The Effect of COVID-19 on European Firms' Leverage Decisions

Alessandro Salvato

Dissertation written under the supervision of
Professor Mário Henrique Machado Meira

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Abstract

The ongoing COVID-19 pandemic has shaken the global system and caused great turmoil heavily impairing cashflows in many industries, with possible adverse implications for corporate solvency and capital structure. In this thesis, I analyze the impact of COVID-19 on European corporate balance sheets and the composition of their liabilities with a dataset made up of 1,384 firms analyzed between 2018 and 2021. I implement a set of OLS regression controlling for a well-established control set and I use a difference-in-differences approach to capture the cross-sectional difference based on the business risk prior to COVID-19. I find that firms increase leverage and the portion of long-term debt over total debt. The increase in leverage is particularly significant for firm more exposed to the business risk prior to COVID-19. Instead, firms more exposed to the business risk prior to COVID-19 do not significantly increase the portion of long-term debt in respect to firm less exposed. The results are robust to changes in the definition of leverage and business risk.

A pandemia de COVID-19 em curso abalou o sistema global e causou grandes turbulência prejudicando fortemente os fluxos de caixa em muitos setores, com possíveis implicações adversas para a solvência corporativa e a estrutura de capital. Nesta tese, analiso o impacto do COVID-19 nos balanços das empresas europeias e a composição dos seus passivos com um conjunto de dados composto por 1,384 empresas analisadas entre 2018 e 2021. Implemento um conjunto de regressão OLS controlando para um bem estabelecido conjunto de controle e eu uso uma abordagem de diferença em diferenças para capturar a diferença transversal com base no risco do negócio. Depois do início do COVID-19, as empresas aumentam a alavancagem e a parcela da dívida de longo prazo sobre a dívida total. O aumento da alavancagem é particularmente significativo para empresas mais expostas ao risco de negócios antes do COVID-19. Em vez disso, as empresas mais expostas ao risco de negócios antes do COVID-19 não aumentam significativamente a parcela da dívida de longo prazo em relação às empresas menos expostas. Os resultados são robustos às mudanças na definição de alavancagem e risco do negócio.

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Author: Alessandro Salvato

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1. Introduction

The COVID-19, also known as the coronavirus, is a global pandemic caused by severe acute respiratory syndrome (SARS-CoV-2). The novel virus was first identified from an outbreak in Wuhan, China, in December 2019 and rapidly spread out to the entire world. To fight the global health crisis governments introduced different measures, aimed at curbing the virus' spread like lockdowns, that had severe economic effects. Curfews and other restrictions on daily life remain a reality for millions around the world and the optimism generated by rapid progress in the development of vaccine has been partially offset by concerns over slow rollouts and their efficacy with new, highly transmissible variants of the virus.

The economic and social disruption caused by the pandemic is devastating, with tens of millions of people at risk of falling into extreme poverty while the number of undernourished people, currently estimated at nearly 690 million, that could have increased by up to 132 million by the end of the year 2020, according to World Health Organization.[1] The toll the COVID-19 pandemic has exacted on the global economy has been significant, with the International Monetary Fund (IMF) estimating that median global GDP dropped by 3.9% from 2019 to 2020, making it the worst economic downturn since the Great Depression. Regarding business activity, cashflows were heavily impaired in many industries, with possible adverse implications for corporate solvency and capital structure.

Capital structure is one of the cornerstones of research in finance theory. The research in this field explains the mix of financing sources firms use to finance investments and other operations. The roots of capital structure research date back to Modigliani and Miller (1958) that propose a theory known as the capital structure irrelevance theorem, which establish that the total value of the firms remains constant across all degrees of financial leverage under certain assumptions like symmetric information, no taxes, no transaction and bankruptcy costs, no corporate dividend tax. This theory relied on a very simplistic view of the world which incentivized other researchers to find answers in a more real-world setting such as Kraus and Litzenberger (1973), which introduce wealth taxes and bankruptcy, Jensen and Meckling (1976), which analyze the effect of issuing equity on agency costs and Kim (1978), which examines the issues of debt capacity and optimal capital structure in the context of the Capital Asset Pricing Model when firms are subject to stochastic bankruptcy costs and corporate

[1] Link for the article: "https://www.who.int/news/item/13-10-2020-impact-of-covid-19-on-people's-livelihoods-their-health-and-our-food-systems"

income taxes. According to these research that relax the main assumptions of the Modigliani and Miller theorem, financing decisions do affect firm value, and many theories of the determinants of capital structure like taxes, information, and agency costs, have been proved empirically as in Titman and Wessels (1988), Huan and Song (2002), Chen (2004), Frank and Goyal (2007). Yet, after decades of research, the general financing strategy of firms, during the different phases of the business cycle and during the crisis, is still quite unclear.

In this thesis I extend the literature on firm leverage decisions during periods of crisis, following Haque and Varghese (2021), authors of the International Monetary Fund. I analyze the impact of COVID-19 on European corporate balance sheets and the composition of their liabilities with a dataset made up of 1384 firms analyzed between 2018 and 2021 and annual data retrieved by Refinitiv-Eikon. The key research questions that motivate this dissertation are:

1. Did the COVID-19 affect the leverage decisions of the firms?
2. Did the COVID-19 affect the percentage of Long-Term Debt over Total Debt?
3. Is the effect in questions 1 and 2 cross-sectionally different based on the business risk the firms were subject prior to COVID-19?

The answers to the first two questions are fundamental for evaluating the equilibrium between liabilities and assets in the firm's balance sheets. The rapid pace of the decline in revenue in conjunction with the difficulty of adjusting costs eroded reserves and quickly led to a sudden increase in liquidity needs. European firms may have borrowed to cover this significant liquidity needs, trough the massive and combined response of supervisory (eased prudential rules), monetary (rate cuts, refinancing operations, asset purchases) and fiscal authorities (state guaranteed loans, tax deferrals, transfers). This could result in a higher ratio of debt over total assets, causing potential problems in the future like a plausible increase in the credit risk because of more impaired liabilities. Further, more financial friction could be possible, preventing projects to be funded even if they could be profitable. Finally, a future lower borrowing capacity is likely to reduce investment and spending on capital, reducing realized economic growth and productive capacity all else being equal. The third question is important to understand more granularly the impact of COVID-19, evaluate the economic efficiency of the actual actions of central institutions and set future ones to sustain real economic growth. Firms with a systematic reduction of the cashflows could find difficult to service the debt in case they happen to be over-leveraged. So, central institutions must avoid the allocation of a massive quantity of capital to firms with the worst fundamentals to stabilize the economic system.

