The Impact of Minimum Wage Increases on Capital Structure: Evidence from Portugal

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Abstract

Title. The Impact of Minimum Wage Increases on Capital Structure: Evidence from Portugal

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Over the last decade, Portugal has experienced one of the steepest increases in the national minimum wage of the European Union countries, following a long period of wage freeze under the Economic Adjustment Program. This dissertation studies how Portuguese firms adjusted their leverage during the sequence of minimum wage hikes. Using employer–employee data from Quadros de Pessoal and firm accounts from SCIE between 2010 and 2022, the analysis compares firms that were highly exposed to the minimum wage in 2014 with less exposed firms. By using a difference in differences approach with propensity score matching, the results show that highly exposed firms increased leverage relative to less exposed firms, and that this pattern is concentrated among low profitability firms. However, treated and control group firms did not follow parallel pre trends, showing that these firms already had diverging financing trends before 2014.

Ao longo da última década, Portugal registou um dos aumentos mais acentuados do salário mínimo nacional na União Europeia, após um longo período de estagnação salarial no âmbito do Programa de Ajustamento Económico. Esta dissertação estuda como as empresas portuguesas ajustaram a sua alavancagem durante a sequência de aumentos do salário mínimo. Utilizando dados empregador-empregado dos Quadros de Pessoal e contas de empresas do SCIE entre 2010 e 2022, a análise centra-se em comparar empresas altamente expostas ao salário mínimo em 2014 com empresas menos expostas. Através de uma abordagem de differences in differences com propensity score matching, os resultados mostram que as empresas altamente expostas aumentaram a alavancagem relativamente às empresas menos expostas, e que este padrão se concentra nas empresas de baixa rentabilidade. Contudo, as empresas dos grupos de tratamento e controlo não seguiram tendências paralelas no pré-tratamento, mostrando que estas empresas já apresentavam tendências de financiamento divergentes antes de 2014.

Keywords: Capital Structure, Minimum Wage, Portugal, Leverage

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1. Introduction

Over the past decade, Portugal has experienced one of the biggest national minimum wage (NMW) increases in the European Union, which took place after a period of wage freeze under the Troika Economic Adjustment Program. While the employment effects of increases in the minimum wage have already been extensively studied in both developed and emerging markets, less attention has been paid to how firms adapt financially to persistent (rather than one-off) labor cost shocks. The evidence is even scarcer in economies with a huge proportion of SMEs, which is the case for Portugal.

Therefore, my thesis investigates how Portuguese firms adjust their capital structure in response to repeated increases in the national minimum wage. Specifically, I analyze whether firms more exposed to the minimum wage respond by increasing leverage to finance the higher salaries or instead deleverage to reduce risk.

I will employ a difference in differences (DiD) estimation with a propensity score matching (PSM) approach to compare firms with high and low minimum wage exposure. Additionally, I will also study the heterogeneity of profitable and unprofitable firms to understand how unprofitable firms differ from profitable ones in response to this shock.

The analysis reveals several revelations. Firms with high minimum wage exposure show higher leverage ratios compared to less exposed firms in the post treatment period, with this increase driven mainly by financial debt rather than other forms of leverage. This pattern is concentrated among unprofitable firms.

The remainder of this thesis is organized as follows. Section 2 reviews the relevant literature on minimum wages and firm financing. Section 3 describes the data sources and variable construction. Section 4 outlines the empirical strategy and presents the main results. Section 5 discusses the findings and their implications. Section 6 concludes with main findings and future research potential.

2. Institutional framework and literature Review

2.1 The Evolution of the National Minimum Wage in Portugal

Following the 2008-2012 global financial crisis and subsequent sovereign debt crisis, Portugal's national minimum wage (NMW)[1] remained frozen at €485 per month from 2011 to 2014, as part of the Economic Adjustment Program (commonly referred to as Troika).

At the time, the Troika implemented several measures to balance public accounts and reduce the fiscal deficit, which had consistently exceeded the 3% of GDP ceiling and had even reached 11.2% in 2011. These austerity measures included raising the Value Added Tax to 23% and freezing pensions. Additionally, the program mandated a wage cut for public employees by an average of 3.5% to 10%, depending on their income levels, which led to some public dissatisfaction. To increase competitiveness, the Troika also conducted several structural reforms, including labor market flexibilization and even privatizing state owned enterprises such as EDP, REN, and ANA airports (OECD, 2017).

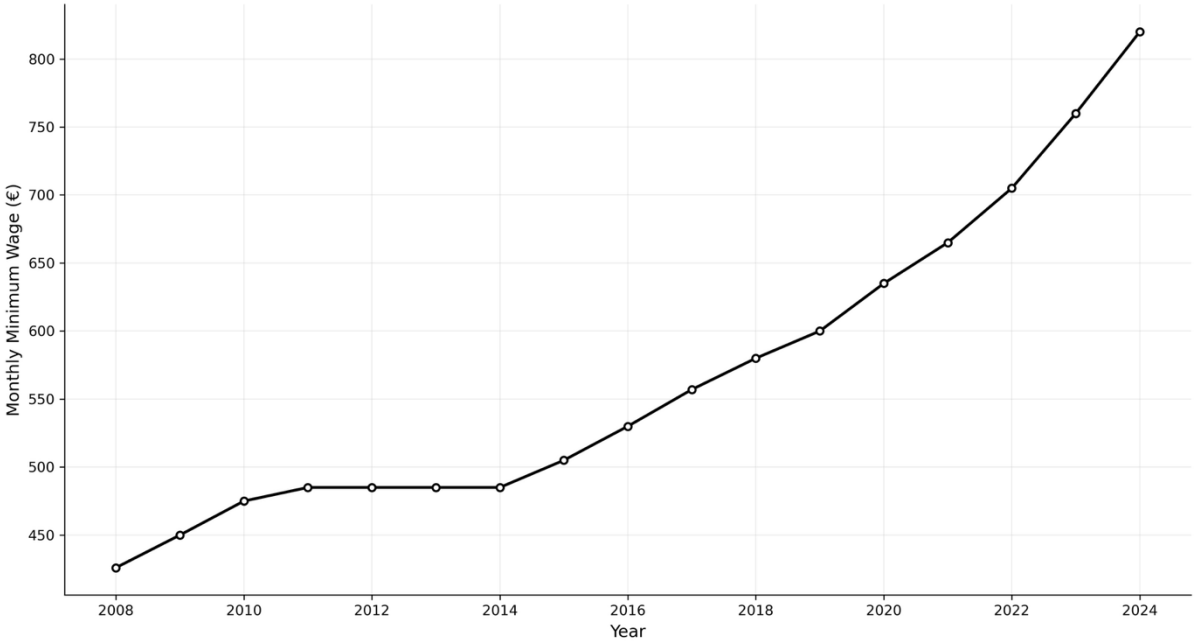
The Economic Adjustment Program enabled Portugal to reduce its public deficit to 4.35% of GDP by 2015. Although unemployment remained high at around 12.45% in 2015 (down from its peak of 16.2% in 2013), the overall improving conditions allowed the government some room to increase the National Minimum Wage (NMW) as an effort to restore social cohesion and public trust (Figure i). In the following years, the NMW increased from €505 in 2015 to €870 by 2025, marking one of the most substantial minimum wage increases in the European Union during this period (Gabinete de Estratégia e Planeamento do Ministério do Trabalho, Solidariedade e Segurança Social, 2019). At the time of writing, the state budget for 2026 was approved, and established the NMW for 2026 at €920.

