2021 and comes from SABI, a database that contains information about the Iberian Peninsula firms. The firms employed in this study are limited to the ones that have at least 4 consecutive years of observations, including 2021, given the focus on the evolution of firms' capital structure during the pandemic outbreak. This leaves us with a sample of approximately 150,000 Portuguese firms. In the following analysis sections, the results and conclusions are made on two different set of data: First, all firms are included in the analysis. In parallel, firms that have used long-term debt to finance their operations during 2019 (one year before the start of the pandemic) are also analyzed separately. The reasoning behind this choice is that firms that did not have any long-term debt balance during 2019 probably face more difficulties when seeking external funds or their activities do not require any long-term financing, thus were less likely to be impacted by the demand/supply shocks that have hit the financing market.

a) Dependent variables

The three main variables of interest are the ratio of total debt to total assets (TD/TA), the ratio of long-term debt to total asset (LTD/TA), and the ratio of long-term debt to total debt (LTD/TD).

- Y1, total debt over total assets: Previous studies have defined total financial debt as the sum of short-term debt plus long-term debt of a company. This study uses the same approach with short-term financial debt as the short-term obligations owed to credit institutions and part of long-term financial debts payable within the year. In the study sample, the average

percentage of total debt to total assets is equal to 21.53 %. However, standard deviation is 30.10 % which makes this measure considerably variant.

- Y2, long-term debt over total assets: This variable captures the percentage to which assets are financed by long-term financial debt. On average, and during the sample period, a Portuguese firm uses 17.14 % of long-term debt to finance their assets. However, this ratio comes also with a standard deviation of 27.41 % making it highly variant.
- Y3, long-term debt over total debt: the last explanatory variable represents the maturity composition of the total debt held by a Portuguese firm. From 2015 to 2021, an average Portuguese company chooses to have 76.02 % of its total debt as long-term. This ratio comes with a standard deviation of 38.73 %.

In addition to these high standard deviation measures, about 43 % of the sample firms do not have any kind of financial debt during 2019. For this reason, the analysis is split into two parts. The first part includes all the firms present in the sample while the second part contain only the firms that had a positive long-term financial debt in the pre-pandemic year, 2019 in this case.

b) Control variables

- Size: Larger firms are expected to have a higher debt ratio than smaller companies. The reasoning behind this assumption is that lager firms have better survival rates than smaller ones. They are more diversified which make them, in general, less risky. In addition, the bigger the firm is, the more transparent it becomes. Finally, the financial transaction costs and the underwriting fees raise the cost of lending for small firms. For all these reasons, it is expected that firm size will have a positive impact on the debt level a firm has. Size is defined as log of total assets.
- Assets tangibility: Previous literature shows that companies that have a high proportion of tangible assets compared to their total assets tend to have a higher debt ratio. Having more assets that can serve as collateral makes long-term debt financing easier and more accessible to companies with higher FA/TA ratio. Having such collaterals decreases the cost of borrowing as creditors are more comfortable with having such type of assets so that can easily recollect their money in case of default.

- Turnover ratio: The third control variable is the ratio turnover to total debt. As mentioned earlier, the type of relationship between this ratio and leverage is ambiguous.
- Profitability: The type of relationship between profitability and leverage of a company is debatable. From one hand, profitable firms can finance their activities and grow using their retained earnings, instead of seeking external sources of funds. According to this analogy, a negative relationship is expected between leverage and profitability (Guney and Paudyal 2005). On the other hand, considering that the capital structure composition is viewed as a signaling instrument of a firm' performance, the impact of profitability on the level of debt a company opt to have will be positive. Profitability is given by the ratio of earnings before interest and taxes to total assets.

2. Methodology

To examine the evolution of firms' capital structure before and during the pandemic, this study employs the empirical model that has been used by Demirguc-Kunt, Martinez-Peria and Tressel (2015). The model links the dependent variables that act as a proxy for debt levels to a set of time invariant unobserved characteristics, and to a time dummy to capture the impact of the sanitary crisis period:

$$Yi(t) = \alpha + \beta \cdot \text{Firm Controls } i(t) + \mu \cdot \text{Covid-19} + fi + \varepsilon i(t)$$

Where Yit is the debt level defined as total debt over total assets, long-term debt over total assets or the long-term debt over total debt ratio for firm i during year t. Firm controls is the set of independent variables presented in the previous section: size measured as log of total assets, profitability measured as EBIT over total assets, assets tangibility computed by dividing fixed assets over total assets and turnover ratio by dividing sales over total assets. Covid-19 is a dummy variable that takes the value of 1 during the pandemic years (2020 and 2021). Fi is a set of firms fixed effects and Ei is the error term.