Two main variables are used for the first two research questions: *Leverage*, defined as the percentage of Total Debt over Total Asset, and *Total Long-Term Debt over Total Debt* (*TLD/TD*). The first variable allows to capture at best the company's debt size and the second describe the debt structure. Then, I define firms more exposed to business risk prior to COVID-19 using a dummy variable *Business Risk* that takes value of 1 if the Sales Growth Rates 2019 is in the lowest quartile of the total 2019 distribution.

My benchmark regression shows on average an increase in the level of *Leverage* by 2.37 percentage point after COVID-19. The regression has a set of control well established in the literature and individual firm level fixed effect factors. Then, a set of carefully specified difference-in-differences regressions reveal a cross-sectional difference with the firm more exposed to the business risk prior to COVID-19 significantly increase 1 percentage point more than the less exposed firms. Finally, I find that on average firms increases the percentage of long-term debt over total debt by 2.59 percentage points, thus reducing short-term refinancing risk in a period of high volatility and uncertainty. As far as the structure of the debt, the difference in the portion of long-term debt over total debt after COVID-19 between firms more and less exposed to the business risk prior to COVID-19 is not statistically significant.

To extend the main results with detailed robustness tests I use a new definition of the dependent variable for the leverage decision, namely Net Debt over Total Asset. Moreover, I change the definition of the dummy variable *Business Risk*, using the Return on Equity 2019 instead of Sales Growth Rates 2019. All the results are unchanged.

The thesis will proceed as follows: Section 2 distinguishes the relevant literature regarding the theoretical foundations of capital structure, and how economic conditions affect a firm's financing. Section 3 presents the Data and Methodology with the sample selection criteria and data overview. Section 4 describes the distribution of the dependent and the independent variable. Section 5 set the empirical strategy with the different specifications. Then, Section 6 and Section 7 show the results and the robustness checks. Section 8 discuss the main limitations and future research, and finally, Section 9 concludes.

2. Literature Review

Capital structure and its determinants have been widely studied by finance scholars, but it remains still an unanswered topic. The modern theory on corporations' capital structure was initiated by Modigliani and Miller (1958), that establish the market value of a company is independent of its capital structure. At its most basic level, companies have only three ways to raise money to finance their operations: issuing bonds, obtaining loans with banks, or issuing new stock shares. The Modigliani-Miller theorem argues that the option or combination of options that a company chooses between this three has no effect on its real market value. However, the theorem leaves out a few relevant factors like taxes, bankruptcy costs, transaction costs, asymmetric information, and corporate dividends, effectively arguing its main conclusion in a perfect and efficient market. Later, many scholars have drawn conclusions that are more in line with economic reality (i.e., there are benefit and costs associated with various financing choices), gradually relaxing the assumptions, thus further enriching and developing the theory of capital structure of companies.

Two main theories, since then, have evolved: The Pecking Order Theory and The Trade Off Theory. Myers and Majluf (1983), with the Pecking Order Theory, postulates that companies do prioritize their sources of financing because the cost of financing is different due to asymmetric information: first they prefer internal financing, then debt and lastly raising equity because issuing new equity would signal that manager believe in an overvaluation of the firms' shares and as a result, investors place a lower value to the new equity issuance. However, the evidence is mixed. Frank and Goyal (2003) find on a broad cross-section of American firms over the period 1971-1988 that internal financing is not sufficient to cover investment spending on average and external finance is heavily used. Li-Ju Chen and Shun-Yu Chen (2011) show that firms prefer to use internal finance on 305 Taiwan electronic companies.

The Trade-Off theory was founded after considerations about tax system and bankruptcy costs and suggest the existence of an optimal level of debt ratio. This theory, states that corporate leverage is determined by balancing the tax-saving benefits of debt against expected costs of bankruptcy. Tax shields arise because interest payments are tax deductible. This means that financial leverage decreases firms' corporate tax liability which conversely increases their Free Cash Flow and, consequently, the firm's value. In Kraus and Litzenberger (1973), the market value of the firm is equal to the unlevered market value plus the corporate tax rate times the market value of the firm's debt, less the complement of the corporate tax rate times the present value of the bankruptcy costs. Furthermore, Kim (1978) shows an optimal capital structure derived with linear bankruptcy costs. De Jong, Verbeek and Verwijmeren (2010) find that the Pecking Order Theory is a better descriptor of firms' leverage decisions than the Trade-Off Theory.

Lastly, Buus (2014) provides the general framework of The Free Cash Flow Theory and states that the value of a firms can still increase, even in presence of dangerously high debt levels, when a firm's operating cash flow significantly exceeds its profitable investment opportunities. So, this is not really a theory predicting how managers will choose capital structures, but a theory that indicates there is not an optimal level of debt ratio.

The presence of many theories proves that the behavior of the firms could be very controversial, and this complexity accentuates after macroeconomic shocks. When uncertainty rises investors have less propension to invest in long-term period. Inevitably, the risk premium at which investors are willing to lend money is higher making debt less attractive for firms, as showed by Gürkaynak and Wright (2012). Then, firms might face the incentive to restrict the maturity structure held because of high volatility of payoffs, diluting the payoffs of the long-term investors as in the "rat race" capital structure model of Brunnermeier and Oehmke (2013), and Duchin et al. (2010). Overall, empirical evidence on the impact of various financial crises on firms' capital structure is mixed too. Lim (2003) finds that large Korean firms left financial intermediaries and turned to capital markets after the Korean crisis in the last half of 1997. Similarly, Voutsinas and Werner (2011) note that extreme credit supply fluctuations in Japan had a significant negative impact on Japanese firms' financial leverage levels. Empirical studies such as Fosberg (2012), Kahle and Stulz (2013) and Iqbal and Kume (2014) consider the impact of 2007-08 financial crisis on capital markets and reveal that, in general, firms relied heavily on the use of public debt markets during the crisis. Kahle and Stulz (2013) note that net debt issuances increased during the first year of the 2007–08 crisis but fell after 2008. Fosberg (2012) reports significant increase in debt ratios of US firms over the pre-crisis period of 2006–2008, followed by a gradual decline in debt levels by the end of 2010 (i.e., post-crisis period) to the pre-crisis levels. Iqbal and Kume (2014) report an increase in leverage from pre-crisis (2006-2007) to crisis (2008-2009) and then decrease in the post-crisis (2010-2011). Pattani, Vera, and Wackett (2011) observe similar patterns in public debt issued by UK firms. They also report an increase in public equity issuance in 2008-2009 and a decline in 2009-2010.