The total annual labor cost for a minimum wage worker in Portugal reached approximately €15 072.75 in 2024, because workers in Portugal receive 14 payments per year, and the employer additionally contributes 23.75% as employer social security contributions. Moreover, these increases affected a substantial portion of the Portuguese workforce, with minimum wage policies becoming binding[2] for an estimated 20-25% of all workers in 2018, up from about 10% in 2010 (Gabinete de Estratégia e Planeamento do Ministério do Trabalho, Solidariedade e Segurança Social, 2019).

[1] In Portuguese, "Remuneração Mínima Mensal Garantida".

[2] A minimum wage is binding when it is set above the natural market wage, forcing employers to pay more than they otherwise would.

Figure i. Portuguese Minimum Wage Evolution (2008–2024)

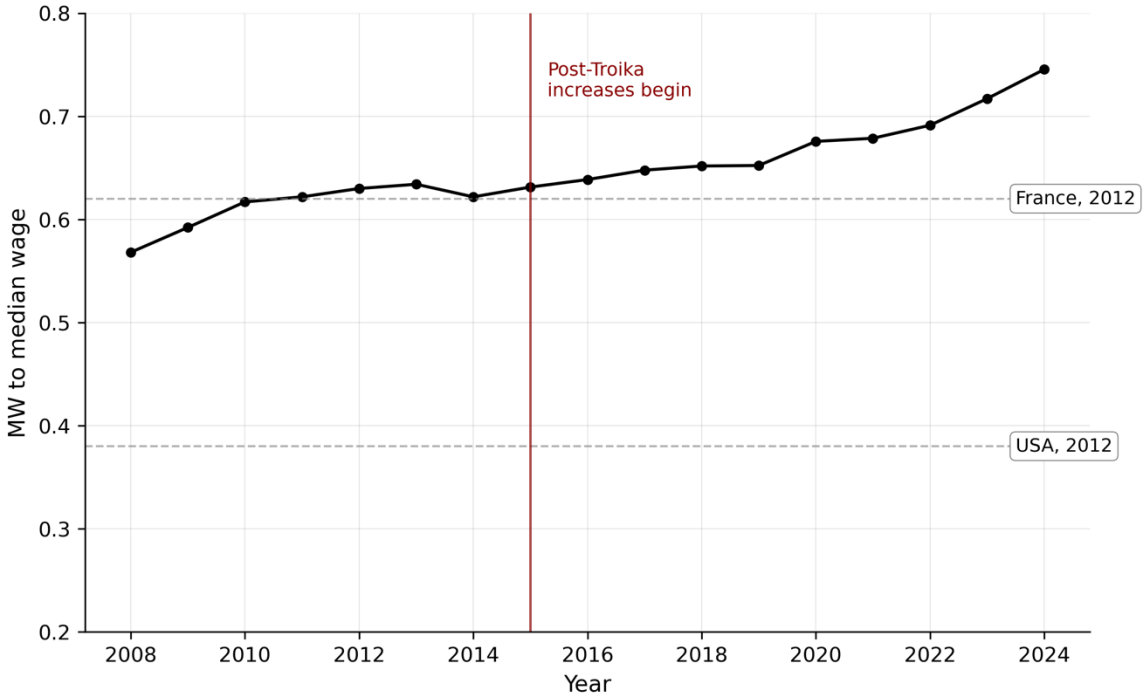


Source: Instituto Nacional de Estatística (INE), Portugal (2024)

Moreover, Portugal's wage distribution is quite compressed. For example, the median salary in mainland Portugal was 1100.17 euros in 2024 (*Portal Do INE*, n.d.), compared to the minimum wage of 820 euros, which sets it at 74.5% of the median wage.

To put Portugal's situation in perspective, Harasztosi and Lindner (2019) show that in 2012, France's minimum wage was 62% of the median wage, while in the United States it was only 38%. As shown in Figure ii, Portugal's minimum-to-medium wage increased from 57% in 2008 to 74.5% in 2024. This means Portugal now has a more compressed wage distribution than France in 2012, and significantly more than the U.S in 2012. Combined with the fact that the minimum wage became binding for 20 to 25% of workers by 2018, this makes Portugal an interesting case to study how firms adapt their financing strategies when labor costs increase substantially.

Figure ii Minimum Wage to Median Wage in Portugal (2008 - 2024)



2.1 Capital Structure Theory and Cost Shock Responses

To understand what might happen, we first must look at the existing theories of capital structure decisions and how cost shocks are transmitted to firm operations.

Capital Structure Theory

Modigliani and Miller (1958, 1963) established the foundation of how we understand corporate financing decisions today. Their trade off theory suggests that companies consider two factors when deciding how much to borrow: the tax benefits of debt versus the potential costs of financial distress. Debt offers a tax advantage because interest payments are tax-deductible, making it an interesting source of financing.

On the other side of the trade off are the expected costs of financial distress, which increase as leverage rises. These costs include both direct costs, such as legal and administrative expenses in bankruptcy, and indirect costs, such as lost customers, damaged supplier relationships, and reduced employee morale. As debt levels increase, so does the probability of distress, and so do these costs.

The trade off theory predicts that firms will choose a capital structure that maximizes firm value by carefully weighing these opposing forces. This optimal leverage level is not the same

for every firm. Rather, it depends on specific firm characteristics, such as business risk, asset tangibility, tax rates, and the volatility of earnings (Li and Islam, 2019).

Alternative Capital Structure Theories

While the trade off theory is the most well known, other theories also contribute to our knowledge of how firms make financing decisions. The pecking order theory, for example, is a quite simple theory based on the idea that managers know more about the company than the outside investors and therefore have an asymmetry of information. Because of this information gap, companies follow a clear preference order for financing. They use retained earnings first, debt financing second, and only issue new shares as a last resort. This order of preference exists because each step sends negative signals to investors about the company's financial health (Myers, 1984).

Another theory is the market timing theory, proposed by Baker and Wurgler (2002). This theory suggests that firms issue equity when their stock price is high and issue debt when equity is perceived as undervalued. Thus, capital structure becomes the cumulative result of past market timing attempts. Unlike the trade-off and pecking order theories, market timing theory implies that capital structure decisions can have lasting effects, meaning today's leverage reflects the past sequence of financing opportunities and managerial perceptions of when equity was over or undervalued.

Lastly, the dynamic trade off theory. Unlike the traditional trade off theory, where firms actively move towards the best leverage to maximize firm value, the dynamic version says that changing capital structure costs money (transaction costs, underwriter fees, and it sends signals to the market). Thus, firms do not constantly adjust their leverage. Instead, they let it vary within a range and only make changes when the leverage levels get too far from the desired level (Fischer et al., 1989).

The dynamic trade off theory is particularly relevant to the Portuguese context. First, minimum wage increases raise financial distress risk by reducing profitability and net cash flows. Second, Portuguese firms were already in the process of already somewhat constrained due to the 2011-2014 sovereign crisis. Third, unlike large corporations, SMEs have less flexibility in financing options, making them more volatile in their reaction.

2.2 Cost Shock Transmission Mechanisms

What are the possible ways a cost shock, such as an increase in the minimum wage, could affect a firm's capital structure? Three can be highlighted:

Profitability Channel: When minimum wage increases, firms see their profitability reduced and lower their cash flows (Alexandre et al., 2022)(Draca et al., 2011). Thus, lower cash flow generation implies less capacity to serve debt obligations, forcing firms to either refinance or deleverage (Frank and Goyal, 2009).

