Minimum Wages and Firm Dynamics: Evidence From Costa Rica's Occupation-Based System

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Abstract

This paper analyzes the impact of minimum wages on different margins of firm dynamics, using Costa Rica's high binding and occupation-specific minimum wage setting. To this purpose, I assemble rich administrative data covering the universe of workers and firms in the 2006-2017 period to construct firm-level exposure measures to the minimum wage policy, and estimate the impact of differential exposure to the minimum wage on firm outcomes at several year horizons. The analysis yields two important results: First, minimum wages induce firms to increase their labor shares, but with a negative and longstanding impact on their profitability. The positive effect on the labor shares moderates as firms reduce their employment levels and expand their capital stocks. Second, raising minimum wages increases firm exit and lowers firm entry, with an estimated adverse effect on employment of 0.8 percent due to the missing entrants associated with the policy.

JEL Codes: D24, J23,J24, J31, J38, O14

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1 Introduction

The minimum wage is a central public policy implemented to protect low-paid workers and reduce income inequality. An active and expanding body of research has predominantly analyzed the policy's impact on the wage distribution, worker outcomes, and employment to assess its effectiveness. However, introducing or raising minimum wages distorts firm-level input choices, and business entry and exit decisions. Given the relative importance of firms in the aggregate economy, it is crucial to understand the policy's effects on these margins to evaluate the minimum wages' macroeconomic impact.

A comprehensive analysis of the minimum wage effects on firms requires detailed and connected worker and firm-level information to account for heterogeneity in exposure to the policy and explore margins other than employment. Moreover, most of the existing empirical methods depend on sufficiently large and persistent minimum wage increases to robustly detect the policy's effects on firms. If the minimum wage is not binding or the adjustments are small and take place over several years, minimum wage increases might not be sufficiently large to induce firms to adjust their input demands, output prices, or leave the market. Put differently, firms are willing to accept lower profits if they expect a transitory and limited impact on labor costs. Consequently, there is significant ambiguity on the policy's incidence on firms, as recent studies have pointed out small to null effects on employment (Card and Krueger (1994); Cengiz et al. (2019); Dube (2019b); Dustmann et al. (2019)), and mixed evidence on profitability, revenues, and firm entry (Giupponi and Machin (2018); Mayneris et al. (2018); Harasztosi and Lindner (2019); Chen et al. (2019); Hau et al. (2020)).

This paper estimates the effect of minimum wages on different margins of firm dynamics. For such purposes, I center the attention on Costa Rica's labor market during 2006-2017. This country has a high binding and occupation-specific minimum wage setting that extends the policy's incidence to the entire labor market segment. The minimum wage ratio relative to the median wage in 2017 equaled 70 percent, exceeding the U.S. (34 percent) and OECD averages (53 percent). Additionally, the country experienced sizeable and permanent minimum wage increases during the analysis period that, jointly with the distinctive and binding minimum wage setting, provides necessary variation to identify the policy's incidence. Between 2006 and 2017, minimum wages increased more than 100 percent in nominal terms and 20 percent in real terms. Finally, Costa Rica offers extensive and granular administrative data to explore the potential effects of higher minimum wages on relevant firm outcomes. All these elements put Costa Rica in an advantageous position to explore the effectiveness and trade-offs associated with minimum wages.

Specifically, the aim of the paper is twofold. First, the paper investigates the minimum wage effects on the labor share, defined as the proportion of value-added paid to workers through wages. The global decline in the labor share (Karabarbounis and Neiman, 2014) has raised concerns about expanding inequality, wage stagnation, and consumer purchasing power deterioration. A large and growing strand of research has extensively evaluated the relative importance of different factors shaping this variable's evolution. Blanchard and Giavazzi (2003); Piketty (2015); Azmat et al. (2012) stress the importance of labor market regulation and minimum wage policies as factors shaping the labor share and possible remedies to revert the decline. However, the literature is divided on the minimum wage's effectiveness in inducing firms to increase their labor shares. Higher minimum wages push firms to raise their wages and strengthen the workers' bargaining power. Yet, the potential disemployment effects and capital-labor substitution associated with the policy could also offset such a positive impact, especially in the long run. The final impact is, ultimately, an empirical question that I address in this paper. Moreover, by focusing on this variable, I can speak about relevant margins such as employment, capital-labor substitution, productivity, and profitability. Recent empirical work exploiting microdata has produced mixed evidence on the minimum wage effects on these firm outcomes, introducing some debate around the policy's incidence on firms (Meer and West (2016); Gustafson and Kotter (2018); Drucker et al. (2019); Clemens and Wither (2019); Jardim and Van Inwegen (2019)).

Second, the paper investigates the effect of higher minimum wages on business entry and exit. The empirical evidence on the policy's effects on these margins is mixed and inconclusive. In particular, recent studies using reliable techniques and sizeable minimum wage adjustments have found no significant impact on entry (e.g., Giupponi and Machin (2018); Harasztosi and Lindner (2019); Jardim and Van Inwegen (2019)) and even a positive effect (e.g., Aaronson et al. (2018)). I combine a high binding minimum wage policy and administrative data to shed new light on this margin. Furthermore, I exploit the minimum wage policy to explore the relative importance of startup activity in shaping aggregate employment dynamics. I implement a dynamic framework to show that the estimated decline in firm entry associated with higher minimum wages has dynamic and sizeable effects on employment levels. This channel of incidence has been notably absent within the discussion around the disemployment effects associated with higher minimum wages.

I construct a linked employer-employee dataset by processing the universe of monthly social security reports provided by employers between 2006 and 2017. I supplement this information with the universe of corporate tax declarations containing annual firm-level balance sheet statements traditionally used to track profitability, capital usage, productivity, and firm revenues. By combining these two sources, I assemble a final dataset uniquely suited to analyze the impact of a high binding and extensive minimum wage setting on firm behavior.

With the merged dataset, I estimate a firm-level minimum wage exposure measure. This variable is defined as the percent increase in the firm's wage bill necessary to bring its current employees up to the new minimum wages[1]. Then, I investigate if differential exposure to the minimum wage leads to differential changes in the relevant firm outcomes at different year horizons. For such purposes, I estimate a sequence of regressions to compute firm outcomes' dynamic responses to minimum wage changes. Costa Rica's minimum wage setting is pivotal for this purpose, as adjustments are sizeable and permanent[2]. To address potential endogeneity issues associated with the minimum wage exposure metric, I exploit the fact that firms are differentially exposed to the common minimum wage adjustments based on their occupational composition. More precisely, I consider an instrument for exposure consisting of the inner product of the firm's occupational shares in 2007 and the occupation-specific minimum wage increases, based on the shift-share design literature (Adao et al., 2019; Goldsmith-Pinkham et al., 2020; Borusyak et al., 2020). Before mid-2008, the legal authorities increased minimum wages to exclusively and explicitly compensate for past CPI changes. Consequently, all minimum wages were stable in real terms and adjusted at the same pace. After 2008, the country experienced a dramatic and fast decline in the inflation rates, from two-digit averages to 5 and then 2 percent averages. Given the strong indexation to past CPI rates and a slow adjustment in inflation expectations, real minimum wages steadily and significantly increased[3]. Besides, during the analyzed period, minimum wages associated with low-skilled occupations increased relatively faster, breaking decades of stability in relative terms. Therefore, 2007 concludes almost a decade of real minimum wage stability[4]. Finally, I use the computed dynamic responses to construct elasticities at different

[1]This variable can also be interpreted as a firm-level compliance cost or a firm-specific minimum wage increase.

[2]As discussed by Sorkin (2015); Clemens and Wither (2019), nominal increases that are temporary due to inflation and rising real wages are unpromising to detect longer-term responses. This is the case of countries where minimum wage increases are phased over several years and not indexed to past inflation.

[3]Such behavior motivated policymakers to introduce adjustments in the setting process to slow down the growth and avoid similar future issues. The outcome was adopting a formula that accounts for past inflation, GDP per capita growth rates, and inflation expectations estimated by the Central Bank of Costa Rica. The changes started to become effective by mid-2014 and returned the stability in the real minimum wages beginning 2015 to the present.

[4]The cumulative percentage change in the real minimum wage for low-skilled occupations between 1998 and 2007 was 1.9 percent, while the cumulative change between 2008 and 2017 was around 21 percent.

year horizons, defined as the percent change in the outcome variable due to a one percent increase in the labor costs *induced* by the minimum wage.

The result of my analysis indicate that minimum wage exposure induces firms to increase their labor shares. The estimated elasticity is more prominent during the first years after the minimum wage change (0.67), as the effect declines in magnitude as the horizon extends to converge to 0.45. Such behavior reflects firms implementing significant input demand adjustments in response to the policy. More precisely, higher minimum wages lead to disemployment effects and capital-labor substitution. Still, the employment elasticity is relatively small (–0.09 to -0.14), which explains the persistent positive impact of higher minimum wages on the labor share. On the opposite, minimum wages negatively impact firm profitability, emphasizing the policy's redistributional nature: higher minimum wages induce a transfer of rents from firms (lower profits) to workers (higher labor shares). To support the documented positive impact on the labor shares, I explore the revenue response to higher minimum wages. According to the neoclassical perspective, minimum wage increases lead to a decline in the firm's revenues due to the employment reduction. If that is the case, then the policy's effect on the firm's labor share is less clear. I estimate positive and sizeable revenue elasticities (0.22-0.37), which can be explained by the small disemployment effects, greater capital adoption, and labor productivity improvements[5].

I exploit the estimated firm responses to compute the elasticity of substitution of labor and capital (σ_{KL}) using a simple model of labor demand with imperfect competition in the output market as in Hamermesh (1993); Aaronson and French (2007); Harasztosi and Lindner (2019)[6]. Given Costa Rica's occupation-specific and binding minimum wage setting extending to the entire labor market segment, σ_{KL} can be interpreted as an aggregate elasticity. This exercise is relevant as it supports the minimum wage's estimated positive effect on the labor share. As explained by the literature (e.g., Elsby et al. (2013); Karabarbounis and Neiman (2014); Oberfield and Raval (Forthcoming)), an elasticity of substitution less than one implies that the labor share increases in the capital-labor ratio. Hence, both the small disemployment effects and the capital-labor substitution esti-

[5]The revenue response also suggests that firms exercise their market power to increase revenues by raising their product prices (Aaronson and French (2007); Harasztosi and Lindner (2019)). Future work is oriented in assessing the relative importance of this channel through a structural analysis

[6]As summarized by Herrendorf et al. (2015), the most recent literature converge in finding an elasticity of substitution less than one. The estimated value in manufacturing is close to Herrendorf et al. (2015); Chen et al. (2019); Oberfield and Raval (Forthcoming), who report elasticities between 0.5 and 0.8. Still, this is a first estimation. Future work will be oriented into a structural analysis accounting for imperfect competition in product and labor markets to provide a more robust estimate of this and other important related parameters.

mated in this paper would be consistent with the increase in the labor share in response to higher minimum wages. Results suggest a value of 0.59 (s.e. 0.05) for all firms and significant heterogeneity across representative sectors. The estimated elasticity of substitution is larger in manufacturing (0.81 (s.e. 0.08)) and tradable sectors (0.76 (s.e. 0.07), but smaller in non-tradable sectors (0.46 (s.e. 0.05)). The contrast in the estimated parameters reflects the differences in the production technologies across sectors, stressing the importance of extending the analysis to different industries.

