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Minimum wage and financially distressed firms: another one bites the dust [*]

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Abstract

Since late 2014, Portuguese Governments adopted ambitious minimum wage policies. Using linked employer-employee data, we provide an econometric evaluation of the impact of those policies. Our estimates suggest that minimum wage increases reduced employment growth and profitability, in particular for financially distressed firms. We also conclude that minimum wage increases had a positive impact on firms' exit, again amplified for financially distressed firms. According to these results, minimum wage policies may have had a supply side effect by accelerating the exit of low profitability and low productivity firms and, thus, contributing to improve aggregate productivity through a cleansing effect.

JEL Classification: E24, J38, L25

Keywords: minimum wage, financially distressed firms, productivity

Note: This article is sole responsibility of the authors and do not necessarily reflect the positions of GEE or the Portuguese Ministry of Economy.

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1. Introduction

This paper assesses the impact on firms of minimum wage policies in Portugal, since the end of the Financial Assistance Programme in 2014. The goal of those measures was to reduce poverty and income inequality. The strong increase in the share of workers earning the minimum wage - from 13.2% in 2014 to 25.7% in 2017 - raised concerns about the impact of its increase on firms' activity and financial condition. Business associations — especially in the traditional sectors, such as apparel and textiles — were vocal about the potential negative consequences of these increases, given that Portugal had been through a severe debt and banking crisis, that left many firms financially vulnerable and constrained in their ability to adjust to the increase in wage costs. After the initial controversy, the discussion on this topic faded away because it occurred in the context of a strong rise in employment and a sharp reduction in unemployment, as the economy rebounded from the crisis. To the best of our knowledge, there is no evaluation of the impact of those minimum wage increases. The estimates presented in this paper support business associations' concerns, suggesting that minimum wage increases reduced employment growth and profits, and accelerated the exit of financially distressed firms.

The costs of 'social policies' implemented through minimum wage increases are, at least partially, borne by firms. The share borne by a specific firm depends on several factors. First, the impact on firms' total costs depends on the share of workers affected by the new minimum wage. Second, it will depend on the firms' ability to absorb the wage cost shock by adjusting its profit margin and/or to pass the cost increase to consumers. Finally, the impact of minimum wage policies will depend on firms' flexibility to change their capital-to-labor ratio. If firms are unable to fully offset the impact of the minimum wage increase, their financial condition will worsen. In more extreme cases, namely when firms are financially distressed, the minimum wage increase may lead to the death of the firm.

A very recent strand of the literature has been focusing on the impact of minimum wage increases on the financial condition of firms. Examples include Draca et al. (2011), for the introduction of a minimum wage in the United Kingdom in 1999; Harasztosi and Lindner (2019) for a large increase in the Hungarian minimum wage in 1997-2004; Chava et al. (2019) for 14 states of the USA, with a focus on the credit score of small firms; and Drucker et al. (2019) for Israel in 2003-2010. All these papers present evidence of a negative impact of minimum wage increases on firms' profitability.

The empirical literature on the impact of minimum wage increases on firm exit is also relatively recent. Draca et al. (2011) presents industry-level evidence of the impact of the introduction of a minimum wage in the UK and concludes that the probability of exit increased 1.5 percentage points. Mayneris et al. (2018) detects evidence of a 'cleansing' effect of the large increases in the minimum wage in 2004 in China, i.e., less productive firms were more likely to be exposed to the minimum wage increase and were also more likely to exit. Chava et al. (2019) relate increases in the minimum wage to lower credit scores and consequent higher exit rates of small businesses in the USA.

Aaronson et al. (2018) and Luca and Luca (2019) focus on restaurants; both conclude that minimum wage rises increase the probability of exit.

In this paper, we analyze the impact of minimum wage increases on firms' profitability and on firms' survival in Portugal since 2014. The relation between firms' financial conditions and minimum wage increases is especially relevant in the Portuguese economy because a significant share of the firms are highly indebted, and have very low profitability and liquidity. In our econometric analysis we allow for the possibility that the minimum wage increase has a more acute effect on financially distressed firms. Our results warrant this hypothesis. According to the estimates reported in this paper, following minimum wage increases, the fall in profits and the increase in the probability of exit are larger in the case of financially distressed firms. Likewise, minimum wage increases lead to lower employment growth, with a magnified effect for financially distressed firms.

The remainder of this paper is structured as follows. Section 2 describes the main facts concerning the evolution and incidence of minimum wage and financially distressed firms in the Portuguese economy. Section 3 presents the dataset, empirical strategy and results. Section 4 concludes.

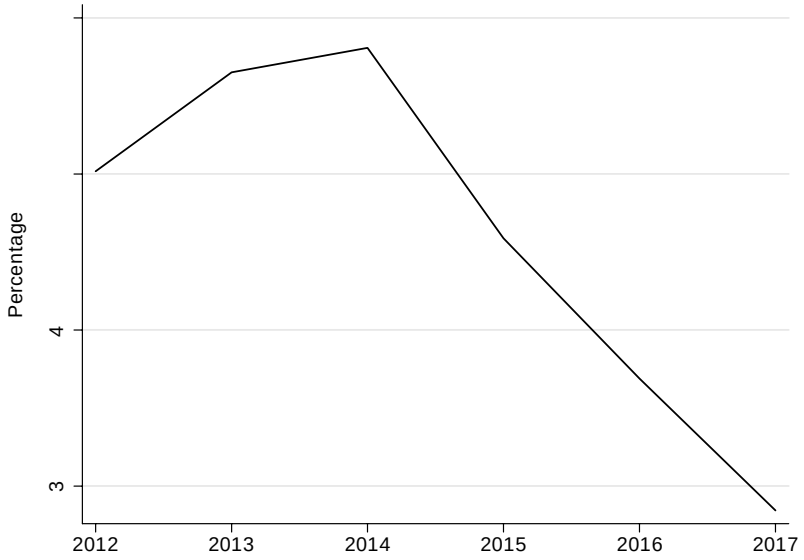
2. Minimum wage and financially distressed firms in the Portuguese economy