Moreover, there are many institutional and financial systems' features that influence the impact of the crisis on the capital structure. As in the agency cost model of Jensen and Meckling (1976), an increase in the variance of returns would induce more risk taking by shareholders (a risk shifting effect) in countries where monitoring costs and bankruptcy costs are high. When widespread bad news and uncertainty materialize, the shortening of debt maturities and resulting reduction of leverage are likely to be larger in environments where contracts are difficult to enforce, for instance where bankruptcy laws and procedures are such that liquidation of assets is costly, as shown in Diamond (2004).

This dissertation follows mainly two works: Demirguc-Kunt et al. (2020), specifically, for the methodology and empirical specification and Haque and Varghese (2021) for the definition of exposure to business risk prior to the crisis. The former authors assess the impact on capital structure of the 2007 Global Financial Crisis (GFF) in 75 countries and find evidence of a leverage and debt maturity decline. Hague and Varghese (2021) provide evidence of a decreased level of leverage for US public firms after COVID-19.

3. Data and Methodology

The sample construction begins with publicly held active firms, listed in twelve exchanges in Europe, that have accounting data in the Refinitiv Eikon database.[2] To mitigate confounding effect coming from previous local and global shocks in the previous year the sample spans from 2018 to 2021. Following Bartram et al. (2015), utilities and financial services companies are excluded since these firms are regulated and may have different specific risks. In addition, a variety of screens are applied to the sample. First, firms whose book asset value is negative are excluded. I also exclude companies with negative net property, plant, and equipment to avoid reporting mistakes. Then, I remove all the observations with missing data. The necessary condition for a firm to be included is the completeness of data for all the variables of interest during all the time span 2018-2021. This criterion can lead to two types of selection bias: the first one is the attrition bias, because I am excluding companies that do not have reported financials and the absence of data might not be random. Also, survivorship bias could be present in the sample because firms might be acquired by another company, stopped reporting from all four year or failed. The two biases are not expected to cause problems with the results because I am not looking at financial performance but rather to leverage decisions.

All the variables are winsorized at the 1 and 99 percentiles as in Almeida, Cunha, Ferreira and Restrepo (2017), to mitigate effects from possible outliers. After this filtering process, the sample is made up of 5536 firm-year observations and identifies 1384 firms. The

[2] The listed companies are listed in twelve exchanges in Europe: the London Stock Exchange, Euronext Paris, Euronext Growth Paris, Euronext access Paris, Nasdaq Tallinn, Nasdaq Stockholm, Nasdaq Helsinki, Euronext Brussels, Euronext Ventes Publiques Brussels, Nasdaq Copenhagen, and Euronext Amsterdam.

data includes firms from a wide range of industries including mining, chemicals, basic manufacturing, electric equipment, accommodation, airlines and other types of transportation, retail stores, machinery, and IT services.

Finally, I construct two dummy variables: the first one is COVID-19, a dummy variable that take the value of 1 in the 2020 and 2021 and 0 in 2018 and 2019. Then, following Hague and Varghese (2021), I construct a dummy variable *Business Risk,* using Sales Growth Rates in 2019 ($\frac{Sales\ 2019}{Sales\ 2018} - 1$), to capture the cross-sectional difference in business risk prior to COVID-19.[3] This variable takes value of 1 for the firms when the Sales Growth Rates of the individual firms in 2019 is in the lowest quartile of the cross-sectional distribution (firms more exposed to the business risk) of all the 2019 Sales Growth Rates and 0 otherwise. Further, as an alternate measure to check the robustness of the base results on *Business Risk* prior to COVID-19, I introduce the dummy variable *Business Risk 2*, substituting the variable Sales Growth Rates with the Return on Equity, a profitability ratio calculated by dividing a company's net income by total equity of common shares and normalized to reflect corporate actions (e.g., stock splits).[4] The variable takes the value of 1 when the Return on Equity 2019 of the firm is in the lowest quartile of the Return on Equity 2019 distribution.

4. Summary and descriptive statistics of the variables

4.1 Dependent Variables

The study examines mainly two variables: 1) Total Debt over Total Assets *(Leverage)*, where Total Debt is represented by notes payables, commercial paper, and other short-term debt plus the portion of long-term debt, excluding financial debt lease; 2) Long-Term Debt to Total Debt *(LTD/TD)*, defined as debt due in more than one year consisting of long-term bank borrowings, bonds and convertible bonds over Total Debt defined as previously.[5] The first variable measures the leverage component, defined as the size of debt, while the second one measure the structure of the firm's debt, defined as percentage of long-term debt over total debt. Table 1 presents the summary statistics for the two main variables across time.

[3] Anything that threatens a company's ability to achieve its financial goals is considered a business risk. Growth Sales Rates is a good proxy for evaluating the inability to meet financial debt service.

[4] Definition from Refinitiv Eikon

[5] The exclusion of financial debt lease in the composition of Total Debt refer to the methodology of Refinitiv Eikon.

Table 1: Descriptive statistics of Leverage and LTD/TD

This Table presents the main features of the dependent variables' distribution. The variables employed are: Total Debt over Total Assets (Leverage) and Long-term Debt over Total Debt (LTD/TD). The two variables are winsorized at 1st and 99th percentile. SD stands for sample standard deviation. The sample contains 1384 European firms.