Finally, the minimum wage policy had an adverse impact on firm entry. I aggregate the data to industry levels to conclude that a one percentage point increase in the compliance cost (minimum wage exposure) decreases entry rates between 0.6 and 1.0 percent and startup employment shares between 1.6 and 2.6 percent. By taking these results and the data to the dynamic framework, I show that aggregate employment is, by the end of the analysis, around 0.8 percent lower due to missing entrants. This sizeable effect contrasts the small employment adjustment computed by incumbent firms, underlining that minimum wage policies have a strong and adverse employment effect by deterring startup activity.

The paper proceeds as follows. Section 2 describes the salient features of Costa Rica's minimum wage setting during the period of study. Section 4 discusses the empirical strategy of the paper, starting with the exposure measures and then the regression analysis. Section 3 describes the data and provides some descriptive statistics. Section 5 presents and discusses the results and robustness checks.

Related literature and contribution: This paper lies in the space of recent literature exploiting micro-data to examine the margins along which firms adjust to higher minimum wages. I introduce an occupation-specific and highly binding minimum wage setting that represents a valuable input to understand the implications of labor market regulation on firm behavior. As a result, this paper is a notable departure from a still dominant number of papers restricting to particular sectors and demographics (e.g., teen workers in the restaurants and retail) to infer the policy's incidence on firms, either because of a low binding minimum wage or data limitations. Extending the analysis to the entire labor market segment is relevant since the degree of substitutability between capital and labor differs across sectors (Herrendorf et al., 2015). Similarly, firms in tradable sectors potentially have less space to adjust their product prices, so input demand adjustments are relatively more important. The related studies extending the analysis to multiple sectors are forced to rely on atypically sizeable minimum wage increases for inclusiveness.

This paper directly contributes to the literature exploring the main determinants of the labor share (e.g., Elsby et al. (2013); Karabarbounis and Neiman (2014); Piketty (2015);

Berger et al. (2019); Kehrig and Vincent (2018)) by showing that minimum wages induce firms to increase their labor shares. The global decline in the labor share has expanded the attention on the minimum wage as a potential tool to improve workers' bargaining power, reduce the monopsony power of firms, and, ultimately, raise the labor share. However, there is no previous research, to my knowledge, exploring the minimum wage effects on this variable.

This paper also contributes by providing new evidence on the adjustment dynamics along which firms adapt to higher minimum wages. Recent work using micro-data and reliable empirical methods have offered conflicting results on important margins. Besides, most of the empirical work focuses on immediate effects, and longer-term evidence is scarce. As a result, there is substantial ambiguity in the literature on whether the small or null incidence found on relevant margins, such as employment, is due to adjustment costs (Sorkin (2015); Neumark (2019))[7]. Specifically, Cengiz et al. (2019); Harasztosi and Lindner (2019); Dustmann et al. (2019); Chen et al. (2019) report small to non-significant disemployment effects, while Clemens and Wither (2019); Jardim and Van Inwegen (2019) estimate significant negative effects. Mayneris et al. (2018) for China and Chen et al. (2019); Jardim and Van Inwegen (2019) for the U.S. use microdata to find no statistically significant effects on productivity, intermediate input usage, profitability, and productivity. Gustafson and Kotter (2018) find that minimum wage hikes induce firms in minimum wage sensitive industries (retail, restaurant, and entertainment) to reduce their capital investment relative to non-labor intensive firms. Harasztosi and Lindner (2019); Hau et al. (2020), on the contrary, document significant capital-labor substitution.

Additionally, this research speaks to prior work assessing the impact of minimum wages on business entry and exit. Most empirical evidence comes from sector-specific studies with intrinsically high entry and exit dynamics (e.g., restaurants). Studies extending the analysis beyond restaurants and similar sectors have produced mixed evidence. Giupponi and Machin (2018); Harasztosi and Lindner (2019) find no significant impact on exit, while Chen et al. (2019) finds a higher probability of closure for firms in the U.S. manufacturing sector. On firm entry, the empirical evidence is remarkably inconclusive and this is, to my knowledge, one of the first papers finding a negative and longstanding impact on entry using administrative firm-level data.

Lastly, this paper contributes to the literature emphasizing the role of new firms in shaping employment dynamics. Decker et al. (2014); Haltiwanger et al. (2013); Karahan

[7]Recent theoretical work on labor monopsony power has introduced further disagreement on the policy's effects on firms. Wage-setting employers, for instance, could increase their employment levels after a minimum wage hike (Card et al. (2018); Berger et al. (2019); Manning (2020)).

et al. (2019); Pugsley and Şahin (2019) show that lower firm entry has significant and dynamic effects on aggregate employment and the main factors explaining current trends. One element in discussion is the role of labor market regulation. This paper shows that minimum wage policies hurt business creation, leading to dynamic adverse effects on aggregate employment. Despite the unbalanced attention on the associated employment effects of higher minimum wages, the literature has neglected this incidence channel, mostly due to a lack of significant evidence.

2 Institutional Context

2.1 Minimum Wage Structure

The minimum wage policy in Costa Rica is substantially more differentiated than in most of the OECD countries. This country implements a multi-tiered system of legal wage floors that vary by occupation, so minimum wage rates are essentially set by skill level. Adjustments are made twice a year, with new levels becoming effective in January and July, and decisions are carried out by the National Council of Salaries (NCS), a national-level tripartite commission formed of three representatives from labor unions, three from the Chamber of Commerce (private-sector companies) and three from the Central Government. The negotiating process is widely publicized, and the central purpose of the policy is to protect low-wage workers by establishing a wage floor that ensures basic living conditions to these individuals.

Statutory minimum wages legally cover employees in private-sector firms and private households (domestic service), representing, on average between 2010-2015, 61 percent of all workers. The policy excludes self-employment or unpaid family workers (one percent of total workers), independent workers (23 percent of total workers). Although the public sector wages (15 percent of total workers) are established within a distinct framework, decision-makers fundamentally based their choices on the minimum wage structure and adjustments, primarily since unions represented in the Council overwhelmingly represent public sector workers (OECD, 2017). Moreover, Costa Rica's private-sector has low unionization rates, and collective bargaining over wages and working conditions is limited. According to the (OECD, 2017), the percentage of workers in Costa Rica in a labor union in 2013 is 7%, remarkably below the OECD average (26%) and the U.S. (10.3%). Similarly, collective bargaining agreements cover around 16% of workers in 2013, below the OECD average (49%), and the largest proportion of these agreements are formed in the public sector. Hence the minimum wage policy constitutes the dominant institutional setting shaping the private-sector wage determination.

In 1987, the NCS embarked on a process of gradual simplification of the structure and the decision-making process. There were 520 different industry-occupation categories before such a year, and, from 1995 to the present, there are 24 different minimum wage levels. Specifically, workers are organized into three broad categories. The first group is of occupations associated with the production process (blue-collar workers). The second one, generic, applies to white-collar or administrative occupations. The third one covers specific occupations such as domestic workers and reporters. The first two groups are further divided into four skill categories: unskilled, semi-skilled, skilled, and specialized. Finally, there is an additional legal wage floor for workers with a bachelor's degree (undergraduate diploma) and university graduates (5-year university degree or *Licenciatura*). Table 1 summarizes the most important categories.

Table 1: Costa Rica: Minimum Wages by Skill Groups

	Minimum Wage (Low Skilled=100)	Kaitz Index	Percentage Increase 2006-2017	
			Nominal	CPI-Deflated
Low Skilled	100	0.82	122.8	27.7
Semi Skilled	122	0.77	118.0	25.0
Skilled	127	0.74	113.1	22.1
Technical Low-Skilled	143	0.61	107.3	18.8
Specialized	146	0.67	108.2	19.3
Technical High-Skilled	194	0.68	107.3	18.8
Bachelors University	216	0.55	107.3	18.8
University Graduate	290	0.45	107.3	18.8

Notes: The Kaitz Index is defined as the ratio of minimum wage to median wage. The monthly minimum wage for a low skilled worker in 2020 is 316,965 CRC, approximately US$560.
Source: Ministry of Labor and Social Security (MTSS)

2.2 Adjustment Process and Time Behavior

In 1998 the Central Government and the NCS agreed on adjusting the different legal wage floors primarily based on the inflation rate accumulated since the last change. Negotiation would only occur in cases of atypically high inflation levels, over 6 percent accumulated over the previous six months (Trejos, 2016). From 1998 to late 2018, this explicit agreement forced the minimum wage to stagnate in real terms, as Figure 1 illustrates.

Figure 1: Minimum Wage Minimorum (CPI-2015 Deflated. January 2000=100)

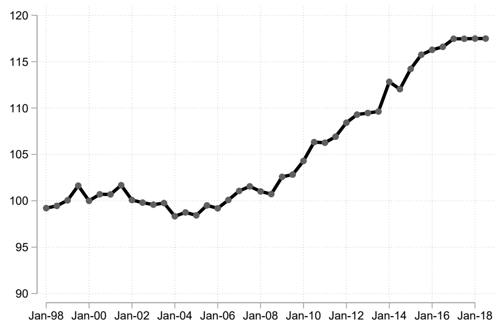
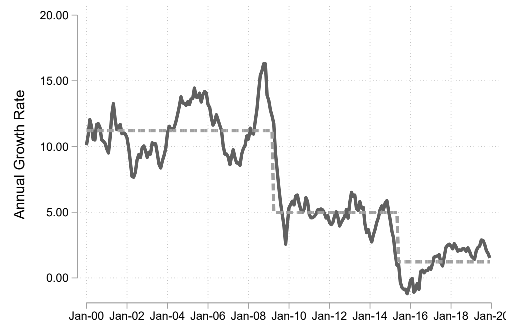


Figure 2: Annual Inflation Rate (CPI-2015)

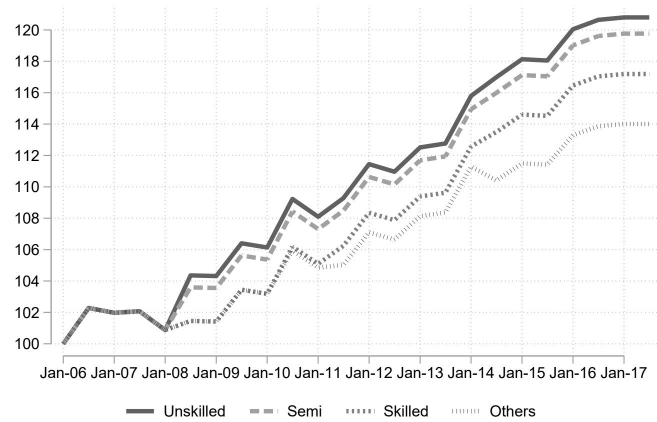


Notes: The Minimum wage minimorum is the lowest level of the multi-tier system, corresponding to low-skilled occupations
Source: Ministry of Labor and Social Security (MTSS) and Central Bank of Costa Rica (BCCR)

Starting 2009, Costa Rica experiences a rapid decline in the inflation rate, a direct result of the adoption of an inflation-targeting regime, and the abrupt decrease in the international price of commodities due to the great recession (See Figure 2). These elements lead to an automatic and significant increase in the minimum wage between 2009 and 2016, as the 1998 agreement opened the room for negotiation only in cases of atypically high inflation rates and given the fact that inflation expectations slowly adjusted to the new inflationary steady state. In late 2011, the NCS and the Central Government agreed upon a new formula that takes into account recent but now expected inflation and GDP per capita during the past five years. Such a transition explains why the minimum wage behavior stabilizes in real terms after 2016. As I discuss in Section 4, I exploit this setting dynamics in the minimum wage to capture how firms adjust their production process to the policy.