Next, we distinguish between two sets of firms: SMEs (small and medium enterprises) and large firms. According to the World Bank Group Enterprise Survey definition, a firm is considered to be small if it has less than 19 employees, medium if it has less than 99 employees and large if it has more than 100 employees. The effect on SMEs will be captured in the model by a dummy variable

called SME.Covid_19 that takes the value of 1 in case the observation is related to a small-medium enterprise during the pandemic.

$$Yi(t) = \alpha + \beta \cdot \text{Firm Controls } i(t) + \mu \cdot \text{Covid-19} + \gamma \text{ SME} \cdot \text{Covid-19} + fi + \varepsilon i(t) \quad (2)$$

IV. Results

1. Summary statistics

Table 1: Summary statistics

Panel A. All observations

	Obs	Mean	Std. Dev.	min	25 %	50 % (median)	75 %	max
Dependent variables (Capital structure)								
Y1 = TD/TA	999361	21.53 %	30.10 %	0.00 %	0.00 %	4.41 %	34.97 %	100.45 %
Y2 = LTD/TA	999361	17.14 %	27.41 %	0.00 %	0.00 %	0.00 %	25.31 %	93.60 %
Y3 = LTD/TD	569597	76.02 %	38.73 %	0.00 %	63.44 %	100.00 %	100.00 %	100.00 %
Control variables								
FA/TA	999361	29.16 %	30.39 %	0.00 %	1.82 %	17.76 %	51.05 %	92.19 %
EBIT/TA	999361	0.71 %	22.08 %	-63.94 %	-2.37 %	2.51 %	10.44 %	38.75 %
Total assets (k€)	999361	519.79	900.08	6.49	43.94	143.36	478.43	1066661.1
Sales/TA	999361	121.50 %	124.93 %	0.00 %	22.68 %	86.45 %	171.96 %	459.83 %
SME	999361	99.17 %						
Crisis years (2020-2021)	999361	30.68 %						

Panel B. Sample firms with long-term debt > 0 during 2019

	Obs	Mean	Std. Dev.	min	25 %	50 % (median)	75 %	max
Dependent variables (Capital structure)								
Y1 = (TD/TA)	479335	35.69 %	31.76 %	0.00 %	8.39 %	27.86 %	55.42 %	100.45 %
Y2 = (LTD/TA)	479335	31.09 %	30.64 %	0.00 %	4.17 %	21.53 %	49.94 %	93.60 %
Y3 = (LTD/TD)	424852	85.66 %	29.09 %	0.00 %	88.96 %	100.00 %	100.00 %	100.00 %
Control variables								
TFA/TA	479335	34.33 %	30.55 %	0.00 %	5.89 %	26.62 %	58.72 %	92.19 %
EBIT/TA	479335	0.84 %	19.62 %	-63.94 %	-1.62 %	2.67 %	8.88 %	38.75 %
Total Assets(K€)	479335	666.10	1007.88	6.49	73.35	218.93	694.50	1066661.1
Turnover/TA	479335	116.94 %	115.54 %	0.00 %	28.33 %	87.76 %	163.05 %	459. 83 %
SME	479335	98.75 %						
Crisis years (2020-2021)	479335	30.26 %						

Table 1 contains summary statistics off all the dependent and explanatory variables defined in the previous section. Panel A presents summary statistics of all observations and during the entire study period. Panel B shows the same variables and during the same period, taking into consideration only firms that had used long-term financing during 2019.

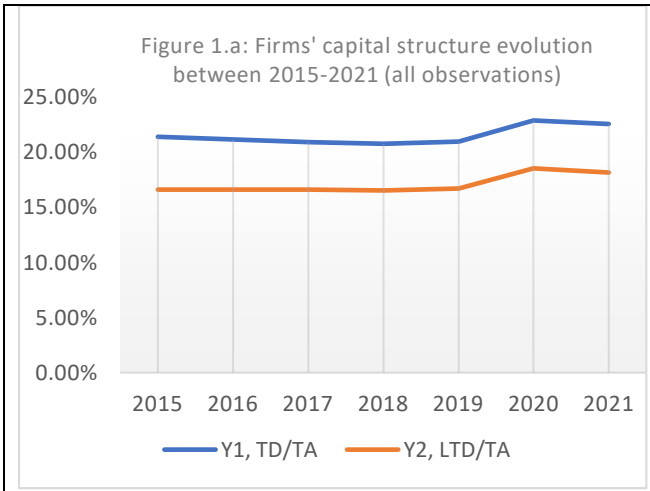
Considering the huge number of companies included in the sample, and the differences created as a result of that, the standard deviation of every control and dependent variable is high. Starting with the first variable of interest, the mean of the total debt to total assets ratio is equal to 21.53% and the standard deviation reaches 30.10%. This average jumps to 35.69% if companies, with no long-term debt prior to the pandemic, are not considered in the sample, with a standard deviation of 31.76%. Second, results show that on average, long-term debt to total assets ratio is equal to 17.14% with a standard deviation of 27.14%. The same measures reach 31.09% and 30.64% in panel B. Consequently, the obvious conclusion from the last two measures is that long-term debt represents three quarters of the total debt held by a random Portuguese firm, which is well reflected in the third dependent variable Y3. The average long-term debt to total debt ratio between 2015 and 2021 is 76.02%, with a standard deviation of 38.73%. This estimate is higher for the second sample as it reaches 85.66% with a standard deviation of 29.09%.