Starting in late 2014, Portuguese Governments adopted an ambitious policy of minimum wage increases. This policy put an end to a long period when the nominal minimum wage was frozen. Between 2008 and 2013, the Portuguese economy went through a severe crisis: GDP decreased by 8%; employment decreased 13% and unemployment increased from 7.7% to 16.4%. Between May 2011 and May 2014, following the bailout by the International Monetary Fund, the European Commission and the European Central Bank, also known as troika, Portugal implemented an Economic and Financial Assistance Program.

The Portuguese crisis was both a debt and a banking crisis. According to data from the Bank of Portugal, total debt of non-financial firms, relative to GDP, reached a maximum of 152% in 2012, one of the highest in the world. Besides being highly leveraged, there was a large fraction of unprofitable firms. In 2013, 34% of the firms had a negative EBITDA (Earnings Before Interest, Taxes, Depreciations and Amortizations) and the average EBITDA across all firms in the economy was -15.5 (data from SCIE, INE; see subsection 3.1 for further details on the data used in this paper). A high share of firms, accounting for a high share of employment, value added and debt, were financially distressed — see Gouveia et al. (2018).

In our analysis, following the OECD approach — see, for example, McGowan et al. (2017) and Gouveia et al. (2018) — we define as financially distressed the firms that report an Interest Coverage Ratio (ICR) — given by the ratio of EBITDA to interest expenses — lower than one over three consecutive years. EBITDA measures the financial performance of the firm and interest expenses gives the costs due to borrowing. As start-ups are not expected to be profitable, in our definition of financially distressed firms we only consider firms that already existed in 2010. Figure 1 shows the share of financially distressed firms in the Portuguese economy, in the period 2012–2017. This share reached a peak of 5.8% in 2014. In 2013, financially distressed firms represented 5% of total employment, 1.3% of total gross value added, 11.5% of total debt and 14% of total interest expenses.

Figure 1: Share of financially distressed firms



Source: Authors' computations using data from SCIE.

The fragile condition of financially distressed firms raised concerns about the effects of minimum wage policies. Minimum wage increases may induce a further deterioration of the financial condition of those firms, which may lead them to reduce employment and even to close down. Business leaders publicly expressed their concerns on the effects of wage cost increases, namely in sectors where there is a high minimum wage incidence and labor costs weigh heavily in total costs.

Between 2014 and 2017, the minimum wage increased 14.8%. In October 2014, the minimum wage increased from 485 to 505 euros, a 4% change. Notwithstanding being a small increase, the percentage of workers receiving minimum wage jumped from 13.2% to 19.6%.[1] In 2016, the Government announced that the minimum wage should reach 600 euros in 2019. In 2016 it increased to 530 euros; in 2017 to 557; in 2018 to 580; and in 2019 to 600 euros. During this period, the share of workers receiving the minimum wage reached a maximum of 25.7% in 2017. However, the debate about the negative impact of minimum wage policies abated because they coincided with the recovery of the Portuguese economy. Between 2013 and 2018, real GDP increased by 11% and the unemployment rate decreased from 16.2% to 7%. This expansion resulted in a 10% increase in employment, corresponding to 437 thousand jobs — for a description of the Portuguese crisis and recovery see, for example, Alexandre et al. (2019) and Blanchard and Portugal (2017).

[1] The numbers mentioned in this part of the text come from a report on the minimum wage in Portugal published by the Portuguese Ministry of Labor—see Ministério do Trabalho, Solidariedade e Segurança Social (2019).

The costs of minimum wage policies aimed at reducing income inequalities and poverty are, at least partially, borne by firms. However, firms are affected asymmetrically by minimum wage increases. In the short run, the impact on firms' total costs depends on their ability to pass the wage cost increase to consumers, and on the share of workers earning the minimum wage. Since 2016, the share of workers affected by minimum wage policies surpassed 30% in several industries. For example, in 'Manufacturing' it reached a maximum of 31.6% in 2016; in 'Construction' it reached 32% in 2017; in 'Accommodation and food service activities' the share was always above 30%, reaching a maximum of 42.4% in 2017.

In this paper, we measure the impact of the minimum wage increase in total costs through a novel measure, which we call the 'potential relative cost increase', henceforth PRCI. PRCI measures the potential impact of the minimum wage increase on firms' costs. The PRCI builds on other measures in the minimum wage literature. Card and Krueger (1994), in a study of the impact of minimum wage increases on fast-food restaurants, use a 'gap' variable defined as the proportional increase in the starting wage necessary to raise it to the new minimum wage. In Machin et al. (2003) and Draca et al. (2011), the intensity of the treatment is given by the relative change in wage costs needed to comply with the new minimum wage. Harasztosi and Lindner (2019) and Drucker et al. (2019) employ a simpler measure to evaluate the impact of changes in the minimum wage: the fraction of workers who earn below the new minimum wage.