	Leverage				**LTD/TD**			
	2018	2019	2020	2021	2018	2019	2020	2021
Average	23.90%	27.79%	29.42%	27.30%	69.12%	73.50%	75.06%	74.11%
SD	15.66%	15.56%	17.03%	17.04%	30.38%	24.02%	21.52%	22.29%
Min	0.39%	2.82%	1.37%	1.00%	0.00%	0.00%	0.00%	0.00%
Percentile 25°	11.76%	16.11%	17.04%	14.55%	55.88%	64.66%	67.05%	65.09%
Median	22.64%	26.75%	28.01%	25.19%	79.39%	80.38%	80.91%	80.25%
Percentile 75°	34.45%	38.29%	39.66%	37.53%	92.96%	90.63%	90.23%	90.26%
Max	73.68%	74.23%	113.30%	108.20%	100.00%	100.00%	100.00%	100.00%
Skewness	0.49	0.37	0.64	0.77	-1.09	-1.38	-1.45	-1.37
Ex. Kurtosis	-0.25	-0.44	0.48	0.83	0.08	1.45	1.94	1.55

As specified in the methodology, I remove all the outliers from all the variables, and the standard deviation is not high: about 16% for *Leverage* while around 24% for *LTD/TD*. The average of the two variables shows a rising trend with spike in the 2020. The percentage of firms that has the level of *Leverage* over 100% after COVID-19 is very low (2% of the full sample). Indeed, the skewness of the distribution is positive in 2020 and 2021, meaning the value are clustered around the left tail of the distribution. The excess kurtosis is low in magnitude but according to Jarque-Bera test it is significantly different from 0. The shape of the distribution become leptokurtic after COVID-19 with the presence of more extreme values. Instead, the distribution of *LTD/TD* is far from the normal distribution being negative skewed and leptokurtic.

Table 2 compares the *Leverage* and *LTD/TD* from the period before the COVID-19, defined as 2018 and 2019 to the period after the COVID-19, defined as 2020 and 2021. It clearly shows an increase in both the variables from one period to the other.

Table 2: Comparison of Leverage and LTD/TD pre and post COVID-19

This Table presents the comparison of the two dependent variables trough the time span 2018-2021. The time span is defined as: 2018-2019 period pre Covid and 2020-2021 period after Covid. The variables are defined in the methodology section. The sample contains 1384 European firms. The firms that show the Sales Growth Rates 2019 in the lowest quartile of the Sales Growth Rates 2019 distributions are the firms more exposed to business risk prior to COVID-19.

Panel A: Pre Covid	**Leverage**	**LTD/TD**
Full Sample	25.73%	71.31%
Firms more exposed to business risk	25.94%	72.43%
Panel B: Post Covid		
Full Sample	28.84%	74.58%
Firms more exposed to business risk	29.77%	74.63%

Table 2 shows that the level of *Leverage* increases for the full sample from 25.73% to 28.84% and the increase is more pronounced for the firms more exposed to the business risk, moving from 25.94% to 29.77%. Also, there is an increase in the long-term debt component moving from 71.31% to 74.58% for the full sample but with no cross-sectional difference among the more exposed to the business risk and the full sample.

4.2 Set of Control

The complete list of control, well established in the literature (Rajan and Zingales (1996), Demirguc-Kunt and Maksimovic (1996), Stohs and Mauer (1996), Frank and Goyal (2003), Baghai, Servais and Tamayo (2014), Almeida et al. (2017), Demigurc-Kunt et al. (2020)), includes:

1. *Size* computed as natural logarithm of *Total Asset*.
2. *Tangibility*, defined as the ratio of net property, plant and equipment (total reported gross value of fixed assets before accumulated depreciation) over *Total Asset*.[6]
3. *Cash*, defined as cash on hand, balances on demand deposits, and near-term savings over *Total Asset*.
4. *Capex*, defined as capital expenditures that encompass all expenditures for factories and equipment that have a useful life of more than one year over *Total Asset.*

[6] Some of the regressors as *Cash, Capex, Tangibility* used in this dissertation are scaled by Total Assets, defined as anything tangible or intangible that is capable of being owned or controlled to produce value and that is held to have positive economic value, reported in the standardized balance sheet.

5. *Profitability*, defined as the ratio between EBITDA and revenues.
6. *Total Debt over EBITDA*.
7. *ICR (Interest Coverage Ratio),* calculated as EBITDA divided by interest expense.

Table 3 presents the descriptive statistics for the set of control variables, lagged by one year respect the dependent variables. The initial period is 2017-2018 and the second period is 2019-2020. Firms at the end of 2020 hold on average less portion of cash, higher tangible asset and are less profitable on average due to the suspension of the economic activity because of lockdowns implemented by several governments. Finally, as indicated by lower *ICR* firms could be less able to repay debt services in the future. The main features of the distributions of *Tangibility*, *Capex, TD/EBITDA,* and *Size* do not change over time.

Table 3: Descriptive Statistics of the control set

This Table presents the comparison trough the two main period of analysis of the leverage decisions determinants set by the literature review. *Cash, Capex and Tangibility* are scaled by Total Assets. The time span goes from 2017 to 2020 because in the empirical specification the independent variables are lagged by one year. The sample contains 1384 European firms. All the variables are winsorized at 1[st] percentile and 99° percentile to remove the effect of the outliers. There are two columns for each variable: the first one is for the years 2017-2018 while the second one is for the years 2019-2020. SD stands for standard deviation.

Panel A

	Cash		**Capex**		**Profitability**		**ICR**	
	2017-2018	*2019-2020*						
Average	11.39%	10.89%	3.99%	3.33%	17.83%	10.03%	22.98	12.23
SD	10.11%	9.02%	3.99%	3.27%	18.44%	17.86%	31.07	26.33
Min	0.00%	0.00%	0.50%	0.54%	-109%	-145%	1.78	0.89
Percentile 25°	4.42%	5.23%	1.29%	1.10%	8.48%	3.71%	4.22	2.41
Median	8.57%	8.46%	2.82%	2.48%	14.03%	9.31%	10.77	7.16
Percentile 75°	15.25%	14.54%	5.43%	4.47%	22.76%	15.42%	27.03	18.17
Max	84.45%	81.23%	7.64%	7.60%	29.22%	17.34%	30.04	21.13
Skewness	2.04	1.29	2.30	2.31	0.99	0.88	1.54	2.38
Ex. Kurtosis	6.72	2.33	8.21	8.59	17.36	8.99	1.51	12.12

Panel B

	TD over EBITDA		Tangibility		Size	
	2017-2018	*2019-2020*				
Average	3.61	3.54	43.20%	46.98%	2.92	2.99
SD	6.64	10.17	33.62%	32.93%	0.84	0.83
Min	0.40	0.63	8.32%	8.46%	0.45	0.45
Percentile 25°	1.13	1.21	12.77%	18.30%	2.31	2.39
Median	2.32	2.53	34.97%	40.72%	2.89	2.96
Percentile 75°	4.09	4.36	73.36%	78.17%	3.48	3.56
Max	19.47	22.21	77.77%	78.18%	5.63	5.64
Skewness	4.82	2.85	0.40	0.29	0.15	0.13
Ex. Kurtosis	18.73	17.99	-1.26	-1.30	-0.20	-0.21