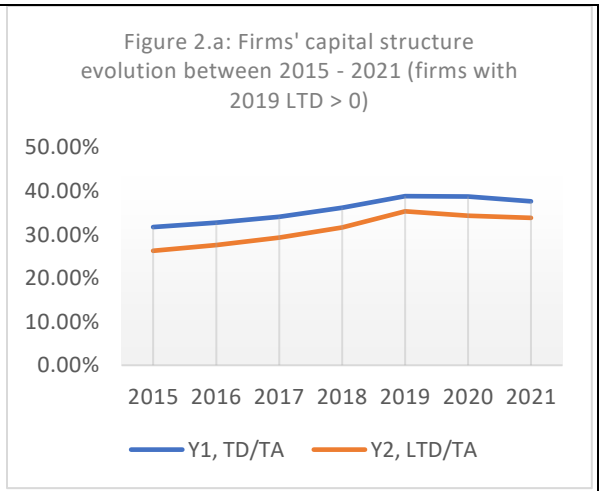
Profitability' average, measured as earnings before interest and taxes over total assets, is equal to 0.71%. This average jumps to 0.84% when considering firms with positive long-term debt during 2019. Assets tangibility given by the tangible fixed assets to total assets ratio, reached almost 30% for all Portuguese companies and nearly 35% in panel B. Tangible fixed assets, that could serve as collateral, represents approximately one third of the total assets. Turnover ratio reached nearly 120% during 2015-2019. Half of these firms have a ratio of almost 90%. The last control variable is size. Defined as total assets, the mean size of all observations is roughly 520 thousand euros. However, given the high standard deviation (900 thousand euros) that comes with it, the median of approximately 150 thousand euros is more informative about the overall situations of the Portuguese sample. The last measure

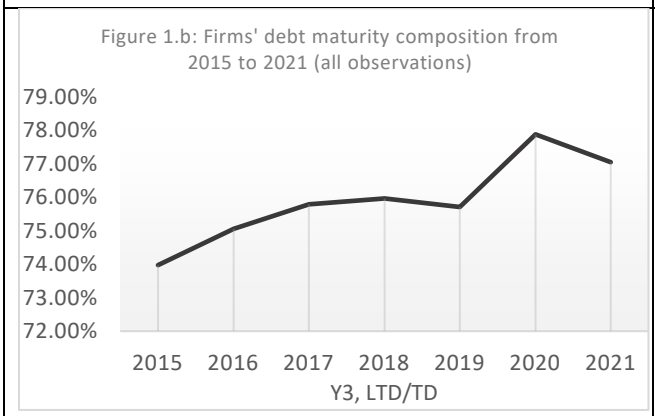
2. Average impact of the pandemic:

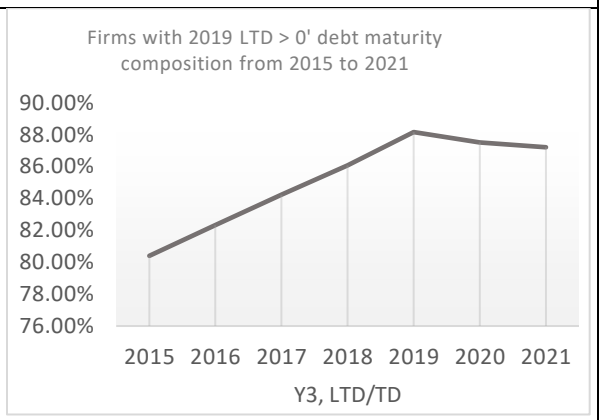
Figures 1.a, 1.b, 2.a and 2.b show the evolution of the capital structure of Portuguese firms before and during the pandemic. In the first two charts, the ratio of total debt to total assets and the ratio

of long-term debt to total assets from 2015 to 2021 are presented. The last two graphs illustrate the evolution of the debt maturity composition during the same period.