In our analysis, the intensity of the treatment of minimum wage policies is measured through the PRCI as defined in equation 1:

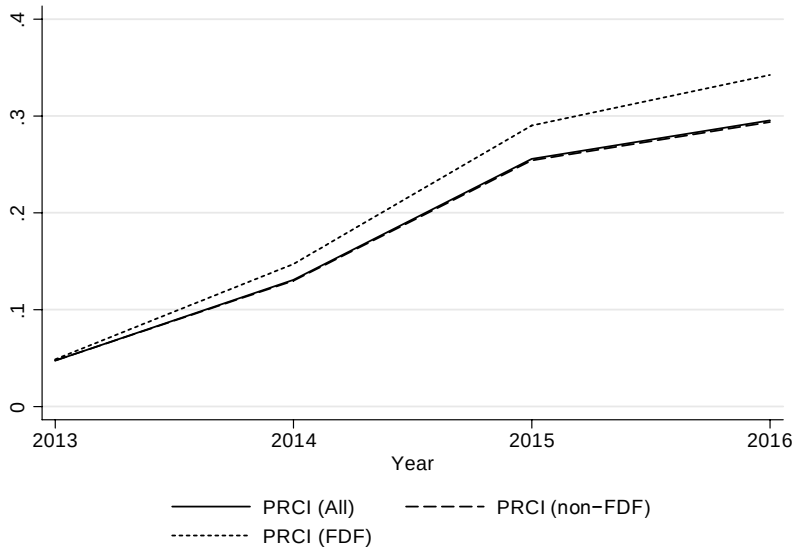
$$PRCI_{it} = \frac{Potencial\ wage\ bill_{i,t+1} - Current\ wage\ bill_{it}}{Total\ costs_{it}} \times 100 \quad (1)$$

This equation tells that the 'potential relative cost increase' associated with a minimum wage rise is the relative change in total costs that the firm would face in year *t* if the firm had to pay in year *t* the year *t* + 1 minimum wage, while maintaining the same productive structure, namely, not adjusting the composition, nor the size, of its labor force in view of the minimum wage increase. By computing the 'potential relative cost increase' we take into consideration the fact that the importance of labor costs varies across industries and firms.

To control for absenteeism and part time jobs, in our computations of the PRCI we use the hourly minimum wage. In 2014, the minimum wage increased in October, affecting only the last quarter of the year. The next increase occurred in January 2016. Consequently, we split the 2014 increase (from 485 euro to 505 euro) between 2014 (one quarter of the increase) and 2015 (the other three quarters). This amounts to assuming that the minimum wage rose from 485 to 490 in 2014, and from 490 to 505 in 2015.

Figure 2 shows the evolution of the average PRCI for the period 2013-2016. We present data for all firms, PRCI (All), for non-financially distressed firms, PRCI (non-FDF) and for financially distressed firms, PRCI (FDF).

Figure 2: Average PRCI



Source: Authors' computations using data from QP.

The average value of the PRCI increased significantly (more than sixfold) over time. The increase in the average PRCI reflects the fact that minimum wage rises resulted in a higher share of workers earning the minimum wage, implying cumulative effects in the value of the PRCI. We should also stress the difference between financially distressed firms and non-financially distressed firms. In 2013, the average value of the PRCI was similar for both groups of firms. However, in the following years, the PRCI for financially distressed firms show a faster increase, raising from 0.05 to 0.34 in 2016 (a 604% increase against 519% in the case of non-financially distressed firms). The evolution of the PRCI suggests that minimum wage increases might have a stronger impact in financially distressed firms, simply because they are more exposed to the minimum wage. However, in this paper, we also test the hypothesis that financially distressed firms are more vulnerable to minimum wage increases in terms of profitability and employment growth, in the sense that the impact of a minimum wage increase is more damaging for a financially distressed firm than for an otherwise identical firm that is not financially distressed. Likewise, we test the hypothesis that minimum wage increases have a stronger impact on the exit of financially distressed firms.

Previous studies on the impact of minimum wage policies in the Portuguese economy focused on the effects on employment. The results of those studies were ambiguous. Pereira (2003) analyses the impact of the 1987 minimum wage increase on teenagers' employment and concludes that it reduced the employment of 18 and 19 years old and that it increased employment of 20-25 years old. Portugal and Cardoso (2006) also studied the impact of the 1987 minimum wage increase. They find that it lowered the proportion of teenagers hired by firms, but also lowered the proportion of teenagers in job separations. Portugal and Cardoso (2006) conclude that the net impact on teenager employment was positive. Another study on the effect of minimum wage increases in Portugal, Centeno et al. (2014), focused on the period 2002-2010. This study estimated that a 1 percentage point (p.p.) increase in the minimum wage lowered employment of minimum-wage earners by 1.1 p.p. However, the impact is stronger for young workers and for workers in manufacturing.

The discussion of the impact of minimum wage policies in the Portuguese economy has left out its potential impact on the financial condition of firms. Nevertheless, as mentioned above, there is evidence for the UK (Draca et al., 2011), for the US (Chava et al., 2019) and for Israel (Drucker et al., 2019) that the minimum wage is a determinant of firms' profitability. Given the financial fragility of Portuguese firms and the significant and consecutive increases of the minimum wage in Portugal since 2014, this is an important issue that we also address in this paper, in addition to providing further evidence concerning the impacts on employment and exit.

3. Empirical analysis

3.1 Data

The data used in our econometric analysis comes from two main sources. The Integrated Business Accounts System (SCIE, 'Sistema de Contas Integradas das Empresas', INE, 2018b) from Statistics Portugal's Registry of Statistical Units. The SCIE database contains firm-level administrative data regarding the balance sheet and other yearly accounting information for the population of firms in the private sector, from 2006 until 2017. In 2017, the SCIE database had 394,967 firms. From SCIE we collected data for EBITDA, operating and total revenue, interest expenditure, value added, labor costs, total costs, leverage, debt, total assets and exports — see Table 1. We consider that a firm exits the market when its information ceases to appear in the SCIE database.