4.2.1 The expected impact of the controls on the *Leverage*

The literature suggests larger firms tend to have higher level of *Leverage*. Specifically, larger firms tend to be more transparent and might have higher stream of free cash flows. Hence, they can access easier to the debt markets borrowing at lower cost and are less likely to default on their debt obligation (in Rajan and Zingales (1995) and Frank and Goyal (2009) firm's size is an inverse proxy of the probability of bankruptcy). Most of the literature agrees on the impact of *Tangibility*: firms that dispose more of tangible assets have higher leverage ratio. Tangible assets, indeed, are easier to evaluate respect intangible assets and should serve as collateral mitigating financial distress. Moreover, Fosu, Danso et al. (2020) show the positive relation of *Size* and *Tangibility* with leverage and maturity is more pronounced during the crisis analyzed in a nineteen-period in Japan respect non-crisis period. Regards *Profitability*, according to the Pecking Order Theory, firms more profitable should have lower level of *Leverage* because they prefer to use retained earnings to sustain the growth and require less external finance than less profitable firms. This theory has been sustained empirically by the work of Rajan and Zingales (1995), Frank and Goyal (2009) amongst the others. The sign of *Cash* is not easy to define because firms with higher default risk save more cash according to the theoretical and empirical work of Acharya, Davydenko and Strebulaev (2012). However, higher liquidity could be indicator of robust financial profile and used to repay debt service obligations, especially during period of crisis. For higher level of *Capex*, Titman and Wessels (1988) hypothesize lower level of *Leverage* because it is an indicator of growth opportunities that add value to the firms but cannot be collateralized and do not produce current income. Finally, I expect higher values of

ICR to be associated with higher level of *Leverage* because it reflects a strong marginality for the firms to repay debt in the future.

4.2.2 The expected impact of the control on the *LTD/TD*

Theoretically, the impact of all the variables is not easy to define. Diamond (1991) argues that firms have the incentive to choose long-term debt to reduce liquidity risk, but the market of long-term debt might not be accessible or accessible at high interest rates because of moral hazard problems.[7] Empirically, Guedes and Opler (1996) find evidence that bigger and riskier firms tend to choose higher portion of long-term debt to avoid the risk of inefficient liquidation because refinancing is not available or is available at high interest rates. Further, Barclay and Smith (1995) and Stohs and Mauer (1994) show higher level of *Size* corresponds to higher portion of long-term debt. So, according to these research *Size* is expected to have a positive relation with *LTD/TD*. *Tangibility, Cash* and *ICR* are expected to have a negative relation because firms with lower values of *Tangibility, Cash* and *ICR* are riskier. No relation at all is expected for the rest of the variables.

All the expected sign of the control set are summarized in Table 4.

Table 4: Expected sign of the control set's impact on Leverage and LTD/TD

This table summarize, according to the vast and mixed literature review on the control set, the expected sign in the OLS regressions on *Leverage* and *LTD/TD.*

	Leverage	**LTD/TD**
Size	+	+
Cash	?	-
Tangibility	+	-
TD/EBITDA	+	?
ICR	+	-
Profitability	-	?
Capex	-	?

[7] Liquidity risk is the inability of a firm to pay the debts in the short term because of the lack of liquid assets. If a business has too much liquidity risk, it must sell its assets, bring in additional revenue, or find another way to reduce the discrepancy between available cash and its debt obligations.

5. Empirical Strategy

To formally examine if the COVID-19 had an impact on the balance sheet and determined the increase in the *Leverage* and *LTD/TD* showed by Table 2, I implement a set of OLS regressions controlling for regressors well established in the literature review. The goal of this specifications is to answer to three research questions:

1. Did the COVID-19 affect the leverage decisions of the firms?
2. Did the COVID-19 affect the percentage of Long-Term Debt over Total Debt?
3. Is the effect in question 1 and 2 cross-sectionally different based on the business risk the firms were subject prior to COVID-19?

The hypothesis for the first research question regards firms that increased leverage for a few reasons like substituting the expected reduction in cashflow (less revenues and constant costs) and sustain the business activity severely affected. Moreover, many firms could have financed the increased business activity due to higher demand like for the technological and pharmaceutical industries or invested resources to structurally enhance the efficiency of the business model with the most appropriate technological structures. While, for the second research question, theoretically according to Diamond and He (2014), borrowers should aim at increasing the maturity during period of financial crisis to avoid higher rollover costs of short-term debt. This theory is supported empirically by the work of Costa and Laureano (2014), Chala (2017), who show an increase in the long-term debt after the Global Financial Crisis in 2007.

The basic and first specification is the following:

$$Y_{i,t} = \alpha_i + \beta \times COVID - 19 + \delta \times Controls_{i,t-1} + \epsilon_{i,t}$$

The two dependent variables are *Leverage* and *LTD/TD*, described in the subsection Dependent Variables. The vector $Controls_{i,t-1}$ include all the determinants mentioned in the subsection Set of Control.

In the second specification I add the interaction variable *Business Risk X COVID-19*, made up by the product of the COVID-19 dummy and the dummy variable *Business Risk*. Studying more granularly the impact of COVID-19 allows to dispose of more information for future actions of central institutions. The riskier firms could happen to be over-leveraged with a financial structure not equilibrated between short-term and long-term debt, inefficient or with the business out of the market. So, the systemic risk is going to increase, given, presumably, that the optimal level of debt ratio decreases and the probability of default of these firms increases. In this case, the implementation of actions that aims at stabilizing the system, avoiding the allocation of resources to firms with the worst fundamentals, will be necessary.

The second specification is described as follows:

$$Y_{i,t} = \alpha_i + \beta \times COVID - 19 + \theta \times COVID - 19 \times Business\ Risk + \delta \times Controls_{i,t-1} + \epsilon_{i,t}$$

In this specification, the variable *Business Risk* is not added itself in order to avoid multicollinearity problem. The coefficient of interest is θ that captures the cross-sectional difference in the leverage decisions and the composition of the debt structure held by the firms due to different exposure to business risk prior to COVID-19.