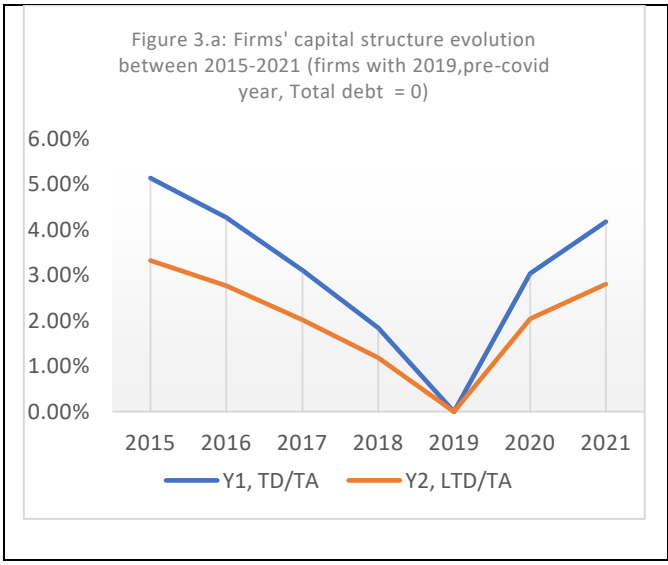


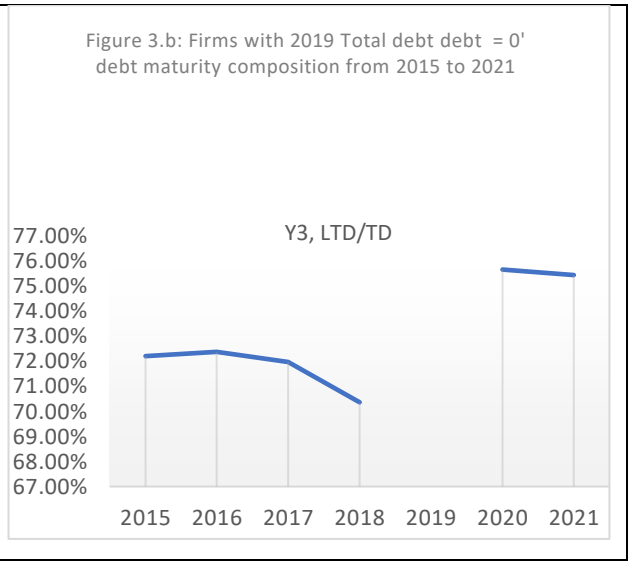
What is easily noticeable in in these figures is that there is a significant increase in the average level of debt of a Portuguese firm during the pandemic, compared to previous years. In both cases, considering all observations or considering only the firms that had a positive long -term debt during 2019, firms increased their borrowing to mitigate the impact the economic distress caused by Covid-19.

Looking at the evolution of the maturity composition of debt shown in Figures 1.b and 2.b, it is easy to say that the portion of long-term debt in a firm' leverage structure increased, compared to the percentage of short-term debt. This can be explained by the fact that several companies had to ask for more long-term financing due to the uncertainty and the losses caused by the governmental

measures and restrictions, such as lockdowns and curfews. To soften these measures, the Portuguese government provided support measures that involves state guarantees for new loans and a debt moratorium for existing ones (Mateus, Neugebauer 2022).

Comparing figure 1 and figure 2, it seems that the trends are explained mostly by firms that previously did have any long-term debt, or any kind of debt prior to the pandemic (during 2019). The firms that did not have any kind of debt represent 43.45 % of the total firms present in 2019. The evolution of their capital structure is shown in figure 3.a and 3.b.





As expected, the leverage ratios Y1 and Y2 jumped from 0 to 4 % and 3 % in 2021. Another interesting outcome form the figure above is the evolution of Y3, the maturity composition of debt. After Covid-19, the use of long-term debt compared to short-term debt reached almost 76 % which is 5% higher than the average rate of the previous years (around 71% between 2015 and 2018).

3. Regression tables

Equation 1 regressions results for TD/TA, LTD/TA and LTD/TD ratios are reported in table 2, 3 and 4. The average impact of the pandemic on firms' capital structure is given by the coefficient of the covid19 dummy variable, after controlling for firms' characteristics, before and after controlling for unobserved firm fixed effects. Equation 2 analysis results are presented in table 5, 6 and 7. The SME*Covid-19 dummy variable captures the effect on SMEs.

Impact on total debt to total assets ratio:

Table 2. TD/TA regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' total debt to total assets ratio (TD/TA) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover ratio is the ratio of the turnover divided by total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019' LTD > 0 and (5) and (6) for firms with no 2019' debt. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects.

	All firms			Firms with 2019 LTD > 0			Firms with 2019 TD = 0	
	(1)	(2), fe		(3)	(4), fe		(5)	(6), fe
				Y1 = TD/TA				
Size	0.010 ***	0.022 ***		-0.019 ***	0.045 ***		0.009 ***	0.021 ***
	(66.59)	(84.86)		(-65.55)	(78.07)		(33.39)	(42.39)
Turnover ratio	-0.001**	-0.012 ***		-0.023 ***	-0.012 ***		0.003 ***	-0.005 ***
	(-3.07)	(-41.81)		(-58.64)	(-25.52)		(33.92)	(-33.22)
Profitability	-0.272 ***	-0.137 ***		-0.430 ***	-0.220 ***		-0.026 ***	-0.025 ***
	(-197.76)	(-128.04)		(-187.25)	(-116.53)		(-53.36)	(-44.86)
Asset tangibility	0.180 ***	0.141 ***		0.181 ***	0.202 ***		0.026 ***	0.045 ***
	(180.8)	(111.8)		(124)	(98.66)		(56.52)	(44.86)
Covid_dummy	0.009 ***	0.006 ***		0.017 ***	0.005 ***		0.009 ***	0.006 ***
	(19.29)	(17.44)		(18.65)	(7.9)		(31.25)	(26.28)
_cons	0.109 ***	0.078 ***		0.426 ***	0.060 ***		0.003 ***	-0.006 ***
	(111.1)	(56.34)		(226)	(18.89)		(6.48)	(-7.58)
obs	999361	999361		479335	479335		420299	420299
R-squared	0.0809	0.0514		0.1334	0.0263		0.0208	00086