Investment Channel: Theory suggests that higher labor costs would make firms buy machines and technology to replace workers (Acemoglu and Restrepo, 2020) (Harasztosi & Lindner, 2019), which would, in turn, require additional financing, potentially through debt. However, empirical evidence shows the opposite: increases in the minimum wage may actually lead firms to reduce their capital expenditures rather than increase them (Gustafson and Kotter, 2022). In Portugal, where labor regulation is strict, this effect can be even stronger (Simintzi et al., 2015).

Leverage Substitution Channel: When minimum wage increases make labor costs more rigid, wages behave less like variable costs and more like fixed costs. This increases operating leverage because a larger portion of costs is no longer proportional to revenue. Higher operating leverage amplifies both positive and negative shocks, and increases business risk. Following the risk substitution principle documented by Simintzi et al. (2015), firms may reduce financial leverage to maintain acceptable overall risk levels.

2.3 Minimum Wage Shocks on Labor Markets

The impact of minimum wage shocks on labor markets has been well documented in economics. Traditional economic theory predicts that minimum wage increases above market clearing levels should reduce employment by making labor artificially expensive. However, the empirical evidence presents a more complex picture.

While Castillo-Freeman and Freeman (1992) find that Puerto Rico's employment decreased by 8 to 10% as a result of applying the U.S. federal minimum wage to its much lower wage economy, Katz and Krueger (1992), on the other hand, show no evidence of job losses in New Jersey's fast-food industry after the state's minimum wage increase.

Moreover, Harasztosi and Lindner (2019) demonstrate that most firms did not destroy jobs in response to a persistent increase in the Hungarian minimum wage. Instead, they absorbed the majority of wage costs through a decline in profits (of about 4 to 6%), with only 25% of costs

ultimately borne by firm owners, and the remaining costs gradually passed on to consumers through higher prices.

Spain, however, tells a different story. When the country raised its minimum wage by 22% in 2019, businesses did not just absorb the cost, but also reduced jobs. Casanova et al. (2025) found that companies where all workers had the minimum wage saw their employment growth fall by 4.5 percentage points compared to other firms. The study calculated an "own wage elasticity" of -0.39, meaning that for every 1% increase in wages due to the minimum wage, employment fell by 0.39%.

What were the effects in Portugal? Cardoso and Portugal (2006) studied the impact of a minimum wage change in 1987 in Portugal that targeted young people aged 17 to 19. These workers saw their minimum wage increase sharply, and the authors concluded that although firms hired fewer young adults after the reform (15 to 20% reductions in accessions), those already employed were less likely to leave or be dismissed (10 to 15% reduction in separations), which meant stronger job stability and few net job losses. In other words, higher minimum wages can reduce turnover instead of cutting employment. The results were more robust for labor intensive sectors.

However, the idea that minimum wages need not reduce employment was severely tested in Portugal during the period from 2008 to 2013 when unemployment rose from 8 to 16% and, in fact, minimum wage binding was responsible for 30% of the total "catastrophic job destruction" (Carneiro et al., 2014). This effect was stronger in SMEs and labor intensive sectors such as services, suggesting that the existence of a minimum can become a significant constraint during recessions when firms need to reduce labor costs. The inability to adjust wages downward made firms resort to more drastic measures: eliminating jobs entirely.

According to Centeno et al. (2014), who examined minimum wage increases from 2002 to 2010, workers receiving the minimum wage were less likely to keep their jobs. Specifically, for each 1% increase in the minimum wage, the likelihood of minimum wage workers staying employed decreased by 1.1 percentage points. It also showed stronger effects for the manufacturing sector, a sector that had a bigger percentage of minimum wage workers.

Moreover, between 2014 and 2019, increases in the national minimum wage in Portugal had a negative impact on both company profits and employment growth, with more pronounced effects in financially distressed companies (Alexandre et al., 2022).

Since companies cannot easily adjust their workforce when minimum wages rise, especially in rigid labor markets such as Portugal's, what does the empirical evidence tell us about how firms adapt their financial decisions?

2.4 Minimum Wage Impacts on Firm Financial Performance

A consistent finding across different institutional contexts is that minimum wage increases reduce firm profitability and market valuations. Draca et al. (2011) shows that the introduction of a minimum wage in the UK significantly reduced firm profitability, particularly in sectors more exposed to minimum wage binding. The profitability channel was quickly reflected in valuations: Bell and Machin (2018) show that the surprise announcement of the U.K. minimum wage introduction reduced firm value by 2 to 3% for low wage firms[3]. Similarly, Harasztosi and Lindner (2019) find that Hungarian firms absorbed 60 to 70% of minimum wage costs through profit declines of 4 to 6%. Finally, as seen before, Portuguese firms decreased their profitability as a result of minimum wage increases in Portugal (Alexandre et al., 2022). This evidence suggests that firms cannot fully pass the increased costs to consumers.

There is evidence that rather than substituting capital for labor when labor becomes expensive, firms actually reduce their investment. Cho (2025) found that a one standard deviation increase in the minimum wage reduced corporate investment rates by 3.18 percentage points in U.S. firms. Moreover, Gustafson and Kotter (2022) reported a 12% reduction in capital expenditures among minimum wage sensitive public firms, also in the U.S.A.

Since firms become less profitable and invest less, how do their debt levels change? Liang (2024) shows that after Germany's minimum wage introduction in 2015, firms reduced their financial leverage as a prudent response to higher labor costs. Similarly, Cho (2017) finds that minimum wage increases increase the operating leverage while simultaneously reducing their use of debt financing. The author points out that "downward wage rigidity essentially converts a wage claim into a debt-like contract".

This relationship between employee protection and leverage of the firm is also studied by Ellul and Pagano (2019). The authors demonstrate that its impact depends on firms' financial flexibility. For financially distressed firms, stronger worker protection (such as a higher minimum wage) reduces how much creditors are willing to lend. However, for firms not in financial distress, actually, the opposite happens: they often borrow more when workers have better legal protection as a strategic decision to control wage negotiations.

Overall, minimum wage increases deteriorate the overall financial health of small enterprises, particularly affecting young, labor intensive firms in competitive markets (Chava et al.,

[3] In this context, "low wage firms" are firms whose average wage per employee is less than £15,000 per year.

2019). Moreover, financially distressed firms also amplify the effects of minimum wage increases (Alexandre et al., 2022).

2.5 Thesis Contribution and Research Questions

Despite extensive research on minimum wages, the vast majority of studies focus on labor market outcomes such as employment, turnover, and wages. Far less known is how firms adapt financially to persistent labor cost shocks. While there has been some work on the topic, the findings are mixed: some studies report higher leverage (and bankruptcy risk), while others report the opposite.

This divergence is what motivated me to study Portugal's case. The dominance of SMEs, rigid labor laws, and the post crisis adjustment program make Portugal a good case study for the shock of minimum wage increases on the leverage of companies.

Specifically, I propose to investigate whether Portuguese firms reduced leverage to avoid financial distress or instead increased it to compensate for higher wage bills. I will also study the heterogeneity across firms by labor intensity: do labor intensive firms show stronger adjustments than capital intensive ones? And, finally: which channel best explains the observed results?

Thus, this research contributes in three ways. First, it studies the impact of how minimum wage increases affect capital structure in an SME dominated economy with limited access to financial markets. Second, it fills a gap left by other studies on the topic that commonly study public companies. Third, it informs policymakers about the financial consequences of raising the minimum wage, which is particularly relevant given recent EU policy developments on establishing adequate minimum wages and the Portuguese national context (*Adequate Minimum Wages in the EU - Employment, Social Affairs and Inclusion*, 2025).