The NCS decided to increase the minimum wage of the lower-skilled categories relatively more on three occasions (2008, 2012 and 2014). Hence, by 2017, low-skilled occupations experienced a sharper increase in the legal wage floor (see Figure 3). As it can be read from the NCS minutes that contain the discussion around each minimum wage adjustment decision (MTSS, 2008, 2012, 2014), the resolution of increasing low-skilled legal wage floors relatively more was mostly because under the new inflation rates, the indexation would lead to a small increase that would break a long period of two-digit growth rates, causing some social and political discontent. In other words, inflationary inertia was the main factor behind the decision-making process and the upward trend observed between 2008 and 2016.

Figure 3: Costa Rica: Minimum Wage by Skill Groups
(CPI-2015 deflated. January 2006=100)

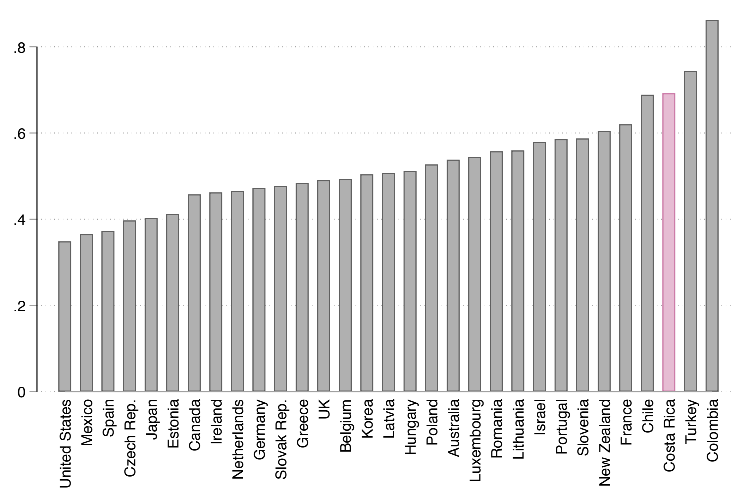


Notes: "Others" include specialized occupations, and university graduates.
Source: Ministry of Labor and Social Security (MTSS)

2.3 Policy Bindingness

One salient feature of Costa Rica's minimum wage policy is that its bite into the wage distribution is deep. Figure 4 offers an international comparison, placing Costa Rica as one of the economies with the highest minimum wage.

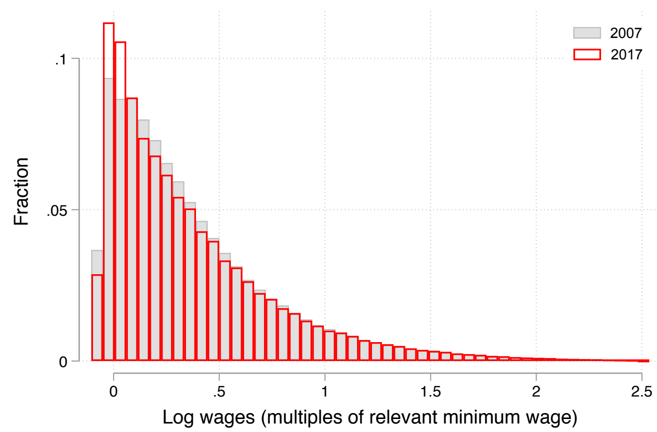
Figure 4: Kaitz Index Across OECD countries
(Percentage of median wage. 2015)



Notes: Minimum relative to median wages of full-time workers
Source: OECD LFS

Similarly, Figure 5 illustrates the aggregate bindingness and the enforcement of the policy by showing a substantial wage compression around the wage floors. Table 2 additionally shows that there is important heterogeneity across occupational and skill groups: Column (1) shows that the Kaitz index –the ratio of the minimum wage to the median wage– of the minimum wage for low-skilled workers with respect the wages of all workers is around 70%[8], above the levels reported by the OECD average (53%), France (62%) and the U.S. (34%) in 2017. Moreover, the minimum wage binds asymmetrically depending on skill groups, with a stronger bite for the lower-skill categories. The strong bite of the minimum wage is key as modest increases over a high base may be sufficient to force firms to modify their behavior. The Kaitz index shows a positive trend in consonance with the nominal and real adjustment of the wage floors that moderates in 2016-2017 as the setting pressure stabilizes back again to show a similar trend before 2007[9]. Therefore, this paper draws on both intertemporal and occupational variation of the minimum wage to infer the policy's economic incidence.

Figure 5: Wage Distribution



Notes: Figure shows the frequency distribution of monthly log earnings in 2008 (last year before the steady increase in the real minimum wage), and in 2017 (when the adjustments stabilized in real terms). Monthly wages are CPI-2015 deflated. Sample selection restricts to full-time workers aged 18-60 employed by the private-sector.

[8] The estimation of the minimum wage bite is roughly the same as the reported by the OECD that incorporates wages of the informal sector, see Figure 4.

[9] Figure B.1 shows the change in the wage distribution between 2008 and 2017 by the main occupational groups. Overall, these graphs show that the observed increase in the legal wage floors asymmetrically compressed the wage distribution across the different groups.

Table 2: Kaitz Index by Minimum Wage Group

	All	Low skilled	Semi Skilled	Skilled	Technical Low-skilled	Specialized	Technical High-skilled	Bachelors University	University Graduate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2006	0.71	0.82	0.79	0.71	0.57	0.60	0.63	0.60	0.46
2007	0.71	0.81	0.77	0.71	0.58	0.60	0.64	0.58	0.45
2008	0.71	0.81	0.76	0.77	0.64	0.71	0.66	0.64	0.52
2009	0.73	0.82	0.78	0.79	0.62	0.70	0.68	0.64	0.51
2010	0.73	0.82	0.77	0.77	0.61	0.69	0.67	0.62	0.50
2011	0.73	0.82	0.77	0.76	0.59	0.67	0.67	0.59	0.48
2012	0.72	0.82	0.77	0.75	0.58	0.66	0.67	0.57	0.46
2013	0.72	0.82	0.77	0.74	0.59	0.67	0.67	0.57	0.45
2014	0.73	0.82	0.78	0.74	0.60	0.67	0.68	0.56	0.45
2015	0.72	0.82	0.77	0.74	0.61	0.67	0.68	0.55	0.45
2016	0.72	0.82	0.76	0.73	0.60	0.66	0.64	0.53	0.44
2017	0.70	0.80	0.75	0.72	0.59	0.64	0.64	0.52	0.43

Notes: The Kaitz Index is defined as the ratio of minimum wage to median wage. Column (1) shows the Kaitz Index for all workers with respect to the lowest minimum wage for international comparison.
Source: Ministry of Labor and Social Security (MTSS) and CR-LEED

The share of workers directly exposed to the policy is also significantly higher than the reported in related studies for other economies, particularly for the U.S. (e.g., Flinn (2011)). Nonetheless, this share remains relatively constant over time, which is expected given the frequency and structure of the minimum wage adjustments.

Table 3: Share of Workers by Minimum Wage Group

	Low Skilled	Semi Skilled	Skilled	Technical Low-Skilled	Specialized	Technical High-Skilled	Bachelors University	University Graduate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006	16.42	8.52	8.10	3.70	3.61	3.71	3.01	2.35
2007	16.26	7.88	8.03	3.81	3.10	3.71	2.65	2.13
2008	14.65	7.59	10.92	8.20	5.44	2.60	3.66	2.23
2009	16.71	8.09	11.30	7.61	5.70	4.18	4.56	2.80
2010	16.27	8.17	10.72	5.95	5.20	3.42	4.55	2.23
2011	16.21	7.83	9.90	4.67	4.41	3.27	3.48	2.73
2012	15.52	7.68	8.84	3.96	3.72	3.09	3.27	2.36
2013	16.04	7.56	9.45	4.28	4.22	3.58	2.84	2.44
2014	16.25	8.25	9.82	4.06	4.08	4.77	3.95	2.82
2015	16.72	8.28	9.71	5.10	4.35	4.29	3.11	2.54
2016	15.98	8.07	8.75	4.96	3.68	3.24	2.41	2.41
2017	15.09	8.34	8.97	4.77	3.85	3.20	2.70	2.17

Notes: Table shows the number of workers earning around 5% or above the minimum wage as percentage of total workers in the corresponding skill group.
Source: Ministry of Labor and Social Security (MTSS) and CR-LEED

3 Data and Descriptive Statistics

3.1 Main Dataset

For this paper, I combine different administrative datasets that collectively comprise the universe of workers and firms in Costa Rica's formal sector. The first source of information is a monthly linked employer-employee data (CR-LEED) that I construct using raw firm-level records reported to the Costa Rican Social Security Fund and secured by the Central Bank of Costa Rica (BCCR). This data source provides me the worker-level detail to construct the minimum wage exposure measures. The information matches workers and employers from 2006 to 2017 and identifies each person and each firm with a legal identifier that facilitates the merging with other administrative sources. By nature, these reports exclude firms not contributing to social security or providing tax declarations[10]. For each worker, I observe sociodemographics such as age, nationality, sex, and residence. The data includes relevant characteristics of the job match such as monthly labor earnings, full-time status, sick-leave status. Jobs are likewise organized into occupations according to the tasks and duties that are undertaken in the job, consistent with the International Standard Classification of Occupations (ISCO) at a 4-digit level. I map the worker with the relevant minimum wage using these occupational codes, correspondence tables provided by the Ministry of Labor and Social Security (MTSS), and employer guidelines provided by the Social Security Administration Fund (CCSS). Employers do not report worked hours, which is a significant but usual limitation found in most employer-employee datasets. To overcome this limitation, I track the employer-employee relationship each month to flag atypical monthly wages, as in Sorkin (2018); Crane et al. (2019); Song et al. (2019); Lachowska et al. (2020) and literature within. These observations could be due to partial months due to labor transitions or sick leaves, for example. I avoid using these observations when aggregating the information into quarter and yearly levels. Refer to Appendix A for more detail on the sources and the data construction.