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

As shown in table 2, the coefficient of covid-19 dummy variable is positive and statistically significant. For both samples, and before and after controlling for unobserved firm fixed effect, the level of debt of an average Portuguese company has increased during the pandemic years: 2020 and 2021. These results hold when considering all firms and also when considering only firms with a positive long-term debt during 2019 or firms with no debt during 2019.

As expected, size has a significant positive impact on the level of debt for a given firm. The larger the firm gets, the more debt it will have in its capital structure. However, the size variable coefficient turns negative when we consider only the companies that had a positive long-term debt during 2019, firms with no debt during 2019, before controlling for unobserved firm fixed effects. After, it bounces back to being positive. As predicted, results in table 2 show that turnover ratio

have a significant negative impact on all the leverage variables. Sales to total assets ratio tends to lower the overall level of debt (TD/TA). In line with the pecking order theory implication, profitability has a significant negative relation with Y1. Profitable companies rely on internally generated profits which help reduce the need to seek external long-term or short-term funding. This negative relationship is persistent in all the columns presented in table 2. The last explanatory variable is assets tangibility. In table 2, and for the three study' samples, the regression coefficients for this control variable are positive and statistically significant. The more tangible fixed assets a company possesses, the more debt it will raise.

Impact on long-term debt to total assets ratio:

Table 3. LTD/TA regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' long-term debt to total assets ratio (LTD/TA) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover ratio is the ratio of the turnover divided by total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019' LTD > 0 and (5) and (6) for firms with no 2019' debt. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects.

	All firms		Firms with 2019 LTD > 0		Firms with 2019 TD = 0	
	(1)	(2), fe	(3)	(4), fe	(5)	(6), fe
			Y2 = LTD/TA			
Size	0.004 ***	0.019 ***	-0.029 ***	0.042 ***	0.006 ***	0.015 ***
	(29.11)	(76.13)	(-101.62)	(71.48)	(29.79)	(39.76)
Turnover ratio	-0.004 ***	-0.011 ***	-0.028 ***	-0.0124 ***	0.002 ***	-0.004 ***
	(-16.64)	(-39.83)	(-73.57)	(-24.00)	(28.99)	(-31.00)
Profitability	-0.204 ***	-0.104 ***	-0.357 ***	-0.184 ***	-0.015 ***	-0.015 ***
	(-161.56)	(-100.85)	(-160.86)	(-95.15)	(-41.89)	(-36.17)
Asset tangibility	0.163 ***	0.125 ***	0.175 ***	0.195 ***	0.018 ***	0.031 ***
	(185.13)	(112.48)	(124.2)	(92.71)	(52.29)	(49.35)
Covid_dummy	0.011 ***	0.008 ***	0.020 ***	0.006 ***	0.007 ***	0.005 ***
	(19.36)	(22.32)	(22.74)	(10.63)	(32.57)	(27.94)
_cons	0.105 ***	0.051 ***	0.438 ***	0.0304 ***	0.002 ***	-0.005 ***
	(116.1)	(38.05)	(241.3)	(9.22)	(5.87)	(-8.70)
obs	999361	999361	479335	479335	420299	420299
R-squared	0.0658	0.0402	0.1306	0.0138	0.0165	0.0071

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

As shown in table 3, results are similar to table 2. The coefficients of covid-19 dummy variable are positive and statistically significant. For all three samples, and before and after controlling for unobserved firm fixed effect, the level of long-term financing of an average Portuguese company has increased during the pandemic years: 2020 and 2021. These results hold when considering all

firms, when considering only firms with a positive long-term debt during 2019 and also when considering firms with no debt prior to the pandemic.

As expected, size has a significant positive impact on the level of long-term debt. The larger the firm gets, the more long-term debt it will have in its debt structure. However, the size variable coefficient turns negative when we consider only the companies that had a positive long-term debt during 2019, before controlling for unobserved firm fixed effects. After, it bounces back to being positive. Results also show that the turnover ratio have a significant negative relationship with Y2. Having a high turnover to total assets ratio tends to lower the overall level of long-term debt (LTD/TA). Profitability has a significant negative impact on Y2. Profitable companies rely on internally generated profits which help reduce the need to seek external long-term borrowing. This negative relationship is persistent in all the columns presented in table 3. Finally, asset tangibility, and for all study samples, the regression coefficients for this control variable are positive and statistically significant. The more tangible fixed assets a company possesses, the more long-term debt it will raise, given that these types of assets can serve as collateral.