3. Data and Variables

3.1 Data Source

My thesis will drink from two main datasets: Quadros de Pessoal (QP) and Sistema de Contas Integradas das Empresas (SCIE), both from Statistics Portugal (INE).

Quadros de Pessoal (QP) is a mandatory annual census for Portuguese companies that employ at least one person (therefore, it does not include companies without employees). It reports

standardized information about Portuguese workers' wages. QP comprises three main components: worker level data, firm level data and establishment level data. I use the worker level data, concretely, the firm identifier (NPC_FIC) and total monthly earnings (rganho), which is the worker compensation paid in October of each year.

Sistema de Contas Integradas das Empresas (SCIE) provides us with harmonized accounting information for non financial, private firms in Portugal. SCIE follows the European System of Accounts and implements the Portuguese Accounting Standards System (SNC).

I merged the two datasets using the firm tax identifier (NPC_FIC). I winsorized continuous variables (leverage, tangibility, profitability, sales growth, and log assets) at the 1st and 99th percentiles to limit the influence of extreme values and excluded firms with total assets below 5,000€ to avoid extreme distortions in leverage. My final sample consisted of 1 726 026 firm-year observations.

3.2 Sample Period

The sample period ranges from 2010 to 2022, which includes the pre treatment years (2010 to 2014) and the post treatment years (2015 to 2022). The pre treatment years were chosen carefully: until 2014, Portugal's minimum wage remained frozen as part of the Economic Recovery Program and started to rise steeply from 2015 onwards. From 2015 to 2022, the minimum wage was raised by 50.5% over just 8 years.

3.3 Variable Definition

Following prior literature (Frank & Goyal, 2009; Liang, 2024), I measure firm leverage as the ratio of total liabilities to total assets:

$$\text{Leverage}_{it} = \frac{\text{Total Liabilities}_{\text{it}}}{\text{Total Assets}_{it}} \times 100$$

I have excluded from the analysis firms whose leverage ratio is above 100% or below 0%. Leverage above 100% indicates negative equity, which typically reflects financial issues and could bias the analysis. Negative leverage is impossible and thus reflects input errors.

I also calculated three additional proxies for leverage for robustness. First, financial leverage captures only the debt obtained from financial institutions (mostly banks), which is composed of the current and non current debt financing, scaled by total assets. Second, short term financial leverage, which isolates only the short term debt financing, is also scaled by total assets. Lastly, operating leverage, which captures only non financial liabilities such as trade credit, tax payables and accrued expenses. It is calculated as the difference between current liabilities and short term financial debt, scaled by total assets.

Additionally, to avoid distortions from part time employment or workers that start or leave at the middle of the month, I set the minimum monthly hours worked to 160, which corresponds to approximately 37 to 40 hours per week and allows for monthly variation due to vacation days or temporary short absences. I also calculate the hourly wage when doing any calculation. For this, I set the hourly wage as:

$$\text{Hourly Wage}_{it} = \frac{\text{Base Salary}_{it} \times \frac{14}{12} + \text{Regular Benefits}_{it} + \text{Irregular Benefits}_{it}}{\text{Hours Worked}_{it}}$$

I define minimum wage exposure as the proportion of a firm's workforce earning less than 115% of the minimum wage in the base year 2014. I measure exposure in the base year 2014 specifically because it precedes the major minimum wage increases and thus is not affected by a possible firm response to policy.

$$\text{MW Exposure}_{i,2014} = \frac{\#\ full-time \text{ workers earning } \leq 1.15 \times MW_{2014}}{\text{Total full time employees}_{i,2014}}$$

I use a 15% margin above the legal minimum wage to capture workers who earn similarly to the minimum wage and thus are affected (or expected to be affected) by the effective increase in the minimum wage. I classify firms as "High Exposure" if they are in the top decile of minimum wage exposure in 2014. Following standard practice, I also winsorize continuous variables (leverage, tangibility, profitability, sales growth, log assets, and hourly wages) at the 1st and 99th percentiles.

Below are presented the main variables used, as well as the core datasource I gathered them from.

Table 1 Variable Description and Datasource

Variable	Description	Source
Leverage Ratio	Ratio of total liabilities to total assets	SCIE
Tangibility	Ratio of fixed tangible assets to total assets	SCIE
Profitability	Return on assets in a given year	SCIE
Firm Size	Natural logarithm of total assets	SCIE
Sales Growth	Year-over-year percentage change in total revenue	SCIE
Firm Age	Years since firm establishment	SCIE
Num Employees	Total number of workers employed	QP
Avg Wage	Average monthly earnings per worker	QP
MW_Exposure	Share of workers earning <= 115% of MW in 2014	QP

High Exposure	Dummy that equals one for firm for firms in the top decile	QP

Notes: SCIE stands for "Sistema de Contas Integradas das Empresas" and QP for "Quadros de Pessoal". All financial variables are winsorized at the 1st and 99th percentile.

3.4 Descriptive Statistics

Table 1 reports the descriptive statistics for the full sample, from 2010 to 2023. The average Portuguese firm has a leverage ratio of 56.42%, although there is some dispersion around this value, with several firms having almost no debt.

Table 2 Descriptive Statistics

	Mean	sd	min	p50	max
leverage	56.42	26.83	2.12	59.64	98.87
profitability	3.84	13.72	-51.10	2.44	52.70
tangibility	23.60	24.50	0.00	14.98	93.23
log_assets	12.62	1.58	9.42	12.47	17.25
avg_hourly_wage	6.36	2.99	3.27	5.48	20.96
financial_leverage	17.75	21.10	0.00	9.22	81.25
short_term_leverage	4.11	9.87	0.00	0.00	53.54
sales_growth	22.30	93.39	-78.75	3.76	694.19

The table summarizes the main statistics for the 1 726 026 firm-year observations. Leverage, financial leverage, short term leverage, operating leverage, tangibility, profitability, sales growth, log assets, and average hourly wage are winsorized at the 1st and 99th percentiles.

Several conclusions can be drawn from Table 2. First, the average Portuguese firm is small, with a median log assets of 12.47 (corresponding to approximately €260,000 in total assets). Second, firms are moderately leveraged, with a median total leverage of 59.64%, though there is substantial variation around this value. Third, the average hourly wage is €6.36, with considerable dispersion across firms, ranging from €3.27 to €20.96 at the extremes. Finally, many firms carry little to no financial debt from banks, as evidenced by the median financial leverage of only 9.22%, well below the mean of 17.75%.

Table 3 shows the evolution of some key variables across the period. Leverage declined from 61.4% in 2010 to 54.2% in 2022, a reduction of 7.2 percentage points. Profitability improved substantially, rising from 2.35% in 2010 to 6.00% in 2022, with a hit in 2020 during the COVID-19 pandemic. Average hourly wages increased, as expected, from €5.65 in 2010 to €7.63 in 2022, representing a 35% increase over the period.

Table 3 Yearly Means

Year	leverage	tangibility	profitability	log_assets	avg_hourly_wage
2010	61.38	24.44	2.35	12.59	5.65
2011	59.82	24.21	1.33	12.58	5.73
2012	58.72	23.69	0.19	12.59	5.79
2013	58.24	23.23	1.87	12.59	5.87
2014	57.13	23.15	3.32	12.57	5.94
2015	56.20	23.20	4.54	12.55	5.95
2016	55.58	23.45	4.99	12.56	6.04
2017	55.13	23.49	5.58	12.58	6.25
2018	54.48	23.89	5.42	12.61	6.48
2019	54.38	24.23	5.35	12.61	6.70
2020	54.83	23.57	2.61	12.69	6.96
2021	54.80	23.08	5.11	12.75	7.24
2022	54.19	23.10	6.00	12.78	7.63

Note: This table presents the average firm level characteristics per year, from 2010 to 2022. All values are the simple mean of firm's characteristics each year. Sample size varies due to firm entry, exit, and data availability in both QP and SCIE database.