Table 1: Variable description and sources

Variable	Description	Source
Potential relative cost increase	$PRCI = \frac{Potencial\ wage\ bill_{t+1} - Current\ wage\ bill_t}{Total\ costs_t} \times 100$	QP and SCIE
Profitability	$Profit = \frac{EBITDA}{Operating\ revenue} \times 100$, winsorized at percentiles 1 and 99	SCIE
Interest coverage ratio	$ICR = \frac{EBITDA}{Interest\ expenses}$	SCIE
Employment growth	$Employment = \frac{Number\ of\ employees_{t+1} - Number\ of\ workers_t}{Number\ of\ employees_t} \times 100$	QP
Productivity	$Productivity = \frac{Value\ added}{Total\ hours\ worked} \times 100$ (Euro)	QP and SCIE
Part-time workers	$Part\text{-}time = \frac{Workers\ with\ a\ part-time\ contract}{Number\ of\ workers} \times 100$	QP
Fixed-term workers	$Fixed\text{-}term = \frac{Workers\ with\ a\ fixed-term\ contract}{Number\ of\ workers} \times 100$	QP
Overtime labor	$Overtime = \frac{Overtime\ hours}{Total\ hours\ worked} \times 100$	QP
Relative labor costs	$LaborCosts = \frac{Labor\ costs}{Total\ costs} \times 100$	SCIE
Exports weight	$Exports = \frac{Exports}{Total\ revenue} \times 100$	SCIE
Leverage ratio	$Leverage = \frac{Total\ liabilities}{Total\ assets} \times 100$	SCIE
Short-term debt	$DebtST = \frac{Short-term\ loans}{Total\ assets} \times 100$	SCIE
Long-term debt	$DebtLT = \frac{Long-term\ loans}{Total\ assets} \times 100$	SCIE

Notes: SCIE stands for "Sistema de Contas Integradas das Empresas" and QP for "Quadros de Pessoal". Total costs includes costs with employees, goods, external services, interest expenses and losses by firm/year. EBITDA stands for earnings before interest, taxes, depreciation and amortization. Potential and current wage bill are computed using data from QP. The variable total hours worked is from QP, while value added is available in SCIE.

The other database used in our analysis is a linked employer-employee dataset, the Personnel Records database (QP, 'Quadros de Pessoal', INE, 2018a) collected by the Portuguese Ministry of Labor, Solidarity and Social Security (MTSS) through a mandatory annual survey. The QP database provides data on all workers in all firms in

Portugal (excluding the public sector) with at least one wage earner, besides other firm-level information. In 2017, the QP database had 290,409 firms and 2,973,246 workers. From the QP database we use worker-level information on the number of employees, wage bill, hours of work and type of contract (part-time and fixed-term) — again see Table 1. The SCIE database is linked, through an anonymized firm identifier, to the QP data, resulting in a very rich database.

Table 2 shows aggregate statistics for the period of our empirical analysis (about 370 thousand observations corresponding to almost 100 thousand firms). Note that we only use data concerning mainland Portugal. Firms from the archipelagos of Madeira and Azores are excluded from our analysis because these regions have specific minimum wage rules.

Table 2: Summary statistics (2013 – 2016)

	Mean	SD	Min.	Max.
PRCI	0.18	0.43	0.00	130.37
FDF	0.05	0.22	0	1
Profit	-9.87	48.91	-227.89	230.61
Employment	-2.16	41.89	-100.00	5980.00
Exit	0.04	0.20	0	1
Productivity	17.46	450.25	-4594.66	248074.48
Part-time	5.65	16.28	0.00	100.00
Fixed-term	22.45	29.26	0.00	100.00
Overtime	0.28	1.75	0.00	83.82
LabourCosts	33.02	20.32	0.02	100.00
Exports	4.15	15.45	0.00	100.00
Leverage	107.01	1699.23	-277.41	810637.50
DebtST	0.08	1.95	0	713.66
DebtLT	0.27	9.23	0	5046.94
Number of workers	18.59	164.10	1	24682

Source: QP & SCIE. The number of observations is 368085. "SD" stands for standard deviation. "Min." stands for minimum. "Max." stands for maximum. See Table 1 for further information.

3.2 Econometric strategy

This paper aims at studying the impact on firms of minimum wage policies. We focus our analysis on profitability, employment growth and exit. In our analysis, we also aim at evaluating whether financially distressed firms are more vulnerable to minimum wage increases.

To test our hypothesis we estimate the following model:

$$\Delta Profit_{i,t+1} = \gamma_1 PRCI_{it} + \gamma_2 FDF_{it} + \gamma_3 PRCI_{it} FDF_{it} + \gamma_4' X_{it} + \eta_i + \in_{it} \quad (2)$$

The dependent variable in equation (2), $Prof\ it_{it+1}$, stands for firm's i profitability and is given by the change in the EBITDA to Operating Revenue ratio from period t to period $t + 1$. In the case that the firm exits the market in period $t + 1$, the change in the EBITDA ratio is set equal to the minimum value observed in the series. In equation (2), $PRCI_{it}$ is the exposure of firm i in year t to an increase of the minimum wage during year $t + 1$ (computed as detailed in the previous section). FDF_{it} is a dummy variable that equals 1 if firm i was classified as financially distressed in year t and equals 0 otherwise. X_{it} is a vector of control variables, which includes the variables exports, leverage, short term debt and long term debt as defined in Table 1. η_i represents firm i's unobserved heterogeneity. The key parameters of interest are those associated with our treatment variable, $PRCI_{it}$, i.e. γ_1 and γ_3. If $\gamma_1 < 0$, an increase in the minimum wage will be detrimental to profitability. This impact will be larger for financially distressed firms if $\gamma_3 < 0$.