6. Results

Table 5 shows the regression of *Leverage* and *LTD/TD* first with year dummy variables for 2019, 2020, 2021 to capture the trend of the two components. It is possible to see the rising trend with a spike in 2020 for both. Respect the 2018, in the model with individual firm level fixed effects the *Leverage* increased by 4.49 percentage points (pp) and the portion of long-term debt over total debt increased by 5.33 pp in 2020. All the coefficients of the dummy variables are statistically significant at 1% level.

Tangibility and *Size* have the expected impact on the *Leverage*: bigger firms and firms with higher percentage of collateral respect *Total Assets* use more *Leverage*, in line with previous literature. The effects are statistically significant at 1% significance level either in the model without individual firm level fixed effects (FE) and with FE. Nevertheless, the magnitude of the impact of *Tangibility* does not seem to be high since 10 percentage point more of tangible asset increase the *Leverage* by 0.03 pp. As far as concerned *Size* the magnitude of the effect is more noticeable: on average firms with 10 billion more of Total Asset, all else being equal, have higher level of *Leverage* of 0.36 pp. Regarding *Cash,* firms with higher percentage of *Cash* use on average less *Leverage*, in line with the results of Acharya, Davydenko and Strebulaev (2012). The effect is statistically significant at 1% significance level in the model without FE and at 5% significance level with FE. Moreover, it is very marked since on average firms with 10 pp more of *Cash,* all else being equal, use 1 pp less of *Leverage*. The empirical model does not sustain the Pecking Order Theory: the impact of *Profitability* is not statistically significant different from 0. Finally, *Capex* and *TD/EBITDA* have not a statistically significant impact on *Leverage*. *ICR* does not have an important impact since the coefficient is statistically significant at 1% significance level in the model without FE but not statistically significant different from 0 in the model with FE. In the second model regarding *LTD/TD,* just the variable *Size* happen to be significative at 1% significance level the model without FE and 5% significance level with FE. *Profitability* and *Capex* are significative at 10% level in the model without FE but not significant with FE. All the coefficient of the remaining variables are not significantly different from 0.

Table 5: Regression of Leverage and LTD/TD with year dummy

This Table presents the OLS regressions of *Leverage* and *LTD/TD* on three-year dummy for 2019, 2020 and 2021 and the set of control. In each specification, the first column the model does not have the individual firm level fixed effects while the second one does contain the individual firm level fixed effects. Cash, Capex and Tangibility are scaled by Total Asset. The control set is lagged by one year. In the parenthesis it is shown the standard errors clustered at firm level. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Leverage		**LTD/TD**	
D19	0.0360***	0.0344***	0.0405***	0.0401***
	(0.00242)	(0.00256)	(0.00741)	(0.00768)
D20	0.0477***	0.0449***	0.0504***	0.0533***
	(0.00309)	(0.00371)	(0.00758)	(0.00858)
D21	0.0282***	0.0223***	0.0442***	0.0462***
	(0.00342)	(0.00426)	(0.00821)	(0.00979)
Cash	-0.128***	-0.112**	-0.0763	-0.0776
	(0.0271)	(0.0298)	(0.0467)	(0.0680)
Capex	-0.0546	-0.0807	0.221*	0.161
	(0.0734)	(0.0840)	(0.109)	(0.133)
Profitability	-0.00346	-0.0229	0.0527*	0.00593
	(0.0173)	(0.0136)	(0.0239)	(0.0165)
ICR	-0.0000629***	-0.0000333	-0.000112	-0.0000448
	(0.0000189)	(0.0000210)	(0.0000431)	(0.0000503)
TD/EBITDA	0.000159	0.0000826	-0.0000852	-0.000128
	(0.000190)	(0.000136)	(0.0000957)	(0.000101)
Tangibility	0.0374***	0.0376***	0.00106	-0.0707
	(0.0106)	(0.0241)	(0.0121)	(0.0393)

Size	0.0372***	0.0855***	0.0685***	0.0844*
	(0.00460)	(0.0234)	(0.00648)	(0.0429)
cons	0.133***	-0.0111	0.488***	0.484***
	(0.0147)	(0.0729)	(0.0242)	(0.131)
FE	No	Yes	No	Yes
N	5536	5536	5536	5536
R^2	0.123	0.106	0.034	0.026

Table 6 shows the regression of *Leverage* and *LTD/TD* with the COVID-19 dummy variable and the control set. After COVID-19, firms increased the *Leverage* on average by 2.91 pp without individual firm level fixed effects (FE) and 2.37 pp with FE. *LTD/TD* increased on average by 2.16 pp without FE and by 2.59 pp with FE. The results are all statistically significant at 1% level. The qualitative results about the control set do not change significantly in respect Table 5.

The results of this dissertation are different from the ones of Demirguc-Kunt et al. (2020) and Hague and Varghese (2021). The first authors find evidence that firms decline leverage and long-term debt. Hague and Varghese (2021) provide evidence of a decreased level of leverage for US public firms after COVID-19. The difference with the Demirguc-Kunt et al. (2020) is mainly due to the nature of the crisis: the GFF is a financial crisis that starts in the financial system and spread-out trough the interconnections of the banking system. COVID-19, instead, has profound economic roots either from the demand side and the value chain side because of all the activities interrupted. During COVID-19, European central institutions fostered looser financial conditions and increased lending capacity incentivizing firms to take on more debt and reconcile the cash flows completely squeezed. The difference with the results of Hague and Varghese (2021), instead, could be because they use the share of firm value financed with debt adjusted for cash instead of the overall supply of debt. Finally, the results, are consistent with Halling, Yu and Zechner (2020), who find that corporate bond issues during COVID-19 have substantially increased since the onset of the pandemic. They also find firms choose longer maturities than in previous crises. The increase of *LTD/TD* is line with Diamond and He (2014), Costa and Laureano (2014), Chala (2017) who show an increase in the long-term debt during period of financial crisis, presumably to avoid higher rollover costs of short-term debt.