The second source comes from the universe of corporate tax returns reported by firms from 2005 to 2018 (REVEC). These reports consist of annual balance sheets and income statements. The Central Bank of Costa Rica (BCCR) collects the information and incorporates information from customs (exports and imports) and conducts an extensive revision to detect anomalies and correct misreports. Since both workers and firms are identified

[10]This represents part of the informal sector. Rates of informality in Costa Rica are around 25% for individuals aged 15-64, which are lower than the Latin American average but higher than the OECD average (OECD, 2017). See Appendix C for a more in-depth discussion on Costa Rica's informal sector.

using the same legal identifiers, it is straightforward to combine both data sources[11]. The outcome is a clean and comprehensive picture of the labor market at an annual level, representing a significant advantage to overcome common and significant shortcomings found in prior work. For instance, the data's administrative and fiscal nature allows tracking with high precision firm entry and exit. Furthermore, I can observe each firm's labor and wage bill composition in great detail to compute accurate and granular measures of exposure to the minimum wage. Lack of worker-level detail has forced prior work to use average wages to estimate minimum wage exposure (Mayneris et al. (2018); Chen et al. (2019); Hau et al. (2020)), introducing additional biases into the estimation.

For the remaining of the analysis, I restrict the sample, as discussed before, to full-time workers aged 18 to 60 employed by a private-sector firm. Hence, I exclude self-employed individuals, households, non-profit firms, and state-owned enterprises, representing around 30% of total firm-year observations in the dataset. Also, I drop firms consistenlty reporting fewer than 2012 US$2,000, and less than four workers, employer-employee matches with a duration less than two quarters. Even though this introduces a size threshold, such cutoff is not as high as other papers need to impose, a desirable circumstance since small firms are usually more exposed to the minimum wage. A high threshold could also obscure the identification and timing of firm entry and exit. Other details are explained in Appendix A.

3.2 Descriptive Statistics

Table 4 summarizes the primary descriptive statistics for the firms in the sample in 2007, and the panel of Figures 6 display binned scatterplots illustrating the non-parametric relationship between key firm characteristics and exposure to the policy. Firms with higher exposure levels have smaller (both in total employment and total revenues), lower productivity, and more labor-intensive. Additionally, firms with high levels of exposure are also lower-paying units. Their employer-specific pay premium and their average wage are negatively associated with the degree of minimum wage exposure. These results suggest to include these characteristics as covariates in the regression analysis.

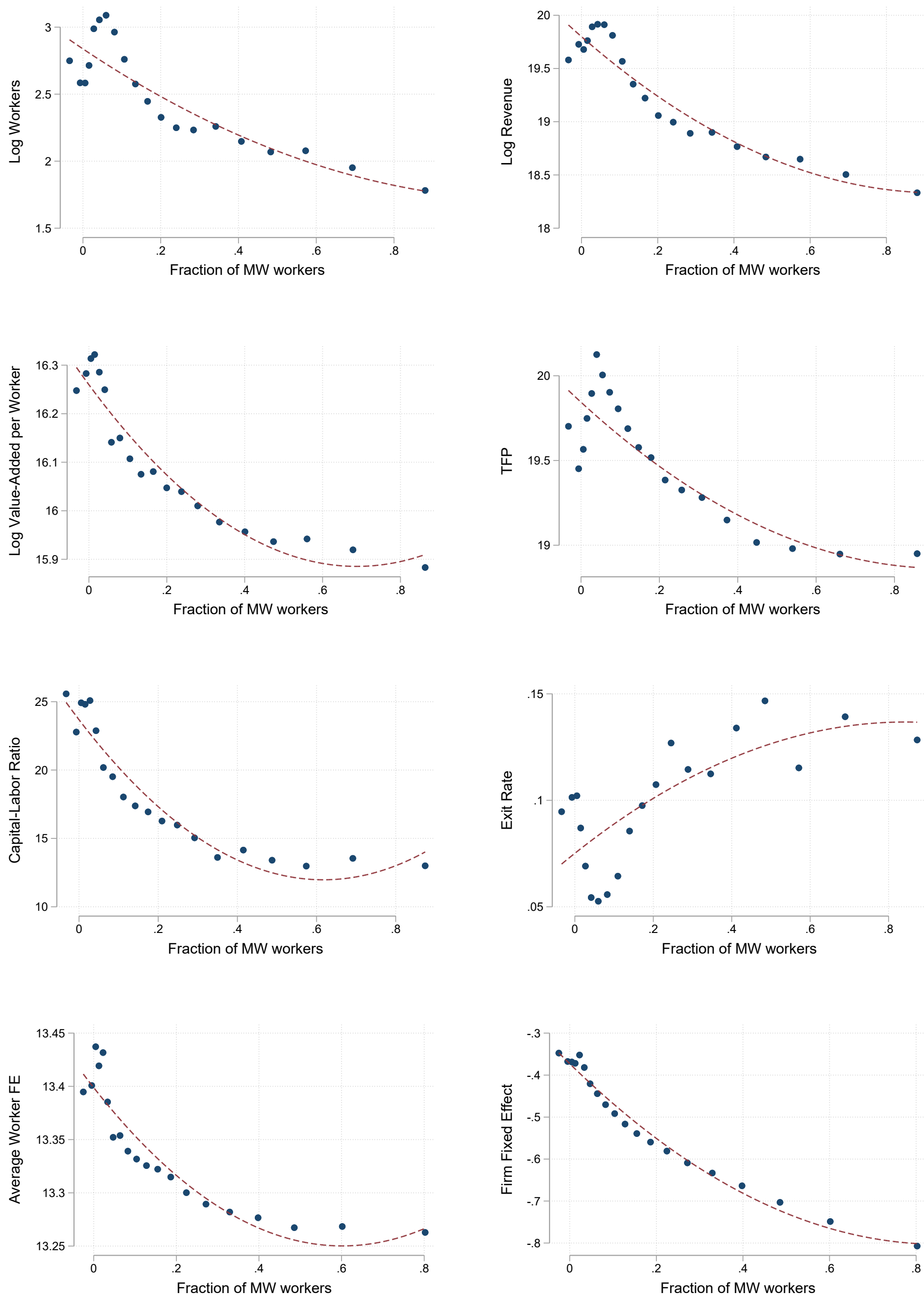
[11]Some firms employ workers using a different ID than the one used in the corporate tax forms. The Central Bank of Costa Rica corrects these issues by identifying corporate and firm groups. I also perform a comprehensive check to identify large employers with multiple IDs. Appendix A discusses the data construction strategy and provides more explanation.

Table 4: Summary Statistics by Exposure Intensity. 2007

	All	Fraction of Minimum Wage Workers			
		0-25	25-50	50-75	75-100
Wage Bill	16.54	17.09	16.31	16.04	15.57
Average Wage	13.99	14.24	13.92	13.76	13.50
Revenue	18.70	19.14	18.47	18.27	17.98
Workers	41.06	64.65	21.35	16.39	11.39
Labor Share	0.17	0.18	0.16	0.16	0.14
Export Share	0.03	0.04	0.03	0.02	0.01
Capital-Labor Ratio	7.35	8.41	7.24	6.66	4.99
Exit Rate	0.11	0.09	0.10	0.11	0.17
Firms	18,646	9,835	3,452	2,287	3,072
(Fraction of total)	100	52.7	18.5	12.3	16.5

Notes: Export and labor share as proportion of revenues, profitability defined as profits per revenue. Export share include firms with zero exports. Capital-Labor ratio (fixed assets divided by number of workers) in millions of 2012 CRC.
Source: CR-LEED

Figure 6: Firm Characteristics and Minimum Wage Exposure



Notes: Figures show the binned scatterplot relating the firm-level fraction of workers exposed to the the minimum wage and firm outcomes, with the red line representing the best quadratic fit. Regressions include 2-digit industry and year fixed effects. Nominal variables deflated using 2012 GDP deflator. Total factor productivity index (TFP) estimated using a control function approach a la Ackerberg et al. (2015). Capital-Labor Ratio in millions of 2012 CRC. Worker and firm fixed-effects estimated using a time-varying AKM model

As discussed in Section 2, there is significant heterogeneity in the bite of the minimum wage across occupations. As shown in Tables 1 and 2, the Kaitz index and the proportion of workers earning the legal wage floor is higher in lower-skilled occupations. Moreover, the ratio of the minimum wage and the median wage depicts a positive trend during the period of study that moderates in 2016-2017, consistent with the nominal and real adjustments conducted since 2008.

4 Empirical Strategy

This section describes the empirical strategy followed by the paper. I start by discussing the exposure measure and potential endogeneity issues associated with the metric. Then, I explain the regression framework proposed to capture the policy's effect on firms, starting with the firm-level analysis and concluding with the firm-entry analysis.

4.1 Minimum Wage Exposure

The paper's main strategy is to explore if differential exposure to the minimum wage leads to differential changes in key outcomes of interests. Hence, the first step is to define exposure to the minimum wage. Costa Rica's minimum wage setting implies that firms are differentially exposed to the common minimum wage adjustments based on their occupational composition. As shown before, the minimum wages corresponding to low-skilled occupations experienced a more substantial increase, and the "bite" (ratio of minimum wage and median wage) varies across skill groups. Consequently, low-paying and low-skilled labor-intensive firms potentially face different pressures from the minimum wage setting than a low-paying firm employing higher-skilled occupations. This particular structure and the richness of the data represent an intriguing venue to estimate the minimum wage incidence.

I estimate minimum wage exposure as the percentage increase in firm j's wage bill required to bring all of its current employees up to the new minimum wage[12]:

$$Exposure_{j,t} = \frac{\sum_{i,o} \max\left(w^{min}_{o,t} - w_{i,j,o,t-1}, 0\right)}{\sum_{i,o} w_{i,j,o,t-1}}$$

This variable can also be interpreted as a firm-level compliance cost or a firm-specific minimum wage increase. It measures the distance between each worker's wage and the next year's minimum wage level[13]. By definition, this exposure measure requires com-

[12]Both wages and minimum wages are deflated using the CPI

[13]Between 2006 and 2015, minimum wages were adjusted in January and June of each year. I use the January level for constructing the exposure measure.

plete worker-level detail for an accurate estimation[14]. The granular detail in the Costa Rican data represents a pivotal advantage to overcome these limitations, as I can construct accurate exposure measures for each firm in the labor market, regardless of its size or industry. If $Exposure_{j,t}$ increases by one percentage point, then the minimum wage policy is forcing the firm to increase its wage bill by one percent. Draca et al. (2011) also used a similar metric to measure minimum wage exposure, calling it the wage gap.