One possible reaction of firms to a minimum wage increase, namely if they cannot pass the cost to consumers, is to reduce their demand for labor. For firms that are more dependent on low-wage labor, the increase in costs may trigger the closing down of the firm and the destruction of all jobs. Therefore, to assess the impact of minimum wage increases on employment, we estimate a model with the same specification as in equation (2), except for the dependent variable, which becomes the change in log-employment from t to $t+1$. For firms that exited in period $t+1$ we recorded a variation in employment equal to minus 100 per cent. The parameters of interest (γ_1 and γ_3) and their interpretation are the same as in the model for profitability.

To evaluate the impact of minimum wage increases on firm exit, we begin by estimating a logit model that accounts for firms' unobserved heterogeneity and in which the dependent variable is the probability that firm i will close down in period $t + 1$:

$$P\left(E_{i,t}+1 = 1|\theta_{it}\right) = \lambda(\theta_{it}) = \frac{\exp\left(\theta_{it}\right)}{1+\exp(\theta_{it})} \quad (3)$$

$$\theta_{it} = \beta_1 PRCI_{it} + \beta_2 FDF_{it} + \beta_3 PRCI_i FDF_{it} + \beta_4' X_{it} + \eta_i \quad (4)$$

In equation (3), $E_{i,t+1}$ is a dummy variable that equals 1 if firm i exited during year $t + 1$ and equals 0 otherwise. The other variables are the same as in equation (2).

Given the focus of the paper, the main parameters of interest are β_1 and β_3, with β_2 playing a lesser role. The parameter β_1 is the effect on the argument of the exit probability function, θ_{it}, of increasing wage costs (as a result of raising the minimum wage) in an amount equal to one per cent of total costs, all else equal. Since we use a logit model (equation 3), the impact of this increase for the probability of exit of the firm varies with the value of the other variables in the model. The parameter β_2 is the difference in the value of θ_{it} between a financially distressed firm that pays at least the new minimum wage to all workers ($PRCI_{it}$ = 0) and a non-financially distressed firm with the same characteristics. If firms pay some workers below the new minimum wage ($PRCI_{it} > 0$), the difference in θ_{it} for a financially distressed firm relative to a non-financially distressed firm with similar characteristics is $\beta_2 + \beta_3 PRCI_{it}$. We interpret $\beta_1 > 0$ as signifying that the minimum wage increase has an adverse impact on the survival of firms that pay the minimum wage to some of its workers. If $\beta_3 > 0$ then the impact of a minimum wage increase is magnified in the case of financially distressed firms. If the increase in the minimum wage raises firms' probability of exit ($\beta_1 > 0$ or $\beta_3 > 0$), then it will in effect be accelerating their exit. When $\beta_3 > 0$, the minimum wage increase may have a 'cleansing' effect, in the sense that it may contribute to driving out underperformers faster, as Mayneris et al. (2018) suggest was the case for firms in China.

The estimation of the conditional logit model uses the set of firms that change status in the sample, i.e. the firms that did exit the market in the period 2014–2017. An alternative approach is to use the linear probability model with fixed effects, which can be estimated using the data on all firms. This model may be written as:

$$E_{i,t+1} = \tilde{\beta}_1 \mathrm{PRCI}_{it} + \tilde{\beta}_2 \mathrm{FDF}_{it} + \tilde{\beta}_3 \mathrm{PRCI}_{it}\mathrm{FDF}_{it} + \tilde{\beta}_4' X_{it} + \tilde{\eta}_i + \tilde{\in}_{it} \quad (5)$$

The interpretation of the sign of the coefficients is the same as in the logit model. However, in the linear probability model the impact of a unit change in one regressor on the probability of exit is constant and equal to that regressor's coefficient. Differently, in the logit model the impact depends on the values taken by the other variables, i.e. the impact depends on the position on the curve. The results reported in the next subsection must be read accordingly.

Models akin to equation (5) are common in the literature. As in the case of equation (2), the main variation is in the definition of the treatment variable. In Mayneris et al. (2018) the treatment variables are dummy variables that identify firms with different degrees of exposure to the minimum wage. Although it distinguishes several categories of exposure to the minimum wage, this approach is essentially the same as the approach used by Draca et al. (2011), who consider low-wage firms to be the treated group. This dummy-variable approach is in contrast with, e.g., Aaronson et al. (2018). In Aaronson et al. (2018) — as in Luca and Luca (2019) — the treatment variable is the level of the minimum wage in each US state (where the restaurants that constitute their sample are located). Chava et al. (2019) interact the change in the US federal minimum wage with a dummy for those states where the minimum wage is binding and another dummy for firms that suffered a rating downgrade from 80 to 79 points. All these papers find that minimum wage rises lead to a higher probability of exit for the firms in the treated group.

Note that the models described above focus on the 'short-run' (from one year to the next) impact of variations in the minimum wage, and are silent about long-term effects. In addition, these models concern the impact on existing firms, not on potential entrants. These two features suggest that the actual impact of minimum wage changes may be larger than estimated by these models.

3.3 Results

The results from estimating models (2) (with the change in the EBITDA ratio and the change in employment as dependent variables), (3)-(4), and (5) (using both the sample of firms that exited during 2014-2017 and the full sample) are reported in Table 3. We report two sets of results, with and without control variables. The estimates are virtually unchanged by the inclusion of controls.