Table 6: Regression of Leverage and LTD/TD with COVID-19 dummy

This Table presents the OLS regressions of *Leverage* and *LTD/TD* on the COVID-19 dummy and the set of control. In each specification, the first column the model does not have the individual firm level fixed effects while the second one does contain the individual firm level fixed effects. Cash, Capex and Tangibility are scaled by Total Asset. The control set is lagged by one year. In the parenthesis it is shown the standard errors clustered at firm level. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Leverage		**LTD/TD**	
COVID-19	0.0291***	0.0237***	0.0216***	0.0259***
	(0.00251)	(0.00307)	(0.00539)	(0.00631)
Cash	-0.138***	-0.0985**	-0.0351	-0.0901
	(0.0269)	(0.0309)	(0.0459)	(0.0663)
Capex	0.0131	-0.0323	0.298**	0.200
	(0.0702)	(0.0842)	(0.109)	(0.132)
Profitability	0.0465*	-0.0358	0.132***	0.000360
	(0.0212)	(0.0274)	(0.0278)	(0.0411)
ICR	-0.000915***	-0.000215*	-0.00121***	-0.000243
	(0.0000901)	(0.000105)	(0.000162)	(0.000219)
TD/EBITDA	0.00115	0.000753	-0.000153	-0.000235
	(0.000317)	(0.000266)	(0.000296)	(0.000292)
Tangibility	0.0433***	0.0461**	-0.00986	-0.0709
	(0.0118)	(0.0286)	(0.0146)	(0.0458)
Size	0.0322***	0.310***	0.0649***	0.126**
	(0.00425)	(0.0237)	(0.00636)	(0.0418)
cons	0.169***	-0.0616	0.525***	0.385**
	(0.0142)	(0.0739)	(0.0239)	(0.128)
FE	No	Yes	No	Yes
N	5536	5536	5536	5536
R-sq	0.071	0.067	0.023	0.017

Table 7 presents the results of the second specification model that include the interaction between the *Business Risk* dummy variable and the COVID-19 dummy variable. Table 7 shows a significative result: the increase in the level of *Leverage* on average is different between the firms more and less exposed to the business risk pre COVID-19. After COVID-19, on average firms increased *Leverage* by 2.35 pp in the model without FE and 2.11 pp in the model with FE. The interaction term indicates that on average the firms more exposed to the business risk in 2019 increased the level of *Leverage* by 1 pp more respect the firms less exposed to business risk. This cross-sectional difference based on risk is significant at 1% significance level. Hence, since the optimal level of debt is likely to decline during the period of crisis these firms with worst fundamental could happen to be over-leveraged. The qualitative results of the control set do not change significantly in respect Table 5.

As far as *LTD/TD,* column 3 and 4 of Table 7 show that there is not a cross-sectional difference among the firms. After COVID-19, firms increased the portion of long-term debt over total debt by 2.55 pp in the model without FE and 2.34 pp in the model with FE but the coefficient of the variable Business Risk × COVID-19 is not statistically significant different from 0. Hence, firms more exposed to the business risk did not increase or decrease the portion of long-term significantly different from firms less exposed to the business risk prior to COVID-19. The qualitative results of the control set do not change significantly in respect Table 5.

Table 7:

Regression of Leverage and LTD/TD with Covid Dummy and the interaction term

This Table presents the OLS regressions of *Leverage* and *LTD/TD* on the COVID-19 dummy, the interaction term Business Risk × COVID-19 and the set of control. In each specification, the first column the model does not have the individual firm level fixed effects while the second one does contain the individual firm level fixed effects. Cash, Capex and Tangibility are scaled by Total Asset. The control set is lagged by one year. In the parenthesis it is shown the standard errors clustered at firm level. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Leverage		**LTD/TD**	
COVID-19	0.0235***	0.0211***	0.0255***	0.0234**
	(0.00294)	(0.00330)	(0.00592)	(0.00727)
COVID-19 × Business Risk	0.0105***	0.0104**	0.0164	0.00820
	(0.00597)	(0.00563)	(0.00990)	(0.0121)
Cash	-0.138***	-0.0983**	-0.0337	-0.0905
	(0.0269)	(0.0308)	(0.0459)	(0.0662)
Capex	0.0130	-0.0323	0.296**	0.200
	(0.0704)	(0.0842)	(0.109)	(0.132)

Profitability	0.0457*	-0.0360	0.132***	0.000736
	(0.0212)	(0.0274)	(0.0277)	(0.0411)
ICR	-0.000925***	-0.000218*	-0.00123***	-0.000235
	(0.0000893)	(0.000104)	(0.000162)	(0.000219)
TD/EBITDA	0.00115***	0.000752**	-0.000157	-0.000232
	(0.000317)	(0.000266)	(0.000296)	(0.000291)
Tangibility	0.0446***	0.0460**	-0.00756	-0.0708
	(0.0119)	(0.0286)	(0.0148)	(0.0458)
Size	0.0316***	0.108***	0.0643***	0.132**
	(0.00422)	(0.0233)	(0.00633)	(0.0426)
cons	0.171***	-0.0547	0.526***	0.366**
	(0.0140)	(0.0727)	(0.0238)	(0.130)
FE	No	Yes	No	Yes
N	5536	5536	5536	5536
R-sq	0.083	0.067	0.023	0.017

7. Robustness tests

In this section I run the analysis with alternative measures to check the robustness of the impact of COVID-19 on *Leverage* and *LTD/TD* of European firms. First thing first, I use another measure of leverage defined as *Net Debt over Total Asset*, a company's total debt less cash and short-term investments over *Total Asset*, to define the impact of COVID-19. Table 8 examines this issue using the baseline specification in the first two column and the specification with the interaction term in the third and fourth columns. The results do not change respect the previous baseline specifications. After COVID-19, on average firms increased the level of *Leverage* by 2.39 pp in the model without FE and 2.07 pp with FE. In the third and fourth column it is possible to see that on average firms more exposed to the business risk prior to COVID-19 increased 3.15 pp in the model without FE and almost 3 pp in the model with FE. The qualitative results do not change significantly in respect Table 5.