Impact on long-term debt to total debt ratio:

As presented in table 4, results are also similar to table 2 and 3. The coefficients of covid-19 dummy variable are positive and statistically significant. For the three samples, and before and after controlling for unobserved firm fixed effect, the ratio of long-term debt to total debt of a random typical Portuguese company has increased during the pandemic years: 2020 and 2021. These results hold in all the studied samples.

Size has a significant positive impact on the long-term debt to total debt ratio after controlling for unobserved firm fixed effects. This variable is significant only at 10% when considering firms with no debt during 2019. Results also show that the turnover ratio have a significant negative impact on Y3. Profitability also has a significant negative impact on Y3. However, this variable loses its significance in table 4, when controlling for firm unobserved fixed effects. Profitability in that case does not affect the long-term debt to total debt ratio. Finally, asset tangibility, the regression coefficients for this control variable are positive and statistically significant. The more tangible fixed assets a company possesses, the higher long-term debt to total debt ratio it will have.

Table 4. LTD/TD regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' long-term debt to total debt ratio (LTD/TD) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover ratio is the ratio of the turnover divided by total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019' LTD > 0 and (5) and (6) for firms with no 2019' debt. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects.

	All firms			Firms with 2019 LTD > 0			Firms with 2019 TD = 0	
	(1)	(2), fe		(3)	(4), fe		(5)	(6), fe
				Y3 = LTD/TD				
Size	-0.039 ***	0.005 ***		-0.050 ***	0.009 ***		-0.136 ***	0.023 *
	(-129.20)	(5.53)		(-163.25)	(9.49)		(-29.24)	(2.56)
Turnover ratio	-0.026 ***	-0.011 ***		-0.031 ***	-0.007 ***		-0.012 ***	-0.009 ***
	(-54.55)	(-15.21)		(-74.26)	(-8.44)		(-8.91)	(-3.71)
Profitability	-0.040 ***	-0.005		-0.043 ***	-0.002		0.037 ***	0.009
	(-14.68)	(-1.95)		(-17.81)	(0.88)		(5.84)	(1.32)
Asset tangibility	0.101 ***	0.078 ***		0.054 ***	0.073 ***		0.061 ***	0.054 ***
	(58.81)	(2.8)		(34.61)	(24.09)		(10.73)	(4.86)
Covid_dummy	0.022 ***	0.014 ***		0.012 ***	0.003 ***		0.042 ***	0.029 ***
	(20.6)	(17.34)		(12.79)	(4.13)		(11.95)	(7.52)
_cons	0.967 ***	0.717 ***		1.145 ***	0.785 ***		0.922 ***	0.682 ***
	(471.9)	(147)		(577.5)	(136.9)		(113.6)	(44.5)
obs	569597	569597		424852	424852		67231	67231
R-squared	0.0342	0.0006		0.0644	0.0043		0.0154	0.000

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

Average impact on SMEs and large firms:

Equation 2 regression results are presented in table 5, 6 and 7. The average impact of the pandemic on SMEs is given by the coefficient of the SME*Covid-19 dummy variable. The results are organized same as in table 2.

Impact on SMEs and large firms' total debt to total assets ratio:

As shown in table 5, the impact of covid-19 on leverage ratio is positive and statistically significant. SMEs variable coefficient is significant and positive. However, this variable loses its significance when controlling for unobserved firm fixed effects. This imply that the SMEs' level of debt was not more affected than the leverage of large firms. The impact of the explanatory variables and their significance remain the same even after introducing the new dummy variable (table 2).

Table 5. TD/TA regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' total debt to total assets ratio (TD/TA) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover ratio is the ratio of the turnover to total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. A firm is classified as an SME if it had an average of less than 100 employees during the period of observation. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019 LTD > 0. Finally, columns (5) and (6) contain coefficient estimates for the firms with no debt prior the pandemic. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects

	All firms			Firms with 2019 LTD > 0			Firms with 2019 TD = 0	
	(1)	(2), fe		(3)	(4), fe		(5)	(6), fe
				Y1 = TD/TA				
Size	0.011 ***	0.022 ***		-0.019 ***	0.045 ***		0.009 ***	0.023 ***
	(67.27)	(84.8)		(-64.05)	(78.04)		(33.83)	(42.36)
Turnover ratio	-0.001 *	-0.012 ***		-0.023 ***	-0.013 ***		0.003 ***	-0.006 ***
	(-2.16)	(-41.80)		(-58.37)	(-25.53)		-34.2	(-33.24)
Profitability	-0.273 ***	-0.137 ***		-0.430 ***	-0.220 ***		-0.026 ***	-0.025 ***
	(-198.06)	(-128.04)		(-187.12)	(-116.52)		(-53.45)	(-44.86)
Asset tangibility	0.180 ***	0.141 ***		0.181 ***	0.202 ***		0.027 ***	0.046 ***
	(180.5)	(111.8)		(124)	(98.66)		(56.46)	(53.35)
Covid_dummy	0.009 ***	0.006 ***		0.017 ***	0.004 ***		0.009 ***	0.006 ***
	(14.24)	(17.44)		(18.65)	(7.88)		(31.25)	(26.27)
SME. Covid-19	0.035 ***	-0.001		0.032***	-0.006		0.014 ***	-0.007
	(10.5)	(-0.32)		(7.83)	(-0.99)		(6.03)	(-1.33)
_cons	0.072 ***	0.079 ***		0.422 ***	0.068 ***		-0.011 ***	0.001
	(20.14)	(15)		(90.75)	(8.84)		(-4.62)	(0.18)
obs	999361	999361		479335	479335		420299	420299
R-squared	0.081	0.058		0.1334	0.0262		0.0208	0.0086

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

Impact on SMEs and large firms' long-term debt to total assets ratio:

As shown in table 6, the impact of covid-19 on long-term leverage ratio is positive and statistically significant. Similar to its effect on TD/TA ratio, SMEs variable coefficient is significant and positive. However, this variable loses its significance when controlling for unobserved firm fixed effects. This imply that the SMEs' level of long-term debt was not more affected than the LTD/TA ratio of large firms. The impact of the explanatory variables and their significance remain the same even after introducing the new dummy variable (table 3).

Table 6. LTD/TA regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' long-term debt to total assets ratio (LTD/TA) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover rqtio is the ratio of the turnover divided by total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. A firm is classified as an SME if it had an average of less than 100 employees during the period of observation. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019 LTD > 0. Finally, columns (5) and (6) contain coefficient estimates for the firms with no debt prior the pandemic. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects

	All firms			Firms with 2019 LTD > 0			Firms with 2019 TD = 0	
	(1)	(2), fe		(3)	(4), fe		(5)	(6), fe
				Y2 = LTD/TA				
Size	0.005 ***	0.019 ***		-0.028 ***	0.042 ***		0.006 ***	0.015 ***
	(32.88)	(76.09)		(-97.20)	(71.46)		(30.55)	(39.76)
Turnover ratio	-0.003 ***	-0.011 ***		-0.028 ***	-0.012 ***		0.002 ***	-0.004 ***
	(-14.94)	(-39.82)		(-72.33)	(-24.00)		-29.42	(-30.99)
Profitability	-0.205 ***	-0.104 ***		-0.358 ***	-0.184 ***		-0.015 ***	-0.015 ***
	(-162.38)	(-100.85)		(-161.24)	(-95.15)		(-42.03)	(-36.17)
Asset tangibility	0.162 ***	0.125 ***		0.175 ***	0.195 ***		0.018 ***	0.030 ***
	(177.5)	(102.3)		(124.3)	(92.71)		(52.21)	(49.35)
Covid_dummy	0.011 ***	0.008 ***		0.020 ***	0.006 ***		0.007 ***	0.005 ***
	(19.55)	(22.32)		(22.68)	(10.62)		(32.58)	(27.94)
SME. Covid-19	0.059 ***	0.001		0.044 ***	-0.002		0.015 ***	0.001
	(19.68)	(0.13)		(11.74)	(0.40)		(9.01)	(0.27)
_cons	0.042 ***	0.050 ***		0.390 ***	0.033 ***		-0.013 ***	-0.006
	(12.93)	(9.8)		(86.78)	(4.23)		(-7.67)	(-1.57)
obs	999361	999361		479335	479335		420299	420299
R-squared	0.0662	0.0406		0.1308	0.0138		0.0167	0.0071

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

Impact on SMEs and large firms' long-term debt to total debt ratio:

As shown in table 7, the impact of covid-19 on long-term debt to total debt ratio is positive and statistically significant. Similar to table 6 and table 7 results, SMEs variable coefficient is significant and positive. However, this variable loses its significance when controlling for unobserved firm fixed effects. This imply that the SMEs' debt maturity composition was not more affected than the LTD/TD ratio of large firms. The impact of the explanatory variables and their significance remain the same even after introducing the new dummy variable (table 4).