In columns (1) and (2) of Table 3 we report the estimates of coefficients γ_1 (coefficient on the PRCI), γ_2 (coefficient on the dummy variable for financial distress) and γ_3 (coefficient on the interaction of the two variables) of equation (2). The estimates of γ_1 and γ_3 are negative and statistically significant at the 1% significance level. In other words, the results indicate that minimum wage increases have a negative impact on profitability and that the effect is larger for financially distressed firms. In fact, since the estimated γ_3 (−16.3) is almost the double of γ_1 (−9.5), the effect of the minimum wage on profitability is almost three times more negative for financially distressed firms. Nevertheless, note that the estimated γ_2 is positive (15.0). This is related to the fact that those financially distressed firms that survive improve their EBITDA ratio more than non-financially distressed firms. Not doing so would probably have forced those financially distressed firms to exit.

To understand the meaning of the estimates of γ_1 and γ_3, note that the average of the variable that measures treatment ($PRCI_{it}$) is around 0.05 for both financially distressed and non-financially distressed firms in 2013 — recall Figure 2. Multiply this average by γ_1 and obtain −0.3. Therefore the model implies that, on average, the minimum wage increase in 2014 reduced the EBITDA ratio of a non-financially distressed firm by 0.3 percentage points. Next add to −0.3 the product of γ_3 and 0.05, obtaining −0.8. Now the conclusion is that, on average, the EBITDA ratio of a financially distressed firm fell 0.8 percentage points as a consequence of the minimum wage increase in 2014. Proceeding in the same way, the average estimated effect on profitability of increasing the minimum wage in 2015, 2016 and 2017 was −0.7, −1.3 and −1.6 percentage points, respectively, in the case of non-financially distressed firms, and −2.4, −4.8 and −5.6 percentage points in the case of financially distressed firms.

Table 3: Profitability, employment and exit

	Profit		Employment		Exit (Logit)		Exit (LPM - A)		Exit (LPM - B)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PRCI	-9.3802***	-9.4769***	-3.7410***	-5.3030***	4.2181***	4.1676***	0.5513***	0.5489***	0.0400***	0.0400***
	(0.240)	(0.239)	(0.241)	(0.242)	(0.108)	(0.106)	(0.012)	(0.012)	(0.001)	(0.001)
FDF	15.0175***	14.9387***	-2.0298***	-2.1600***	0.2577***	0.2783***	0.0590***	0.0642***	0.0024	0.0027
	(0.562)	(0.562)	(0.564)	(0.569)	(0.071)	(0.070)	(0.020)	(0.020)	(0.002)	(0.002)
PRCI × FDF	-16.2153***	-16.3066***	-9.8711***	-11.0962***	0.5415**	0.5893**	0.2048***	0.2050***	0.0787***	0.0792***
	(1.236)	(1.236)	(1.241)	(1.253)	(0.257)	(0.256)	(0.042)	(0.042)	(0.005)	(0.005)

Notes: Standard errors in parenthesis. Significance levels: *, 10%; **, 5%; ***, 1%. The dependent variables are identified in each set of columns. LPM stands for Linear Probability Model. The estimations reported in columns (1), (3), (5) and (7) include additionally the following control variables: weight of exports, share of employees without a fixed-term contract, share of part-time employees, share of extraordinary hours worked, share of costs with employees, the number of workers and its square, leverage ratio, valued-added per hour, short term loans over total assets and long term loans over total assets. Results under Exit (Logit) are estimated by conditional logit while the remaining models account for firm unobserved heterogeneity using the fixed effects estimator. The number of observations is 31185 for columns (5), (6), (7) and (8). The number of observations is 368085 for the remaining estimations. The model Exit (LPM - A) is estimated with the same sample as the model Exit (Logit) model. The model Exit (LPM-B) is estimated with the same sample as the Profit and Employment models.

Notice that we are looking at the average effect on profitability associated with the minimum wage increase, rather than to the marginal effect of increasing the minimum wage. There are two reasons for this choice of focus. First, the minimum wage is not an explanatory variable in our models. In our models, the explanatory variable, *PRCI*, measures the per cent variation in total cost that would occur if, in the current year, the firm adopted the next year's minimum wage (without making any other adjustment). The relation between this variable and the level of the minimum wage depends on the details of the firm's wage and cost structure. Second, given that in the period of our analysis (2013–2017) the Portuguese economy was still recovering from a severe crisis, one might question whether the economy was ready for a minimum wage raise, and what did the raise do to firms' financial condition. In other words, prior to the question of how much it should increase, there was the question of whether it should increase at all, which makes the no-increase case a natural reference point when assessing the impact.

Equation (2) was also estimated with the per cent change in employment as the dependent variable. The corresponding estimates are in columns (3) and (4) of Table 3. The estimates are statistically significant at the 1% significance level, and the estimated γ_1 and γ_3 are negative. Thus, minimum wage increases depress employment growth, especially in the case of financially distressed firms. In the case of employment growth, the average effect in 2014, 2015, 2016 and 2017 is, respectively, −0.2, −0.5, −1.0, and −1.1 percentage points for non-financially distressed firms, and −0.7, −2.0, −3.9 and −4.7 for financially distressed firms. These results, as well as those for profitability, show that the impact of the minimum wage increases rose over time. This is not unexpected, for one effect of each minimum wage increase has been to augment the concentration of workers on, or close to, the minimum wage level, and these workers are those that will be affected by the next minimum wage increase. In addition, note that γ_2 is now negative: financially distressed firms record lower employment growth than non-financially distressed firms with the same characteristics. This may be part of their strategy to improve performance.