$Exposure_{jt}$ is measured based on the labor composition the period before the minimum wage change. In other words, it measures the firm-level increase in the wage bill induced by the minimum wage if the employer does not change its employment structure. Using current minimum wage changes and individual wages could be misleading as it would capture adjustments that the firm already implemented to comply with the policy. However, $Exposure_{jt}$ is still potentially endogenous, as it could be correlated to unobservables affecting firm outcomes[15]. To address this issue, define $z_{j,o,t}$ as the occupational share: the number of workers employed in occupation o relative to the total employment within the firm. Then, the exposure measure can be decomposed as the inner product of the occupational group shares and the respective group-specific exposure:

$$Exposure_{j,t} = \sum_{o} z_{j,o,t} Exposure_{j,o,t}$$

This structure precisely emphasizes that firms are going to be differentially exposed to the common minimum wage adjustments based on their occupational composition. Hence, I consider $Exposure^{IV}_{j,t}$, an instrument for $Exposure_{j,t}$, defined as follows:

$$Exposure^{IV}_{j,t} = \sum_{o} z_{j,o,2007} mw_{o,t+1}$$

Where $mw_{o,t+1}$ is the percent change in the real minimum wage for occupation o relative to 2007 levels and $z_{j,o,2007}$ is the respective occupational share in firm j, estimated in 2007. By fixing the occupational shares to the 2007 levels, I analyze if firms with a particular occupational composition experience differential changes in outcomes following the minimum wage increases. The $Exposure^{IV}_{j,t}$ variable can be interpreted as a firm-level

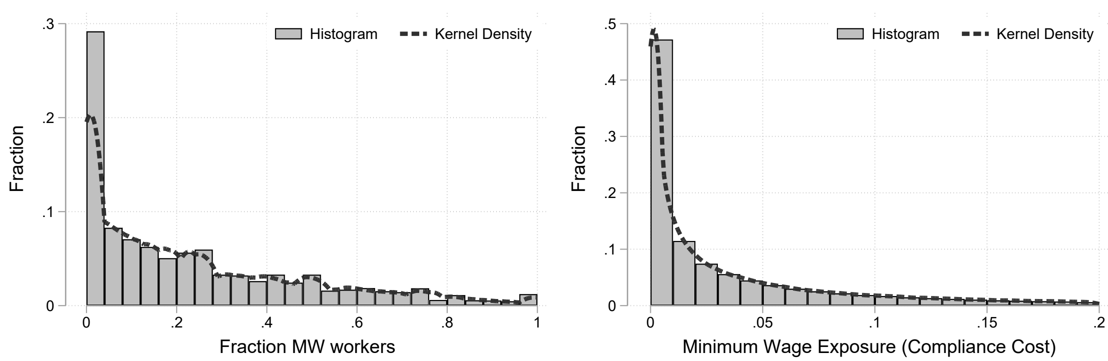
[14]The existing literature has proven that such data requirement is difficult to meet, as there are not many information sources with such detail. Most of prior work measures of treatment intensity based on firm average wages, due to lack of worker-level data. As explain by Draca et al. (2011); Mayneris et al. (2018), any continuous measure of treatment intensity based on firm average wage is potentially noisy, especially when defining groups based on treatment.

[15]For example, an unobserved productivity shock can lead to changes in the employment composition and levels, simultaneously affecting minimum wage exposure and changes in outcome variables. Additionally, exposure could be correlated to unobservables that put the firm closer to the minimum wage and closer to the exit margin.

minimum wage increase, using the initial occupational shares as weights. The instrument is, by nature, a shift-share instrument and, as shown by Goldsmith-Pinkham et al. (2020), the empirical strategy is numerically equivalent to a generalized method of moments (GMM) estimator with the occupation shares as instruments and a weight matrix composed by the occupation-specific minimum wage increases.

Figure 7 summarizes the distribution of minimum wage exposure across firms. Consistent with the nature of the policy, there is a considerable concentration of firms with zero exposure. However, there is substantial variation in the degree of exposure among the rest of the firms. Besides, Table 5 confirms Costa Rica's setting extends to a large proportion of the labor market segment. Low binding minimum wage policies are characterized by an unpromising variation of minimum wage exposure, forcing researchers to restrict the analysis on specific sectors and demographics. Moreover, such a lack of variation has been a point of debate. Part of the literature argues that a low binding minimum wage policy is insufficient to detect the policy's true impact on firms (e.g. Sorkin (2015); Meer and West (2016); Neumark (2019); Clemens and Wither (2019)).

Figure 7: Histogram of Minimum Wage Exposure Measures



Notes: Figures show the histrogram of the firm-year estimated exposure to the minimum wage. Figure on the left shows the fraction of minimum wage workers employed by each firm. Figure on the right displays the wage gap (benchmark minimum wage exposure measure).
Source: CR-LEED

Table 5: Minimum Wage Exposure by Industry

Industry (2-digit ISIC Rev. 4)	Mean	Median
Agriculture, fishing and mines	0.25	0.19
Manufacturing	0.22	0.15
—Food products	*0.21*	*0.14*
—Wearing apparel	*0.30*	*0.27*
—Wood and of products of wood and cork	*0.31*	*0.30*
—Rubber and plastics products	*0.15*	*0.06*
—Computer, electronic and optical products	*0.12*	*0.07*
—Manufacture of machinery and equipment	*0.19*	*0.11*
Electricity , gas and water	0.17	0.07
Construction	0.20	0.14
Wholesale and retail trade	0.17	0.11
Accommodation and food service activities	0.20	0.14
Transportation and storage	0.19	0.11
Information and communication	0.15	0.08
Financial and insurance activities, real estate	0.12	0.04
Professional, scientific and technical activities	0.18	0.13
—Management consultancy activities	*0.11*	*0.03*
—Advertising and market research	*0.18*	*0.13*
—Security and investigation activities	*0.21*	*0.16*
Education	0.24	0.18
Human health and social work activities	0.22	0.18
Arts, entertainment and recreation	0.18	0.11
Other service activities	0.21	0.17

Notes: Table shows the fraction of minimum wage workers by industry in 2006-2007 (average.

4.1.1 Identification Assumptions

In this case, the implied IV strategy is that the initial occupation shares measure the differential exposure to the minimum wage increases. As I show in the next subsections, I focus on differential *changes* in the outcome variables (e.g., log cumulative *changes* in employment). The occupational shares could be correlated with outcome levels without representing an identification threat. The central identification assumption states that the initial shares are exogenous to the error term conditional on observables. In other words, there is an issue if the initial occupation composition predicts *changes* in outcomes through channels other than minimum wage exposure.

First, fixing the occupational composition to 2007 levels seeks to support the identification assumptions. As described in Section 2, such a year concludes almost a decade in which all minimum wages were stable in both real and relative terms (See Figure 1 and

3). Minimum wage adjustments were explicitly made to compensate for past inflation, so the minimum wage variation before 2008 was confounded with the wage adjustments employers make to compensate workers for inflation. Hence, before 2008, differential exposure to the minimum wage should not have driven differential changes in the studied outcomes if the identification assumption holds.

Still, the identification assumption previously stated is not directly testable. I discuss its plausibility based on the recommended strategy by Goldsmith-Pinkham et al. (2020). First, I explore how much the 2007 occupational shares are correlated with other potential confounders, also measured in 2007. For such purposes, I focus on five main occupation groups: low skilled, semi-skilled, skilled, specialized, and college graduate[16]. I estimate the corresponding occupational share for each group, and I compute the correlation between the occupational shares and key firm characteristics: labor share, capital share, export share, import share, and profitability. This set of variables cover the relative importance of labor and capital, firm size, and international trade exposure, as well as how close the firm is to the margin of exit. The idea is to explore if the instruments (occupational shares) are correlated with initial firm characteristics that could lead to confounding channels other than the minimum wage. For example, firms with high low-skilled occupational shares could also operate closer to the exit margin, so these firms may be prone to reductions in their employment levels. Similarly, firms with high skilled occupations could be significantly exposed to international trade, so productivity improvements could be linked to this channel. Reassuringly, Table 6 shows no apparent systematic pattern of correlation.

[16] Goldsmith-Pinkham et al. (2020) suggest estimating Rotemberg weights to identify the most representative shares driving the identification power. Instead, I consider the main occupational groups, although it should lead to similar conclusions. Since I am constructing firm-level instruments, computing Rotemberg weights become computationally intensive.

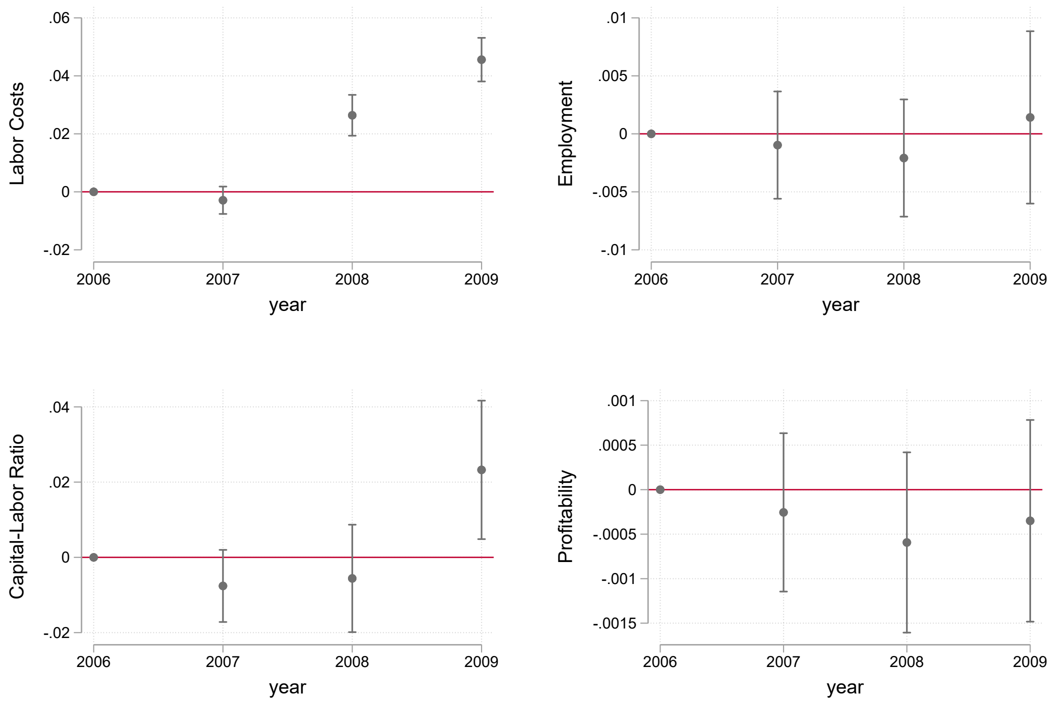
Table 6: Correlation between occupational shares and firm characteristics in 2007