Table 4 compares the high and low minimum wage exposure firms in the base year 2014. High exposure firms are substantially smaller, with average log assets of 11.51 compared to 12.69 for low exposure firms ($p<0.001$), employ far fewer workers, with an average of 3.21 employees versus 12.31 for low exposure firms.

Moreover, high exposure firms are also significantly less profitable (2.29% versus 3.44% ROA) and pay much lower wages (€3.51 versus €6.21 per hour). Both differences are statistically significant at the 1% level. Surprisingly, high exposure firms exhibit slightly lower leverage ratios (55.04% versus 57.37%), which may reflect either limited access to credit for smaller, less profitable firms or a more conservative financing approach.

Table 4 Firm Characteristics by MW Exposure (Base year 2014)

	High Exposure	Low Exposure	P-value
leverage	55.04	57.37	0.000
tangibility	23.61	23.09	0.020
profitability	2.29	3.44	0.000
log_assets	11.51	12.69	0.000
sales_growth	28.50	22.75	0.000
num_employees	3.21	12.31	0.000
avg_hourly_wage	3.51	6.21	0.000
N	13875	123341	137216

4. Empirical Strategy and Results

4.1 Base Difference in Differences

My objective is to study the impact of regular minimum wage increases on the leverage of Portuguese companies. I employ two complementary regressions. Firstly, I conduct a simple Difference in Differences (DiD) that compares the leverage between the high and low exposure minimum wage groups defined earlier:

$$Leverage_{it} = \beta_1\left(High_{Exposure_i} \times Post_t\right) + \beta' X_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

Where $HighExposure_i$ is a binary indicator equal to 1 if firm I is in the top decile of minimum wage exposure in 2014 and 0 otherwise, $Post_t$ equals one for years 2015 to 2022 and zero otherwise. The model alsoincludes firm fixed effects (α_i) and year fixed effects (γ_t). The control vector X_{it}includes tangibility, profitability, firm size (log of assets), and sales growth, variables established in prior literature as determinants of capital structure (Frank & Goyal, 2009). The coefficient β_1 captures the differential change in leverage between the two groups, in the period of 2015 to 2022.

Results are presented in Table 5 for the total leverage definition (where Leverage is calculated as Total Liabilities divided by Total Assets).

Table 5 Simple Differences in Differences Results

	(1)	(2)	(3)
DiD	-0.039	-0.219	0.714***
	-0.232	-0.228	-0.195
Treated	-6.696***	-6.176***	
Post	-4.313***	-2.630***	
Controls	No	Yes	Yes
Year Fixed Effects	No	No	Yes
Firm Fixed Effects	No	No	Yes
Observations	1,953,671	1,726,026	1,726,026
R squared	0.009	0.076	0.136

This table presents the difference in differences (DiD) estimation results for the impact of minimum wage increases on firm leverage. The dependent variable is Total Leverage, defined as the ratio of total liabilities to total assets. Column (1) reports the baseline OLS estimates. Column (2) adds controls. Column (3) presents the specification with Fixed Effects (FE). Treated is a dummy variable equal to 1 if the firm is in the top decile of minimum wage exposure in the base year (2014); Post is a dummy variable equal to 1 for the years 2015 to 2022. Controls include Tangibility, Profitability, Firm Size and Sales Growth. In Column (3), the *Treated* and *Post* coefficients are omitted because they are absorbed by Firm Fixed Effects and Year Fixed Effects, respectively. *** p<0.01, ** p<0.05, * p<0.10.

The results from the total leverage approach suggest there is no clear change in total leverage when there are no fixed effects (Columns 1 and 2). When considering fixed effects, we see a statistically significant coefficient, suggesting that high exposure firms exhibit higher leverage in the post treatment period relative to low exposure firms.

The Differences in Differences methodology relies on the parallel trends assumption, which says that without a minimum wage hike, the leverage of firms in different groups would have followed a similar path. To formally test the parallel trends assumption, I estimate an event study specification following Liang (2024):

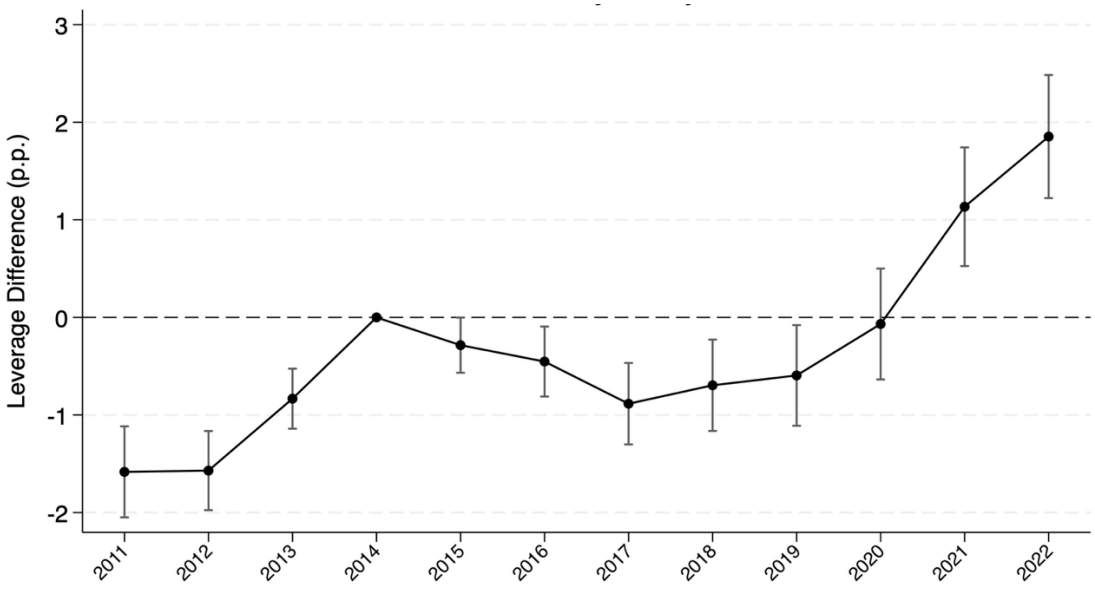
$$Leverage_{it} = \sum_{k \neq 2014} \beta_k (HighExposure_i \times Year_k) + \beta' X_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

Where k the indexes years relative to the reference year 2014. The pre treatment coefficients ($k < 2014$) test whether high and low exposure firms exhibited differential trends before the minimum wage increases.

Figure iii plots the event study coefficients and shows clearly that there is a violation of the parallel trends assumption. In the pre treatment period (2011-2013), the coefficients are negative and statistically significant, when they should not be statistically different from zero to allow us to perorm causal inference. The fact that the coefficients are negative means that before

2014, the treated and control firms had divergent financing trends. High exposure firms showed lower increases in leverage than control firms.

Figure iii Parallel Trends Analysis for simple DiD



Note: This figure plots the estimated coefficients from an event study specification. The dependent variable is Total Leverage (Total Liabilities / Total Assets). The plot shows the coefficients on the interaction terms ($Treated \times Year_i$), each being the difference in leverage relative to the base year of 2014. The regression includes Firm Fixed Effects, Year Fixed Effects, and the control variables as before. The vertical bars indicate 95% confidence intervals.