Table 8: Robustness Check on the impact of COVID-19

This table presents the OLS regressions of *Net Debt over Total Assets* on the COVID-19 dummy and the set of control. In the third and fourth column there is the interaction term Business Risk × COVID-19. In each specification, the first column the model does not have the individual firm level fixed effects while the second one does contain the individual firm level fixed effects. Cash, Capex and Tangibility are scaled by Total Asset. The control set is lagged by one year. In the parenthesis it is shown the standard errors clustered at firm level. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Net Debt over Total Assets			
COVID-19	0.0239***	0.0207**	0.0215***	0.0199**
	(0.00297)	(0.00349)	(0.00347)	(0.00393)
Business Risk × COVID-19			0.0105**	0.00985**
			(0.00677)	(0.00675)
Cash	-0.520***	-0.199***	-0.520***	-0.199***
	(0.0354)	(0.0404)	(0.0354)	(0.0404)
Capex	0.0538	0.0587	0.0531	0.0588
	(0.0814)	(0.1000)	(0.0817)	(0.0999)
Profitability	0.101***	-0.0420	0.0999***	-0.0419
	(0.0245)	(0.0346)	(0.0244)	(0.0346)
ICR	-0.00123***	-0.000222	-0.00124***	-0.000220
	(0.000106)	(0.000125)	(0.000105)	(0.000124)
TD/EBITDA	0.00139***	0.000760**	0.00139***	0.000761**
	(0.000377)	(0.000281)	(0.000377)	(0.000281)
Tangibility	0.0429***	0.0375**	0.0442***	0.0375
	(0.0125)	(0.0289)	(0.0125)	(0.0288)
Size	0.0396***	0.181***	0.0390***	0.182***
	(0.00488)	(0.0277)	(0.00487)	(0.0279)
cons	0.0773***	-0.365***	0.0787***	-0.369***
	(0.0163)	(0.0844)	(0.0162)	(0.0846)
FE	No	Yes	No	Yes
N	5536	5536	5536	5536
R-sq	0.07	0.049	0.063	0.049

Finally, the second part of the robustness check regards the definition of exposure to business risk prior to COVID-19. In the regression showed in Table 9 I use the Return on Equity distribution to construct the dummy variable Business Risk 2: the dummy takes value of 1 if the firm happens to have the value of Return on Equity 2019 in the lowest quartile of the 2019 Return on Equity distribution. Then, I add the interaction term COVID-19×Business Risk 2, made by the product of Business Risk 2 and the dummy COVID-19. All the primary results are unchanged but the cross-sectional difference based on business risk is more pronounced. After COVID-19, firms less exposed to the business risk increased the level of *Leverage* by 2.37 pp in the model without FE and by 1.82 pp in the model with FE. The group of more exposed to the business risk increase the level of *Leverage* 1.62 pp more than less exposed firms in the model without FE and 1.96 pp with FE. All the results are statistically significant at 1% significance level. The qualitative results of the control set do not change significantly in respect Table 5.

Table 9: Regression of Leverage with COVID-19 and interaction term 2

This Table presents the OLS regressions of *Leverage* on the COVID-19 dummy, the interaction term COVID-19 × Business Risk 2 and the control set. In each specification, the first column the model does not have the individual firm level fixed effects while the second one does contain the individual firm level fixed effects. Cash, Capex and Tangibility are scaled by Total Asset. The control set is lagged by one year. In the parenthesis it is shown the standard errors clustered at firm level. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Leverage	
COVID	0.0237***	0.0182**
	(0.00264)	(0.00326)
COVID-19 × Business Risk 2	0.0162***	0.0196***
	(0.00847)	(0.00824)
Cash	-0.163***	-0.104***
	(0.0272)	(0.0307)
Capex	0.00783	-0.00877
	(0.0731)	(0.0848)
Profitability	0.00452	-0.0156
	(0.0201)	(0.0150)
ICR	-0.0000642*	-0.0000325
	(0.0000182)	(0.0000204)
TD/EBITDA	0.000190	0.000112
	(0.000191)	(0.000134)
Tangibility	0.0290**	0.0267
	(0.0103)	(0.0229)
Size	0.0385***	0.112***
	(0.00455)	(0.0230)
cons	0.152***	-0.0662
	(0.0144)	(0.0714)
FE	No	Yes
N	5536	5536
R-sq	0.088	0.072

8. Main limitations and further research

This study is conducted with a limited availability of granular European firms' data regarding the composition of debt issuance and the needs of firms. To fully assess the impact of COVID-19 on leverage decisions, it would be necessary to conduct detailed research on the reasons for the issuance of debt. The reasons for the demand of debt might differ: some firms might have issued debt to reconcile cash flows for the running activities, others to finance structural change in the business model and others to finance investments for new business opportunities created by COVID-19.

Future research might investigate the cross-sectional difference in the leverage and structure of debt decisions based on the exposure to financial risk, namely rollover risk.[8] More specifically, the heterogeneity in firms' need to rollover current portion of long-term during COVID-19 can be studied to analyze if firms with higher refinancing needs contract different levels of leverage than similar firms that do not need rollover long-term debt.

9. Conclusion

In this dissertation, using a sample of 1384 European firms I provide evidence that on average the level of leverage and the portion of long-term debt over total debt increased, at 1% significance level, controlling for a set of control well established in the literature and individual firm level fixed effects. Then, a set of difference-in-differences regressions show that the change in the level of leverage is different cross-sectionally: on average firms more exposed to the business risk prior to COVID-19 increased leverage by 1 pp more firms less exposed to business risk. This difference is statistically significant at 1% significance level. As far as the portion of long-term debt over total debt there is not a statistical significative difference between firms more and less exposed to the business risk.

For the firms with lower expected growth rates of cashflows and surge in volatility of returns the optimal debt level reduced according to Hague and Varghese (2021). The massive quantity of capital injected in the system by the central institutions could have sustained the activity of firms inefficient or with the business out of the market after COVID-19. The results, from a policy perspective, clearly raise serious future questions and possible implications for

[8] Rollover risk is a risk associated with the refinancing of debt, commonly faced by firms when a loan or other debt obligation is about to mature and needs to be converted, or rolled over, into new debt.

the financial stability and systemic risks with the potential of a significative wave of defaults: the systematic reduction of cashflows and a contractionary monetary policy, indeed, will create difficulties for the repayment of the debt service. However, like the pattern observed in the aftermath of other financial crisis like the Global Financial Crisis in 2007, it seems reasonable to conjecture, further, that the COVID-19 shock will increase corporate saving rates in the long run as firms may attempt to restore their liquidity and reserves to strengthen their balance sheets in the longer term and prepare for future shocks. Given these scenarios, firms will probably engage less in new investment activities. Therefore, it is likely a deleveraging process (i.e., a period of low investment and increasing profits) in the medium-long term. This will in turn create downward pressure on real interest rates and complicate the conduct of monetary policy.

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