The estimates in columns (5) and (6) of Table 3 — regarding parameters β_1, β_2 and β_3 of the logit model in equation (4) — indicate that an increase in the minimum wage does raise the probability that firms exit ($\beta_1 > 0$). As was the case for employment growth and the EBITDA ratio, the magnitude of the impact (in this case, on the argument of the probability of death function) of the minimum wage increase is larger for financially distressed firms ($\beta_3 > 0$). Assume that the firm has a zero fixed effect ($\eta_i = 0$) and ignore controls (as remarked above, the estimates do not change much). Under these conditions, for non-financially distressed firms ($FDF_{it} = 0$), the impact of a minimum wage increase on a firm's probability of exit is given by the difference between the probability of exit when there is a fraction of workers affected by the future minimum wage increase ($PRCI_{it} > 0$) and the probability of death when there is no minimum wage increase in the following year ($PRCI_{it} = 0$). Mathematically, this difference is given by

$$\Delta_{non}(PRCI_{it}) = \lambda(\beta_1 PRCI_{it}) - \lambda(0) \quad (6)$$

For financially distressed firms ($FDF_{it} = 1$), the impact of a minimum wage increase is

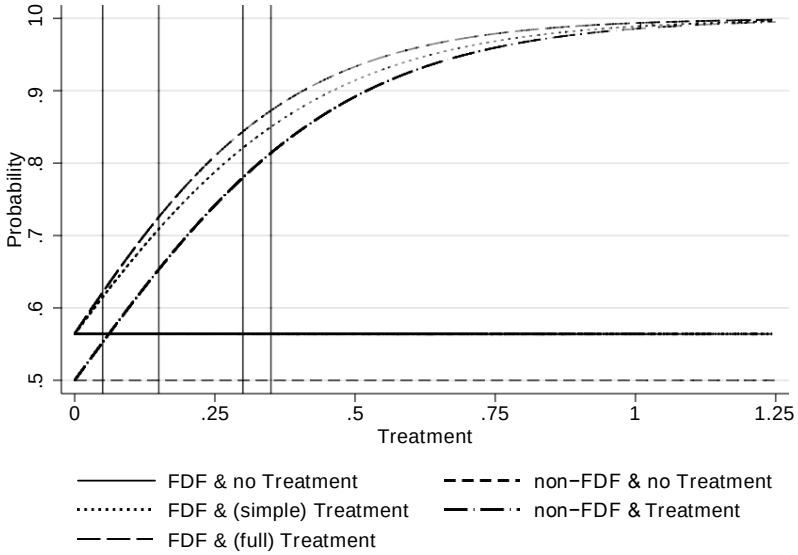
$$\Delta_{full}(PRCI_{it}) = \lambda[(\beta_1 + \beta_3)\, PRCI_{it} + \beta_2] - \lambda(\beta_2) \quad (7)$$

If we continue to take the logit model literally, the impact of the minimum wage increase may be represented by the diagram in Figure 3. In terms of Figure 3, $\lambda(0)$ corresponds to 'non-FDF & no Treatment', $\lambda(\beta_1 PRCI_{it})$ to 'non-FDF & Treatment', $\lambda(\beta_2)$ to 'FDF & no Treatment', and $\lambda[(\beta_1 + \beta_3)\, PRCI_{it} + \beta_2]$ to 'FDF & (full) Treatment'. In Figure 3 there is another curve, 'FDF & (simple) Treatment', which represents the function $\lambda(\beta_1 PRCI_{it} + \beta_2)$. This is the effect on a hypothetical financially distressed firm in the case when minimum wage increases impact financially and non-financially distressed firms in the same way, i.e. when $\beta_3 = 0$. For this hypothetical firm, the effect is

$$\Delta_{simple}(PRCI_{it}) = \lambda(\beta_1 PRCI_{it} + \beta_2) - \lambda(\beta_2) \quad (8)$$

Note that in Figure 3 the variable on the horizontal axis is the treatment variable ($PRCI$). Thus, the vertical difference between the 'non-FDF & Treatment' and the 'non-FDF & no Treatment' curves gives $\Delta_{non}(PRCI)$; $\Delta_{full}(PRCI)$ is the vertical difference between the 'FDF & (full) Treatment' and the 'FDF & no Treatment' curves; and $\Delta_{simple}(PRCI)$ is the vertical difference between the 'FDF & (simple) Treatment' and the 'FDF & no Treatment' curves. The vertical lines in Figure 3 identify the average $PRCI_{it}$ for financially distressed firms in each year in our sample (2013–2016), i.e., they correspond to 'PRCI (FDF)' in Figure 2. The average treatment for non- financially distressed firms in 2013 and 2014 is similar to that of financially distressed firms, in 2015 is 0.25 and in 2017 is 0.29, which is the average for financially distressed firms in 2015. Consequently, to avoid cluttering the plot, we did not draw additional lines to represent the average values for non-financially distressed firms in Figure 3.

Figure 3: Minimum wage PRCI treatment effects



Source: Authors' computations using data from SCIE and QP.

Thus, on average, the minimum wage increase in 2014 (treatment in 2013) led to the probability of exit rising five percentage points — see Table 4. The estimated average impact rises over time to about 30 percentage points in 2017. The variations for financially distressed firms are a bit higher than for non-financially distressed firms, namely in later years. It is also visible in Figure 3 that the additional impact on financially distressed firms ($\beta_3 > 0$) led to the probability of exit rising by a relatively low amount. This additional effect is about half of a percentage point in 2014, one percentage point in 2015, two in 2016 and three in 2017. Obviously, these results are conditional on the fixed effect equaling zero; on other points of the curve, the impacts will be different. These results are also conditional on the logit functional form.