The plot reveals a two phase response following 2014. Initially (2015 to 2019), treated firms exhibit a decline in leverage relative to the control group, with coefficients remaining negative but gradually approaching zero. This suggests a potential convergence in leverage. However, this trend sharply reverses in 2020, with coefficients becoming positive and statistically significant in 2021 and 2022. It is worth noting that this trend coincides with the COVID-19 pandemic and subsequent support programs from the Portuguese government, which may have differentially affected labor intensive firms.

The dynamic regression shows that the positive coefficient reported in Table 5 cannot be entirely explained by an increase in leverage of high exposure firms after the minimum wage increase. While this is true, after 2020, this positive coefficient can also be partially explained by the pre trends identified in this analysis. Treated and control firms seem to have already been on a divergent trend before being treated. This means that we are not able to perform causal inference and consider that the minimum wage increase led to an increase in leverage.

I have also performed a robusteness exercise where, instead of an interaction between two dummies (Post and Treatment), I used the interaction between a dummy and a continuous variable of Minimum Wage Exposure (Post and Exposure). The results are in line with the interaction before and are presented below in the table. In summary, my results say that the higher the exposure to the minimum wage workers in 2014, the higher the post leverage.

Table 6 Robustness Check: Continuous Treatment (with Full Sample)

	Leverage
did_continuous	0.010***
	(0.002)
tangibility	0.128***
	(0.002)
profitability	-0.360***
	(0.002)
log_assets	3.142***
	(0.086)
sales_growth	0.033***
	(0.000)
Firm Fixed Effects	Yes
Year Fixed Effects	Yes
Observations	1726026
R squared	0.141

Note: This table presents the results of a regression using a continuous measure of minimum wage exposure instead of a dummy, for robusteness porpuses. The independent variable here is the interaction between the Post dummy (equal to one for the years 2015-2022) and firms' minimum wage exposure in 2014. This specification tests whether the impact on leverage is proportional to the intensity of the treatment. *** p<0.01, ** p<0.05, * p<0.10.

Leverage Decomposition

To understand not only the overall change in leverage but also how firms adjust the *composition* of their liabilities, I run this specification using four different proxies: (i) total leverage, (ii) financial leverage, (iii) operating leverage, and (iv) short term financial leverage. Table 7 presents the results.

Table 7 Leverage Coefficients

	(1) Total Lev.	(2) Financial Lev.	(3) Operating Lev.	(4) Short term Lev.
did	0.714***	1.064***	0.002	0.447***
	(0.195)	(0.156)	(0.002)	(0.076)
tangibility	0.126***	0.196***	-0.001***	0.018***
	(0.002)	(0.002)	(0.000)	(0.001)
profitability	-0.310***	-0.159***	-0.002***	-0.036***
	(0.002)	(0.001)	(0.000)	(0.001)
log_assets	3.246***	6.022***	-0.006***	1.466***
	(0.069)	(0.055)	(0.001)	(0.026)
sales_growth	0.016***	-0.001***	0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	1726026	1726026	1726026	1726026
R^2	0.136	0.097	0.054	0.011

Notes: This table presents the difference in differences (DiD) estimates for the four leverage proxies. Column (1) uses Total Leverage, defined as total liabilities divided by total assets. Column (2) uses Financial Leverage, defined as debt obtained from financial institutions divided by total assets. Column (3) uses Operating Leverage, calculated as current liabilities minus short term financial debt, divided by total assets, and captures non financial liabilities such as trade credit. Column (4) uses Short term Financial Leverage, defined as short term debt divided by total assets. All include Firm Fixed Effects, Year Fixed Effects, and controls as before. The coefficient of interest is DiD, the interaction term between the high exposure dummy and the post 2015 period dummy. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

The first specification we have already seen before: the DiD coefficient for total leverage shows that high exposure firms increased their leverage relatively to low exposed firms.

Interestingly, financial leverage increases by 1.064 ($p<0.01$), contrary to what Simintzi (2015) found, where financial leverage decreased as a result of more employee protection[4].

It seems that the relative increase in leverage comes from financial debt and short term debt. The control variables behave as expected. Tangibility increases leverage because fixed assets serve as collateral. Larger firms have more leverage because they have better access to credit. Sales growth is positively correlated with total leverage but negatively correlated with financial leverage.

[4] Such as an increase in the minimum wage.

4.2 Propensity Score Matching (PSM)

Propensity Score Matching (PSM) is more effective at making fairer comparisons between firms because it pairs companies that are similar in terms of size, profitability, assets, and growth, which are factors that can influence both wages and debt decisions. This helps ensure that any differences in leverage after treatment are not just due to those firms being different to begin with.

There are several steps for a PSM. First, I use a logistic regression where the dependent variable is the probability of a firm being "high exposure", dependent on tangibility, profitability, size, and sales growth. To avoid endogeneity, I calculate scores using firm characteristics measured only in 2014, to avoid any response bias.

$$P(\text{HighExposure}_i = 1) = \frac{1}{1 + e^{-(\alpha + \beta_1 \text{Size}_i + \beta_2 \text{Profitability}_i + \beta_3 \text{Tangibility}_i + \beta_4 \text{SalesGrowth}_i)}}$$

Based on the scores, I match each treated firm with its three nearest neighbors in the control group, using a caliper of 0.05 for best matching quality. I discard firms not matched.

Before matching, treated firms (high exposure) differed greatly from the control group across several metrics. In particular, they were substantially smaller and less profitable. These differences are confirmed by large biases and statistically significant differences in the mean in the unmatched sample, as shown in Table 3.

After matching, the standardized bias for all covariates falls to approximately 1% or even less, representing reductions of 45% to 100%, with the largest improvements observed for profitability and firm size. Moreover, the post matching t tests show no statistically significant differences between treated and control groups. Overall, the matching procedure effectively created a sample in which treated and control firms are statistically comparable along all observed dimensions. The matched and unmatched groups' statistics are presented below:

Table 8 Post and Pre PSM Sample Statistics

Variable	Sample	Treated Mean	Control Mean	% Bias	% Reduction	p-value
Tangibility	Unmatched	23.61	23.13	1.9		0.035
	Matched	23.61	23.87	-1.1	44.8	0.407
Profitability	Unmatched	2.03	3.38	-8.9		0
	Matched	2.03	2.14	-0.8	91.6	0.596
Log Assets	Unmatched	11.54	12.72	-85.7		0
	Matched	11.54	11.54	-0.1	99.9	0.939
Sales Growth	Unmatched	28.5	22.75	5.7		0
	Matched	28.5	29.58	-1.1	81.3	0.432

Table 9 presents the DiD estimates using the matched. The DiD coefficient for total leverage remains positive and statistically significant, though somewhat smaller in magnitude than the baseline estimate (0.714). Even after matching, high exposure firms still demonstrate higher leverage in the post treatment period.