Table 7. LTD/TD regression coefficients and t-statistics summary

This table presents the regression results for Portuguese companies' long-term debt to total debt ratio (LTD/TD) over the period 2015-2021. The explanatory variables are specified as follows: size is the total amount of assets expressed in thousands of euros. Turnover ratio is the ratio of the turnover divided by total assets. Asset tangibility is the ratio of tangible fixed assets to total assets. Profitability is earnings before interest and taxes over total assets. The coefficient of interest Covid-19 dummy is specified as a dummy variable that takes the value of 1 for the years 2020 and 2021 and 0 otherwise. A firm is classified as an SME if it had an average of less than 100 employees during the period of observation. First two columns (1) and (2) are regression results for all firms while columns (3) and (4) are for firms with 2019 LTD > 0. Finally, columns (5) and (6) contain coefficient estimates for the firms with no debt prior the pandemic. Columns (2), (4) and (6) contain regression results after controlling for firm unobserved fixed effects

	All firms			Firms with 2019 LTD > 0			Firms with 2019 TD = 0	
	(1)	(2), fe		(3)	(4), fe		(5)	(6), fe
				Y3 = LTD/TD				
Size	-0.038 ***	0.005 ***		-0.048 ***	0.009 ***		-0.128 ***	0.023 *
	(-120.59)	(5.47)		(-152.79)	(9.46)		(-27.41)	(2.56)
Turnover ratio	-0.025 ***	-0.011 ***		-0.029 ***	-0.006 ***		-0.010 ***	-0.008 ***
	(-52.91)	(-15.24)		(-71.02)	(-8.47)		(-8.05)	(-3.71)
Profitability	-0.037 ***	-0.005		-0.039 ***	-0.002		0.035 ***	0.009
	(-13.83)	(-1.94)		(-16.32)	(-0.88)		(5.43)	(1.32)
Asset tangibility	0.101 ***	0.078 ***		0.054 ***	0.073 ***		0.061 ***	0.053 ***
	(85.68)	(25.8)		(36.95)	(24.09)		(10.68)	(4.86)
Covid_dummy	0.022 ***	0.014 ***		0.012 ***	0.003 ***		0.041 ***	0.029 ***
	(20.54)	(17.33)		(12.7)	(3.98)		(11.94)	(7.52)
SME. Covid_19	0.057 ***	-0. 010		0.131 ***	-0.014		0.281 ***	0.003
	(12.04)	(-1.19)		(34.65)	(-1.57)		(11.59)	(-0.07)
_cons	0.904 ***	0.728 ***		1.002 ***	0.799 ***		0.630 ***	0.679 ***
	(159.9)	(69.81)		(218.2)	(74.44)		(23.8)	(13.56)
obs	569597	569597		424852	424852		67231	67231
R-squared	0.0344	0.0006		0.0670	0.0142		0.0174	0.000

Significance levels: ***: p < 0.01, **: p < 0.05, *: p < 0.1

V. Conclusion

This thesis examines the effect of Covid-19 on Portuguese firms' capital structure. It also studies this impact on small and medium enterprises and large firms. Using a dataset of around 150,000 companies from 2015 to 2021, the impact of the pandemic is obtained through a regression model with a dummy variable that takes the value of 1 during the years of the pandemic (2020 - 2021).

After controlling for firm specific characteristics, and after controlling for firms unobserved fixed effects, this study finds evidence of an increase in firm leverage during the pandemic. The significance of this effect is not found to be more significant on SMEs than large firms. Results

show that Covid-19 had an increasing impact on the ratio of total debt to total assets, the ratio of long-term debt to total assets and the ratio of long-term debt to total debt. These findings are opposite to the 2008 global financial crisis in which deleveraging was associated with a reduction in long-term debt financing. Previous capital structure studies showed that debt maturity composition should also be shortened during periods of economic turmoil. However, this thesis concludes that the Covid-19 had the opposite effect on firms' capital structure. This can be explained by the uniqueness of the pandemic in terms of measures and economic repercussions. Confinements have destabilized households' demand on many levels. Add to that, central bank unprecedent economic stimulus through lower interest rates and purchase programs have made debt more appealing to the majority of firms that had lost the first source of funds according to the pecking order theory, profits made from the business operating. The Portuguese government tried to stabilize the economy by providing guarantees and support to companies mostly affected.

This paper also concludes that size, measured as total assets, has a positive effect on leverage. The bigger the firm gets, the more debt it will need. This can be easily explained by the fact that such companies need high working capital requirements and requires additional capital that shareholders alone cannot provide. The turnover ratio and profitability on the other hand tend to have a deleveraging effect on capital structure. In line with the pecking order theory, this paper concludes that profitable companies with high turnover ratio can rely on its internally generated profits to maintain and expand their activities. Thus, external financing will be minimized. Finally, the coefficient of the ratio of tangible fixed assets to total assets is also found to be positive and statistically significant. This goes with the idea that tangible fixed assets can be considered as collateral when a firm asks for a loan.

This paper adds more evidence to studies related to the effect of the pandemic on capital structure, Portuguese firms' capital structure precisely. However, given the lack of data faced when writing this thesis, industry analysis and its related covid-19 responses will be a nice extension to this paper. Additionally, since more data and research will be available in the future, a similar study may be conducted to assess the economic impact of Covid-19 not just during the pandemic and before, but also in the years that follows. Finally, since Covid-19 has proven its uniqueness in comparison with previous crisis, more research papers and studies about its impact are needed to end a more thorough explanation for these findings.

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