	Low Skilled	Semi-Skilled	Skilled	Specialized	College Graduate	Aggregate Instrument
Labor Share	-0.405	-0.070	-0.188	0.104	0.146	-0.040
	(0.316)	(0.091)	(0.153)	(0.080)	(0.160)	(0.025)
Capital Share	-0.002	-0.004	-0.004	-0.000	0.004	-0.001
	(0.006)	(0.006)	(0.003)	(0.001)	(0.004)	(0.001)
Export Share	-0.209	-1.980	0.080	0.532	0.179	-0.177
	(0.633)	(1.511)	(0.388)	(0.589)	(0.402)	(0.125)
Import Share	0.109	-1.620	0.070	0.166	0.369	0.015
	(0.092)	(1.047)	(0.046)	(0.429)	(0.417)	(0.092)
Profitability	0.006	-0.010	-0.006	-0.002	0.013	-0.000
	(0.037)	(0.022)	(0.017)	(0.004)	(0.013)	(0.001)
Obs.	13,586	13,586	13,586	13,586	13,586	13,586
R^2	0.366	0.316	0.202	0.309	0.200	0.311

Notes: Table shows the result of a regression of the occupational share on firm characteristics, both estimated in 2007. The final column corresponds to the aggregate instrument, i.e., the interaction of all occupational shares with the respective minimum wage increase. Standard errors in parenthesis. For legibility, coefficients and standard errors are scaled by 10,000,000. * p<0.05

Second, I explore for parallel pre-trends. As mentioned previously, the idea is to explore if firms showed a different behavior depending on minimum wage exposure before 2008. Unfortunately, there is no available information before 2006 to extend the analysis beyond this point, but the available information discards the presence of pre-trends. Figure 8 displays the results of a set of regression of the log changes in firm outcomes (relative to 2007) on the minimum wage exposure instrument in 2007, i.e., the inner product of the occupational shares and the occupation-specific minimum wage increases, both in 2007. The plots indicate that before 2007, and in some cases 2008, there is no significant difference in the evolution of the firm characteristics between exposed and non-exposed firms.

Figure 8: Pre-Trends on Selected Firm Outcomes



Notes: Figures report results of regressing the log outcome changes relative to 2006 on the minimum wage exposure instrument in 2007, alongside 95% confidence intervals estimated using robust standard errors.

Finally, results suggest a strong first-stage and no evidence of misspecification. The F-statistics are sufficiently large to support the relevance assumptions behind the strategy and the overidentification tests fail to reject the null of misspecification (See Table 8). I will discuss these statistics in more detail in Section 5.

4.2 Firm-Level Regression Analysis

The main goal of the paper is to explore if differential exposure to the minimum wage leads to differential changes in relevant firm outcomes. To account for dynamics in the response, I estimate a sequence of regressions based on the local projection framework proposed by Jordà (2005). For firm j at year t and horizon $h = 1, ..., 5$, I consider the following specification[17]:

$$\Delta_h \ln Y_{j,t+h} = \alpha_h + \beta^h Exposure_{j,t} + \sum_{i=0}^{h-1} b_i Exposure_{j,t+1+i} + \gamma_h X_j + \nu_{s,t+h} + u_{j,t+h} \quad (1)$$

[17] For $h = 0$, consider $\Delta_0 \ln Y_{j,t} = \alpha_0 + \beta_0 Exposure_{j,t} + \gamma_0 X_j + \nu_{s,t} + u_{j,t}$

With $Y_{j,t}$ denoting firm's j outcome (e.g., employment, revenue, productivity, firm exit), $\Delta_h \ln Y_{j,t+h} = \ln Y_{j,t+h} - \ln Y_{j,t-1}$ the cumulative difference at horizon h[18]. $\nu_{s,t+h}$ denotes a set of industry (2-digit)-year controls and X_j a battery of firm-level characteristics in 2006-2007[19]. As discussed above, one p.p. increase in $Exposure_{j,t}$ means that the minimum wage policy is pushing firms to increase their wage bills by one percent to comply with the new requirements.

In case of a single and permanent minimum wage increase, a local projection of $\Delta_h \ln Y_{j,t+h}$ on $Exposure_{j,t}$ would be enough to capture short and longer-term responses to a single period minimum wage change at t. However, minimum wages also vary between $t+1$ and $t+h$ following the initial change captured in $Exposure_{j,t}$. Therefore, the h-period cumulative change in outcome Y combines the impact of the initial and subsequent minimum wage changes. To account for this staggered nature, equation (1) controls for those minimum wage changes between $t+1$ and $t+h$ through the $\sum_{i=0}^{h-1} b_i Exposure_{j,t+1+i}$ term. Hence, β^h would be the coefficient of interest: the firm-level response to a minimum wage change in t at different year horizons, controlling for subsequent minimum wage changes.

As mentioned previously, one issue is that $Exposure_{j,t}$ is likely to be endogenous. Then, for each relevant year horizon h, I instrument the exposure term using the instrument discussed previously, $Exposure^{IV}_{j,t+h} = \sum_o z_{j,o,2007} mw_{o,t+h}$.

To have a more comparable and intuitive estimate, I translate the impulse responses to minimum wage elasticities ε^y_{t+h}, defined as the percent change in the outcome variable y due to a one percent increase in the labor costs *induced* by the minimum wage:

$$\varepsilon^y_{t+h} = \frac{\Delta_h \ln Y_{j,t+h}}{\Delta_h \ln W_{j,t+h}} = \frac{\beta_{y,t+h}}{\beta_{\text{Wage Bill},t+h}}$$

Capturing long-term responses to minimum wage increases is particularly challenging. As argued by Sorkin (2015), in lack of indexation and if adjustments are phased over several years, nominal minimum wage increases are temporary and even not binding. Inflation and real wages in the relevant labor market erode the initial pressure from the policy rapidly. Costa Rica's setting is pivotal for exploring longer-term responses, as the strong indexation leads to more permanent minimum wage increases.

[18]For firm exit, define $\Delta_h Exit_{j,t+h} = Exit_{j,t+h} - Exit_{j,t-1}$, with $Exit_{j,t}$ an indicator taking the value of one if the firm exits after $t+1$, 0 otherwise.

[19]I measure and fix these characteristics in the 2006-2007 as these two years represent the ending of a long period of real minimum wage stability, as previously discussed. Variables include export share, import share, profitability, labor share, capital share, average industry-level exposure. These covariates control for the relative importance of capital and labor within the firm, international trade exposure, firm size, and how close the firm is to the exit margin. I additionally include the square of these variables, and the average industry-level exposure in 2006-2007

To capture the minimum wage incidency on firm entry, I aggregate the data to 4, 5 and 6 digit industry levels and, similar to the incumbent analysis, I estimate the following sequence of local projections:

$$\Delta_h \log(Entry_{I,t+h}) = \alpha_h + \beta_h Exposure_{I,t-1} + \sum_{i=0}^{h-1} b_i Exposure_{I,t+i} + \gamma_h X_I + \nu_{s,t+h} + u_{I,t+h} \tag{2}$$

Both, the industry-level exposure measures and the corresponding instrument are constructed similar to the procedure adopted at the firm-level[20]. Specifically, $Exposure_{I,t+h}$ is instrumented using $Exposure^{IV}_{I,t} = \sum_o z_{I,o,2007} mw_{o,t+1}$, with $z_{I,o,2007}$ industry-level occupational shares. I measure firm entry in two main ways. The first one is the startup or entry rate: the fraction of new firms[21] (age 0 firms) relative to the total number of private sector firms in the industry I at t. The second one, the startup employment share, is defined as the employment at new firms relative to the total private employment in the industry I at t. The administrative and fiscal nature of the data employed in this paper is crucial for this entry analysis. The frequency and coverage of the information facilitate the identification of the entry and the corresponding timing, without being susceptible to attrition biases related to survey or rotating panel data. X_I controls for heterogeneity in the 2006-2007 period by including industry-level characteristics (export and import share, labor share, capital share, profitability, employment level), I include 2-digit industry and year dummies and I use robust standard errors.

5 Estimation Results

First, Table 7 reports the dynamic responses following equation (1) and Table 8 the respective elasticities, i.e., the percent change in the outcome variable due to a one percent increase in the labor costs induced by the minimum wages[22]. Table 7 also reports the first-stage F-statistics and the overidentification tests. The F-statistics greatly exceeds different critical values (e.g., Stock-Yogo weak ID test critical values), confirming a robust

[20]The procedure to construct the exposure measure and its instrument follows the same strategy but I consider an *industry* as the unit of analysis instead of a *firm*.

[21]I use the employer-employee dataset (CR-LEED) and the firm-level information (REVEC) to precisely identify the entry, exit of firms, and the respective timing. The administrative nature of the information is a crucial advantage to truly capture firm entry and exit, as other papers rely on surveys that naturally introduce additional noise. More details in Section 3 and Appendix A.

[22]Dube (2019a) explains that this elasticity has been extensively used, mostly to report disemployment effects, because it accounts for the minimum wage's bindingness. Moreover, these elasticities facilitate the comparison across studies.

first-stage. Furthermore, for all horizons the overidentification tests do not reject the null hypothesis of no misspecification. More precisely, the null establishes that the instruments are valid, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.

Table 7: Firm Outcome Responses to Minimum Wage Exposure

	Horizon (Year)					
	0	1	2	3	4	5
Wage Bill	0.135*	0.358*	0.577*	0.783*	0.944*	0.998*
	(0.012)	(0.021)	(0.026)	(0.031)	(0.036)	(0.040)
Labor Share	0.092*	0.211*	0.305*	0.417*	0.450*	0.439*
	(0.017)	(0.026)	(0.031)	(0.036)	(0.040)	(0.043)
Employment	-0.012	-0.041*	-0.059*	-0.086*	-0.119*	-0.125*
	(0.013)	(0.020)	(0.023)	(0.026)	(0.030)	(0.035)
Capital	-0.018	0.106*	0.225*	0.340*	0.408*	0.418*
	(0.024)	(0.038)	(0.050)	(0.059)	(0.069)	(0.079)
Capital-Labor Ratio	0.034	0.130*	0.257*	0.369*	0.437*	0.519*
	(0.021)	(0.038)	(0.052)	(0.061)	(0.068)	(0.079)
Profitability	-0.013*	-0.035*	-0.050*	-0.058*	-0.071*	-0.087*
	(0.005)	(0.008)	(0.010)	(0.012)	(0.014)	(0.016)
Revenues	0.030*	0.100*	0.196*	0.273*	0.349*	0.377*
	(0.012)	(0.020)	(0.026)	(0.031)	(0.035)	(0.038)
Value-Added per Worker	-0.001	0.016	0.063*	0.084*	0.113*	0.138*
	(0.021)	(0.025)	(0.029)	(0.033)	(0.037)	(0.039)
Exit Probability	0.115*	0.115*	0.093*	0.081*	0.081*	0.064*
	(0.009)	(0.011)	(0.012)	(0.012)	(0.013)	(0.013)
Observations	142,360	120,310	101,791	85,657	71,258	57,805
F-Statistic	4,815.2	3,318.4	383.2	288.9	205.2	145.7
Overidentification Test	[0.219]	[0.127]	[0.128]	[0.505]	[0.942]	[0.571]