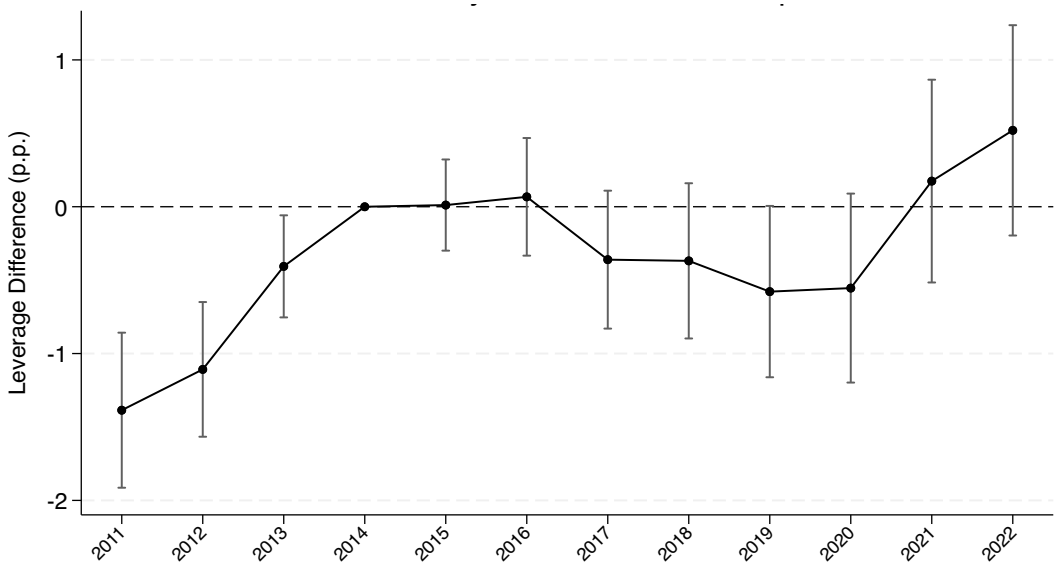
Table 9 DiD Results after PSM

	(1) Total Lev.	(2) Financial Lev.	(3) Operating Lev.	(4) Short term Lev.
did	0.470**	0.447**	0.000	0.102
	(0.219)	(0.176)	(0.002)	(0.085)
tangibility	0.160***	0.197***	-0.000***	0.022***
	(0.004)	(0.004)	(0.000)	(0.002)
profitability	-0.307***	-0.137***	-0.002***	-0.025***
	(0.004)	(0.003)	(0.000)	(0.001)
log_assets	3.123***	6.111***	-0.011***	1.139***
	(0.156)	(0.121)	(0.002)	(0.053)
sales_growth	0.021***	-0.001**	0.000***	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	348156	348156	348156	348156
R^2	0.129	0.096	0.049	0.009

Note: This table reports the Difference in Differences estimation results using the Propensity Score Matched (PSM) sample (N=348 156). The dependent variable is Total Leverage (Total Liabilities divided by Total Assets). The sample was constructed using a 1 to 3 nearest neighbour matching with a caliper of 0.05. The propensity scores were estimated using a logit model based on 2014 firm characteristics: Size (Log Assets), Profitability (ROA), Tangibility, and Sales Growth. The coefficient of interest is the DiD, which represents the interaction between the high exposure dummy and the post 2015 period dummy. All specifications include Firm Fixed Effects, Year Fixed Effects, and the full set of time varying firm controls. Standard errors are clustered at the firm level and presented in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

The findings from the matched sample reinforce the results from the baseline model. Interestingly, it shows another result: the differences between the groups come primarily from the pre period 2011 to 2014. In fact, after treatment, there is no significant change in relative leverage between the groups, suggesting they behave somewhat similarly.

Figure iv Parallel Trends Analysis for PSM DiD



Note: The figure shows the event study coefficients using the propensity score matched sample with the vertical line plotting the 95% confidence intervals for each coefficient.

Once again, it shows that the difference in leverage between the groups comes, in fact, from the pre period, where there was clearly a reduction in leverage for low exposed firms. The behavior between the groups is not statistically after the treatment. This is a very interesting discovery as it suggests that both high and low exposure firms were already on different routes before the minimum wage started to increase in 2015. Low exposure firms appear to have been

deleveraging more during the 2011 to 2014 period, possibly as a response to the economic conditions under the Troika program.

4.3 Heterogeneity Analysis

Do firms exhibit different labor cost shock responses based on their pre existing financial condition? Specifically, are unprofitable firms more vulnerable to a labor cost shock? Alexandre et al. (2022) find that minimum wage increases had more pronounced negative effects on financially distressed Portuguese firms. Similarly, Ellul and Pagano (2019) show that for financially distressed firms, stronger worker protection reduces creditor willingness to lend, while firms not in distress may actually borrow more strategically.

To test this hypothesis, I conduct a heterogeneity analysis by splitting the sample based on firm profitability (measured as Return on Assets) in the base year 2014.

The descriptive statistics are presented in Table 10 below:

Table 10 Descriptive Statistics by Firm Profitability (2014)

	Profitable Firms		Unprofitable Firms		Difference
	mean	*sd*	*mean*	*sd*	
leverage	51.22	26.83	54.42	27.66	-3.20***
financial_leverage	15.18	19.60	16.34	21.33	-1.16***
operating_leverage	0.33	0.25	0.35	0.26	-0.01***
tangibility	23.41	24.06	25.95	26.51	-2.54***
log_assets	12.04	1.19	11.78	1.19	0.26***
sales_growth	14.13	67.90	11.21	73.02	2.92***
Observations	283092		95071		378163

The model is estimated using the following regression:

$$Leverage_{it} = \beta_1(HighExposure_i \times Post_t) + \beta' X_{i_t} + \alpha_i + \gamma_t + \varepsilon_{i_t}$$

Where all variables are defined as before. The key difference is that the model is estimated separately for unprofitable and profitable firms. The coefficient of interest, β_1, captures the differential leverage response to minimum wage exposure within each group.

The results, grouped by groups of firms, are in Table 11:

Table 11 Leverage Response by Firm Profitability

	(1) Profitable Firms	(2) Unprofitable Firms
did	0.126	1.574***
	(0.246)	(0.458)
tangibility	0.192***	0.193***
	(0.005)	(0.010)
log_assets	3.571***	1.174***
	(0.181)	(0.336)
sales_growth	0.013***	0.005***
	(0.001)	(0.001)
Observations	261799	86357

The results show clear differences between the two groups. For profitable firms, the effect is economically small and statistically insignificant. For unprofitable firms, however, the effect is statistically significant and indicates that unprofitable firms increased relative leverage after the minimum wage increases. To assess if there are still pre trends within these groups, I also performed the parallel trends analysis for both groups.