As an alternative to the logit functional form, in columns (7) and (8) of Table 3 we report the estimates obtained using the linear probability model, estimated in the same sample as the logit model, i.e., the sample of firms that did exit during 2014-2017. As in the logit model, the coefficients are positive and statistically significant at the 1% significance level. Hence, qualitatively the results are the same as in the logit model. Quantitatively, the change in the probability of exit assigned to the minimum wage rise is a bit lower than in the logit model — see the mid-section of Table 4. This is especially so for non-financially distressed firms, for which this model estimates impacts that are not much higher than half of the logit estimates. Nevertheless, the magnitude of the average impact is still reasonably large, reaching 16 percentage points in 2016. For financially distressed firms, the linear model also produces lower estimates of the average impact than the logit model, but the difference is relatively small (less than six percentage points). In short, the linear probability model attenuates the magnitude of the average impact of the minimum wage increases, but is in line with the conclusions derived from the logit model.

Table 4: Impact on the probability of exit (%) of the average firm

	2013	2014	2015	2016
Logit				
Non-FDF	5.0	13.4	24.5	27.5
FDF	5.6	15.9	27.3	30.4
LPM – A (firms that exited)				
Non-FDF	2.6	7.2	14.0	16.2
FDF	3.7	11.1	21.9	25.9
LPM – B (all firms)				
Non-FDF	0.2	0.5	1.0	1.2
FDF	0.6	1.7	3.4	4.1

Notes: The numbers are the difference in the probability of exit between a firm with a value for the treatment variable equal to the average of that variable for the same category of firms (non-FDF or FDF) in each year, and a firm with the same characteristics but a zero value for the treatment variable. "Logit" uses the estimates in column (5) of Table 3. "LPM - A" and "LPM - B" use the estimates in columns (7) and (9), respectively.

We also estimated the linear probability model on the full sample of firms. The results are in columns (9) and (10) of Table 3. Extending the sample to include the firms that did not exit during 2014-2017 makes some difference. First, the dummy for financially distressed firms is no longer statistically significant. Second, and more importantly, the attenuation effect detected above is now much stronger — see the lower section of Table 4. The estimated average impact is now in the range 0.2 − 1.2 for non-financially distressed firms, and in the range 0.6 − 4.1 for financially distressed firms. Nevertheless, the conclusion that the minimum wage rises increased the probability of death still holds.

The positive impact of minimum wage increases on the probability of exit contributed to accelerate the insolvency of less productive firms. In Table 5, we report productivity and profitability statistics, by class of firms and year, for firms that survived and for firms that exited the market. The statistics for productivity show that the firms that exited the market tended to be much less productive than the firms that survived. Therefore, our results suggest that minimum wage policies might have produced a cleansing effect, as in Mayneris et al. (2018), contributing to improve aggregate productivity.

Table 5: Productivity and profitability by exit and financial status

Year		2013		2014		2015		2016	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
		Productivity (Euro per hour)							
Non-Exited	All	16.16	10.80	16.33	11.10	20.77	11.71	17.92	12.15
	Non-FDF	16.74	11.13	17.02	11.47	21.50	12.03	18.36	12.39
	FDF	5.57	4.74	4.19	4.67	4.47	4.83	5.51	5.14
Exited	All	9.21	6.48	9.89	6.68	12.67	7.56	12.91	8.86
	NonFDF	12.83	7.38	12.34	7.51	14.22	8.32	14.41	9.58
	FDF	-11.18	2.97	-3.59	2.59	2.04	2.51	-0.74	2.93
		Profitability (%)							
Non-Exited	All	1.91	4.97	2.76	5.50	4.98	6.14	6.14	6.51
	Non-FDF	3.66	5.42	4.56	6.01	6.38	6.56	7.23	6.86
	FDF	-29.87	-16.65	-28.98	-14.95	-26.29	-13.77	-24.58	-13.08
Exited	All	-22.76	-6.71	-22.09	-4.85	-14.70	-0.41	-8.37	2.37
	NonFDF	-18.15	-1.59	-17.04	-0.02	-9.86	1.69	-4.72	3.62
	FDF	-48.71	-31.86	-49.78	-29.45	-47.69	-30.96	-41.48	-27.82

Source: QP & SCIE. The number of observations for the year 2013, 2014, 2015 and 2016 is, respectively, 99790, 94146, 89145 and 85004.

4. Conclusion

In this paper, we evaluated the impact of significant and consecutive minimum wage increases in the Portuguese economy since 2014. Our estimates suggest that minimum wage policies had a negative impact on profitability and employment. Additionally, the results indicate that the impact was magnified for financially distressed firms. The financial vulnerability of those firms also lowered their ability to survive following the increase in wage costs.

These results contribute to a better understanding of the impact of minimum wage policies on firms. So far, most studies of the impact of minimum wage policies have been focused on employment and other dimensions of labor markets. This paper presents evidence that minimum wage policies affect the financial situation of firms and their survival. Therefore, these are issues that policymakers should bear in mind when setting new floors for wages.

The assessment of minimum wage policies in Portugal, since 2014, carried out in this paper suggests that the negative impact on employment and profitability may have been compensated for the economy as a whole by the expansionary phase of the business cycle. On the other hand, our results also suggest that minimum wage policies might have had a supply side effect. The exit of lower productivity firms caused by the increase in wage costs might have worked as a cleansing effect, contributing to higher aggregate productivity. The channels through which productivity may have benefited from minimum wage policies deserve further investigation, namely by analyzing the reallocation of resources from the firms that exit the market to new or incumbent firms.

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