Notes: Table shows the log changes in the outcome variable to a one p.p. increase in minimum wage exposure, following equation (1). Robust standard errors in parenthesis. Overidentification test reports the p-value (in brackets) for the null hypothesis that the instruments are valid (no misspecification). * p<0.05

Table 8: Firm Outcome Elasticities to Minimum Wage Exposure

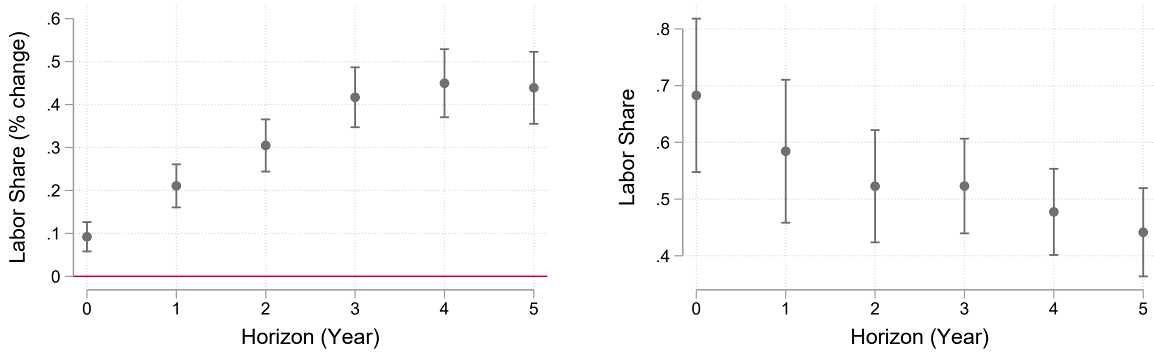
	Horizon (Year)					
	0	1	2	3	4	5
Labor Share	0.683*	0.584*	0.523*	0.523*	0.477*	0.442*
	(0.069)	(0.064)	(0.050)	(0.043)	(0.039)	(0.040)
Employment	-0.050	-0.117*	-0.107*	-0.12*	-0.137*	-0.147*
	(0.060)	(0.056)	(0.044)	(0.036)	(0.034)	(0.038)
Capital	-0.062	0.296*	0.393*	0.437*	0.438*	0.43*
	(0.131)	(0.109)	(0.093)	(0.080)	(0.075)	(0.082)
Capital-Labor Ratio	0.261	0.365*	0.445*	0.469*	0.463*	0.517*
	(0.157)	(0.106)	(0.092)	(0.077)	(0.072)	(0.079)
Profitability	-0.097*	-0.099*	-0.089*	-0.078*	-0.075*	-0.085*
	(0.029)	(0.021)	(0.017)	(0.016)	(0.014)	(0.015)
Revenues	0.223*	0.281*	0.343*	0.354*	0.372*	0.371*
	(0.065)	(0.050)	(0.040)	(0.036)	(0.032)	(0.035)
Value-Added per Worker	-0.006	0.047	0.116*	0.119*	0.127*	0.155*
	(0.089)	(0.069)	(0.052)	(0.044)	(0.040)	(0.042)
Observations	142,360	120,310	101,791	85,657	71,258	57,805

Notes: Table shows the the percent change in the outcome variable due to a one percent increase in the labor costs induced by the minimum wage. Bootstrapped standard errors in parenthesis, computed after 1,000 iterations. * p<0.05

5.1 Minimum Wages and the Labor Share

Higher minimum wages induce firms to increase their labor shares. As shown in Figure 9, the associated elasticity peaks in the first years (0.67) and declines in magnitude to a value of 0.45 five years after the initial minimum wage change. Put differently, a one percent increase in the labor costs induced by the minimum wage increases firm-level labor shares by 0.45-0.67 percent.

Figure 9: Minimum Wages and Labor Shares



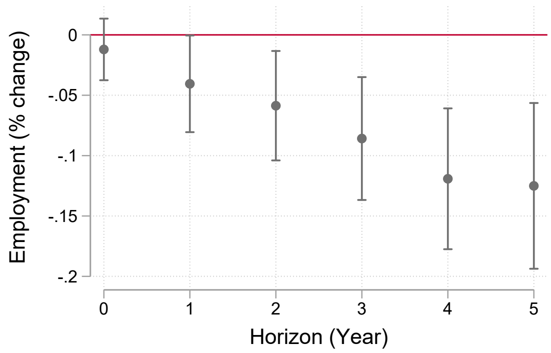
(a) Impulse Responses

(b) Elasticities w.r.t. Labor Costs

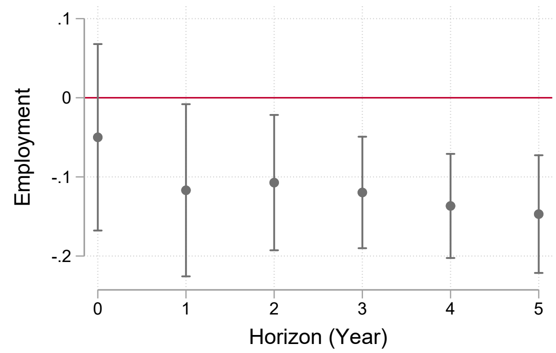
Notes: Figure on the left shows the response to a one percentage point in firm-level minimum wage exposure, calculated using equation (1), including 95 percent confidence intervals estimated using robust standard errors. Figure on the right shows the associated elasticity (percent change in the outcome variable due to one percent increase in the labor costs induced by the minimum wage) and 95 percent confidence intervals estimated using boostrapped standard errors

This behavior is explained by firms implementing input demand adjustments as the horizon extends. As described in Figure 10, raising minimum wages cause firms to reduce their employment levels and increase their capital-labor ratios. Nevertheless, employment adjustment is relatively small. After the first two years following the minimum wage change, the employment reduction materializes, and the associated elasticity stabilizes around -0.14. On the contrary, minimum wage exposure leads to greater capital adoption, with capital elasticities between 0.30 and 0.44. Despite the increase in capital-labor ratios, the minimum wage effects on the labor share are persistently positive in the longer-term. The small disemployment effects precisely explain such persistence.

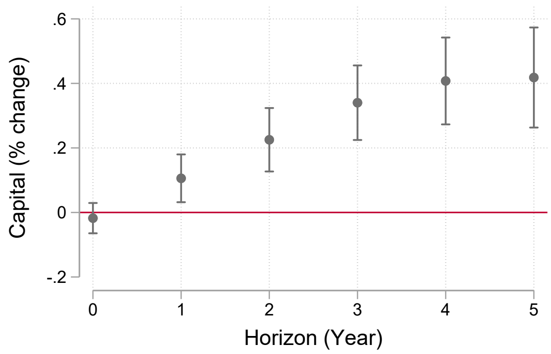
Figure 10: Minimum Wages, Employment and Capital Stock



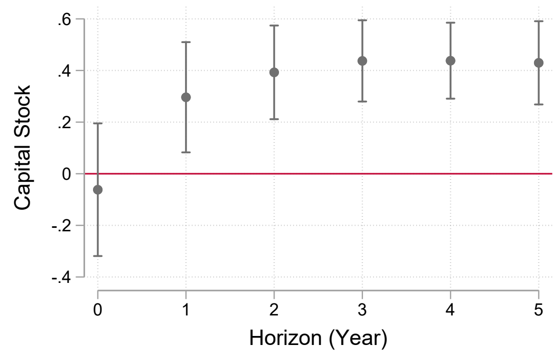
(a) Impulse Responses



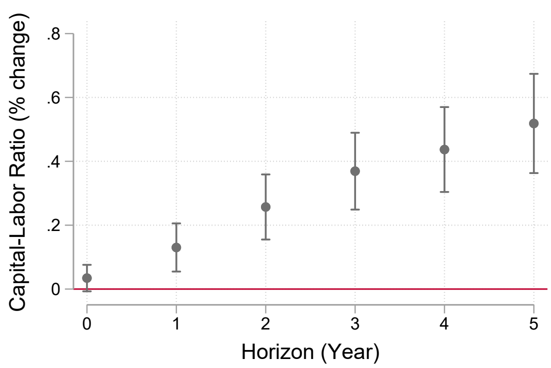
(b) Elasticities w.r.t. Labor Costs



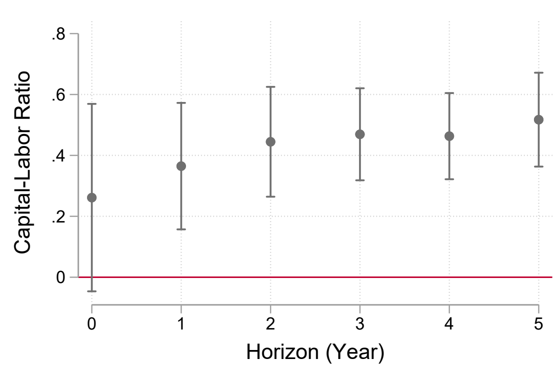
(c) Impulse Responses



(d) Elasticities w.r.t. Labor Costs



(e) Impulse Responses

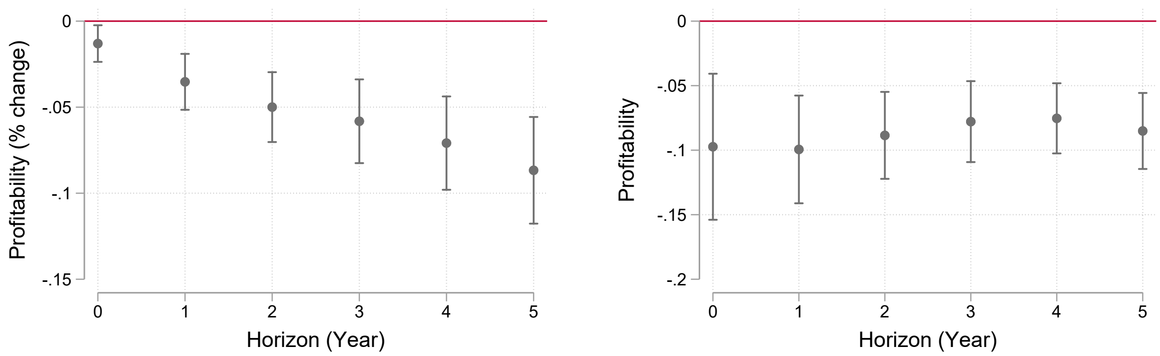


(f) Elasticities w.r.t. Labor Costs

Notes: Figures on the left shows the response to a one p.p. increase in minimum wage exposure, calculated using equation (1), including 95 percent confidence intervals estimated using robust standard errors. Figures on the right shows the respective elasticity (percent change in the outcome variable due to one percent increase in the labor costs induced by the minimum wage) and 95 percent confidence intervals estimated using boostrapped standard errors.