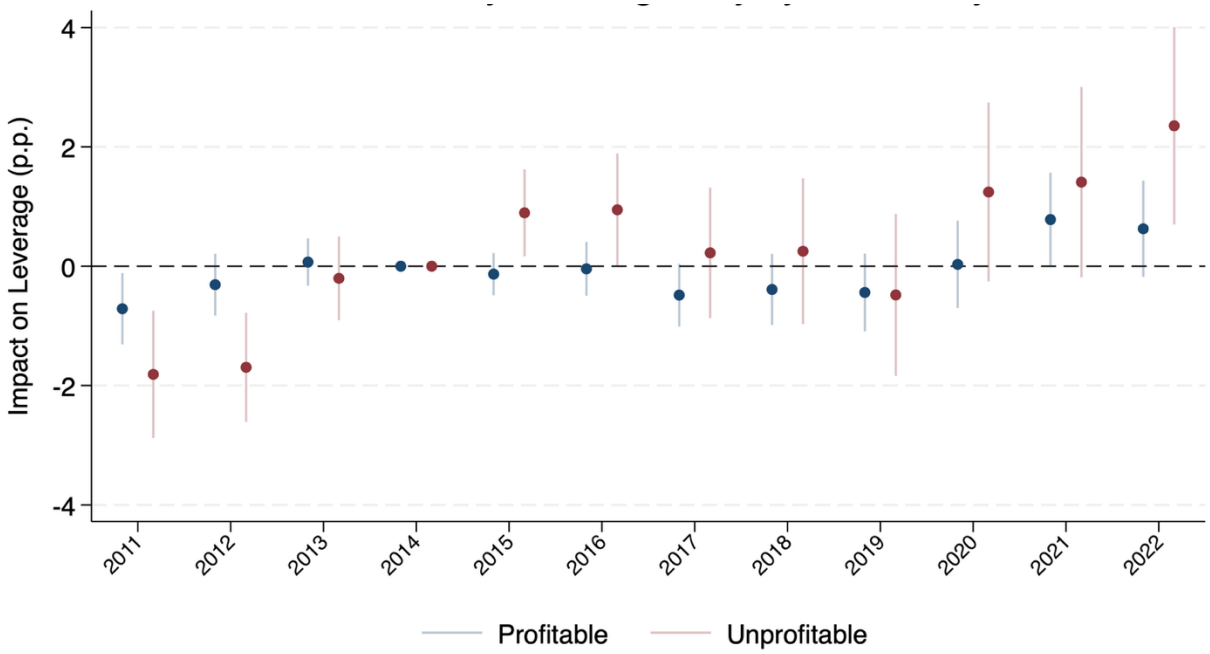
Similarly to before, Figure v presents event-study estimates of the leverage response for profitable and unprofitable firms by year. Here, there are several differences to note.

For profitable firms, the pre treatment period shows relatively small deviations from zero, yet not fully. More importantly, after 2015, these firms show minimal and statistically insignificant changes in leverage.

In contrast, unprofitable firms show a different behavior. The pre treatment period shows larger deviations from zero, which tells us that these firms were already on a different trajectory and deleveraging. However, in the post period, they fall behind and increase their relative leverage compared to the control group. By 2021, 2022, unprofitable firms highly exposed to minimum wage increases have approximately 2 percentage points more leverage than their unexposed counterparts.

In other words, the divergence in leverage between high and low exposure firms is mainly observed among firms that were unprofitable in 2014. Profitable firms appear able to absorb higher labor costs.

Figure v Parallel Trends Analysis for Heterogeneous Groups



Unfortunately, the inexistence of parallel trends in the pre period means we cannot claim these results are causal. Nonetheless, the correlation is clear and economically sound: firms that were unprofitable in 2014 and highly exposed to the minimum wage showed persistent increases in leverage over the following years.

Robustness Tests

I conduct two robustness tests to validate the heterogeneity results and ensure they were not driven by an effect on measurement. First, I replace the definition of profitable as ROA in 2014 with the average ROA over 2012 to 2014 to reduce the possibility of a bad year influencing the result of a good firm. In this specification, the DiD coefficient for firms in the unprofitable group remains positive and statistically significant (coefficient of 1.914).

Table 12 Leverage by average profitability (2012–2014)

	(1) ROA + (Avg 2012-2014)	(2) ROA - (Avg 2012-2014)
did=1	-0.098	1.914***
	(0.252)	(0.419)
N	2.44e+05	1.05e+05
R^2	0.125	0.047

I have also sorted firms into ROA terciles and re-estimate the model separately for each group using the PSM sample. The relative increase in leverage is concentrated in the first tercile (coefficient 1.246), which is also the lowest profitable one. The medium and high profitability firms show no statistically significant response.

Table 13 Tercile ROA Decomposition with PSM sample

	(1) Low ROA	(2) Medium ROA	(3) High ROA
did=1	1.246***	0.095	0.451
	(0.401)	(0.346)	(0.378)
N	1.07e+05	1.24e+05	1.17e+05
R^2	0.045	0.102	0.160

5. Discussion

This thesis aimed to examine how Portuguese firms adjusted their leverage in response to repeated minimum wage increases between 2015 and 2022. While the data does not support causality, given the violation of the parallel trends assumption, this section focuses on correlations between the two variables.

Although the baseline DiD results showed a significant change in total leverage, the treated and control firms do not follow parallel trends before the minimum wage increase. Propensity Score Matching was used to improve comparability, but even after matching, the two groups are still very different. For this reason, all results should be interpreted as descriptive rather than causal.

However, this persistent difference is in itself an important finding. It indicates that firms heavily reliant on minimum wage labor are structurally different from the rest, being typically smaller and less capitalized.

When decomposing leverage into its financial and operating components, the results do not support the idea that firms shifted from bank loans to trade credit. Instead, the positive and significant coefficients for financial leverage suggest that highly exposed firms relied relatively

more on bank financing than the control group, while operating leverage remained statistically unchanged. The PSM results reinforced this idea.

This finding contrasts with the risk substitution hypothesis explained earlier, which predicts that firms should reduce financial debt to offset higher operating risk from rigid wages. Instead, the reliance on bank debt implies that Portuguese SMEs lacked the internal funds to absorb the wage shock. Consequently, they were forced to turn to external financing. This, in part, means firms align better with the pecking order theory.

Interestingly, it was firms that were unprofitable in 2014 that had the most significant results and showed a persistent relative increase in leverage for firms exposed to the minimum wage compared to the control group.

This behavior aligns with the hypothesis of distress borrowing. While profitable firms could absorb the wage shock through internal cash flows, unprofitable firms appear to have accumulated debt to survive.

6. Conclusion and Future Research

My master's thesis investigated how Portuguese firms adjusted their capital structure in response to the significant and persistent increases in the national minimum wage (NMW) between 2015 and 2022. In an economy where SMEs are the most common firm type and where the labor market is rigid, I studied whether firms responded to this labor cost shock by reducing leverage to reduce business risk or by increasing leverage to finance the higher wage bill.

The results show that firms with higher exposure to the minimum wage exhibited higher leverage ratios relative to the control group. Contrary to the hypothesis that firms could have substituted bank debt for trade credit, the increase in leverage was primarily driven by financial debt obtained from credit institutions (relative to the control group).

When splitting the sample by profitability, the results show that profitable firms did not significantly alter their capital structure in response to minimum wage hikes, but rather it was firms that were unprofitable in the base year (2014) that showed a statistically significant and persistent increase in leverage.

There are, of course, some limitations to my analysis. Firstly, the obvious violation in parallel trends in the pre treatment period does not allow me to claim any type of causal relation between the variables. Thus, I can only document correlations. A second limitation is that I do not account for firms that exit (because they went bankrupt, for example). In other words, I am

subject to survivorship bias, which could underestimate the true impact of the minimum wage shocks.

Even without causality, there are specific policy implications to be taken from my study. Unprofitable firms are a very significant part of firms and normally bear the costs of measures that increase expenditure, ultimately taking on more leverage and possibly exiting the market.

For future researchers, there is some room to grow. The event study graphs (Figure iii and Figure v) show a sharp increase in leverage coefficients starting in 2020, which coincides with COVID-19 pandemic and the subsequent government support measures. Thus, future studies could aim to explore the effect on firms' capital structure during this period as a result of these measures, particularly because labor intensive sectors (such as hospitality and retail) were simultaneously highly exposed to the minimum wage and severely hit by lockdowns. Moreover, it would be interesting to understand if firms leave the market because of Minimum Wage hikes

To conclude, while raising the minimum wage is important for reducing inequality, policymakers must also understand how firms pay for it. The evidence suggests that struggling SMEs, unable to easily cut staff, are funding these higher wages by taking on more debt relative to low exposed firms.

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