Still, the positive impact on the labor shares is not exempted from a cost. Figure 11 shows that raising the minimum wage negatively impacts firm profitability, with an elasticity of -0.1 after the minimum wage change that slightly moderates but keeps being significantly negative in the longer-term horizons. The contrasting effects of the labor share and firm profitability emphasize the redistributional impact behind minimum wage policies. The recent and expanding literature on labor monopsony power has renewed the attention of minimum wage policies as a redistributional tool to reduce the market rents accumulated by wage-setting employers (e.g., Card et al. (2018); Berger et al. (2019); Manning (2020)). However, recent empirical work using micro-data has provided mixed evidence on the minimum wage effects on firm profitability. For instance, Mayneris et al. (2018); Chen et al. (2019) find no significant impact on profitability.

Figure 11: Minimum Wage Effects on Firm Profitability



(a) Impulse Responses

(b) Elasticities w.r.t. Labor Costs

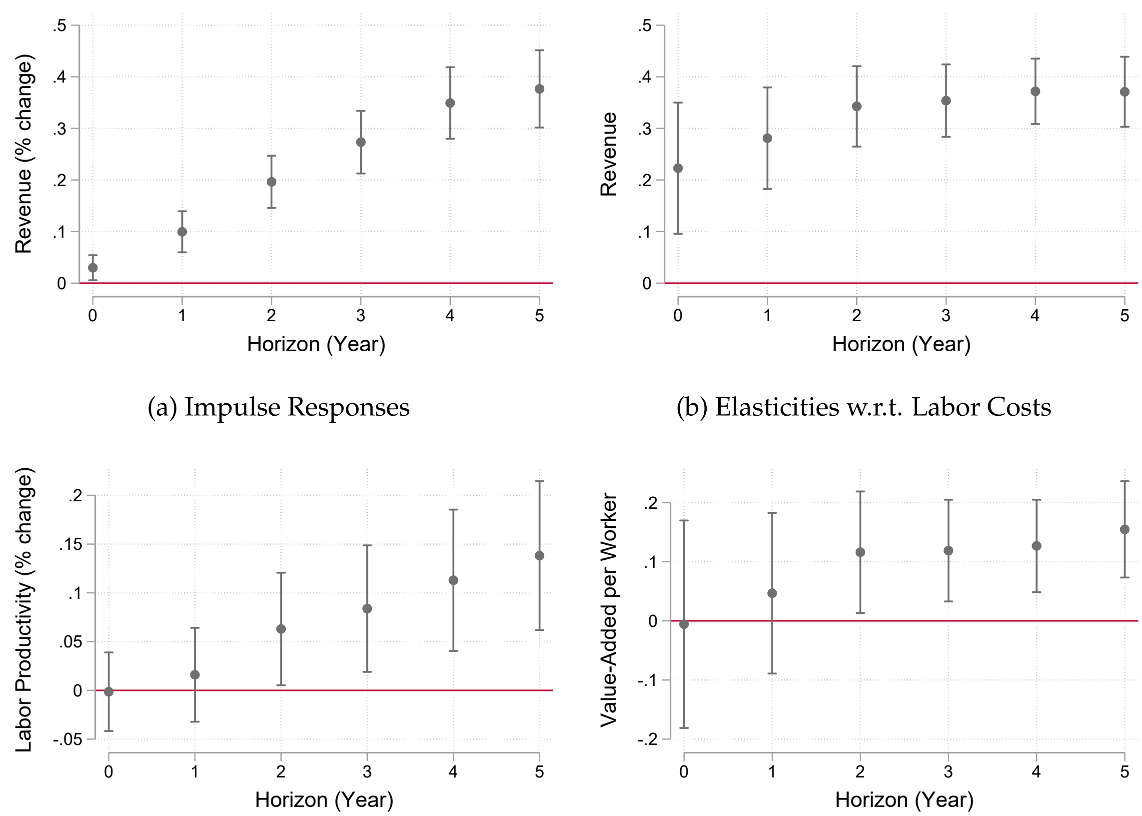
Notes: Figures on the left shows the response to a one p.p. increase in minimum wage exposure, calculated using equation (1), including 95 percent confidence intervals estimated using robust standard errors. Figures on the right shows the respective elasticity (percent change in the outcome variable due to one percent increase in the labor costs induced by the minimum wage) and 95 percent confidence intervals estimated using boostrapped standard errors.

One important argument that has fueled substantial disagreement on the minimum wage impact on the labor share is that minimum wages could reduce firm revenues. From a neoclassical perspective, higher labor costs lead to output declines associated with the disemployment effects. However, larger capital adoption, productivity improvements and product price increases could offset such a reduction. Figure 12 shows the revenue and labor productivity responses[23], precisely highlighting positive and significant increases in revenues after minimum wage increases, jointly with labor productivity improvements. The revenue responses further suggest that the output demand channel is a

[23]This labor productivity improvement is consistent with (Hau et al., 2020) arguing that firms adopt better managerial practices due to the minimum wage's competitive pressures, and (Coviello et al., 2018) showing that workers perform better when their employers raise their wages.

relevant adjustment channel. Firms exercise their market power to adjust prices. Future work is oriented on analyzing this adjustment mechanism.

Figure 12: Minimum Wages, Revenues and Labor Productivity



(a) Impulse Responses

(b) Elasticities w.r.t. Labor Costs

(c) Impulse Responses

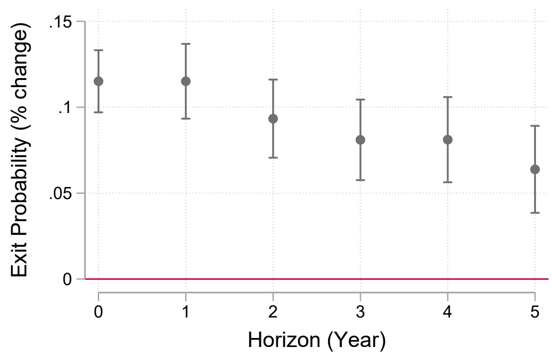
(d) Elasticities w.r.t. Labor Costs

Notes: Figures on the left shows the response to a one p.p. increase in minimum wage exposure, calculated using equation (1), including 95 percent confidence intervals estimated using robust standard errors. Figures on the right shows the respective elasticity (percent change in the outcome variable due to one percent increase in the labor costs induced by the minimum wage) and 95 percent confidence intervals estimated using boostrapped standard errors.

5.2 Minimum Wages and Firm Exit

Now, I examine the policy's effect on firm exit. As documented previously, the minimum wages have a negative and persistent impact on profitability, which is unlikely to be bearable for all firms, especially those operating closer to the exit margin. Figure 13 shows suggestive evidence that firm exit represents a relevant adjustment mechanism. A one percentage point increase in minimum wage exposure translates to an 11.5 percent increase in exit probability during the first two years after the minimum wage adjustment. The impact declines in magnitude to stabilize around 6.5-8.0 percent in the longer-term. This behavior hints that higher labor costs induce firms to either adjust their production process or leave the market altogether. Despite there is greater consensus on an increase in firm exit after minimum wage hikes, recent empirical work extending the analysis beyond restaurants have provided mixed results. Harasztosi and Lindner (2019), for Hungary and Giupponi and Machin (2018) for the U.K., for instance, report no significant change in firm exit after minimum wage increases.

Figure 13: Minimum Wage Impact on Firm Exit



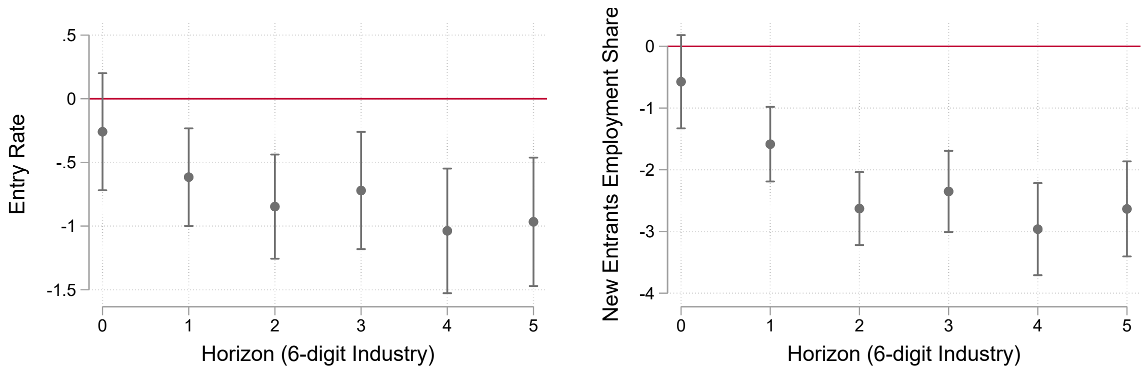
Notes: Figure shows the percentage increase in the probability of exit associated to one percent increase in minimum wage exposure, alongside 95% confidence intervals estimated from robust standard errors.

5.3 Minimum Wages and Firm Entry

Now, I focus on the minimum wage incidence on firm entry. As discussed in Section 4, I aggregate the data to industry levels[24] to conduct the regression analysis specified in equation (2). Overall, results reveal that higher minimum wages have a negative and longstanding effect on the number and size of new entrants. Table 9 and Figure 14 show that a percentage point increase in the cost of compliance is associated with a decrease in the startup rate between 0.6 and 1.0 and a negative impact on startup employment shares between 1.6 and 2.6 percent.

[24] Figure B.4 shows that the results are robust to different industry aggregation levels.

Figure 14: Minimum Wage Exposure and Firm Entry



Notes: Figures show the percent change in the entry rate associated to a one p.p. increase in minimum wage exposure, alongside 95% confidence intervals. Regressions include industry-level controls and 2-digit industry and year dummies.

Table 9: Minimum Wages and Firm Entry Rate Changes

	Horizon (Year)					
	0	1	2	3	4	5
	4-Digit ISIC Industry Codes					
Entry Rate	-0.347	-0.825*	-0.898*	-0.698*	-0.892*	-0.898*
	(0.238)	(0.198)	(0.216)	(0.245)	(0.266)	(0.263)
Startup Employment Share	-0.868*	-2.21*	-2.68*	-2.661*	-3.404*	-3.015*
	(0.410)	(0.315)	(0.306)	(0.345)	(0.395)	(0.396)
Observations	1,507	1,370	1,233	1,096	959	822
F-Statistic	2,166.8	1,493.3	172.4	130.0	92.3	65.6
Overidentification Test	[0.664]	[0.92]	[0.409]	[0.655]	[0.78]	[0.795]
	5-Digit ISIC Industry Codes					
Entry Rate	-0.332	-0.772*	-0.826*	-0.681*	-0.785*	-0.899*
	(0.232)	(0.193)	(0.213)	(0.239)	(0.260)	(0.257)
Startup Employment Share	-0.706	-1.898*	-2.484*	-2.341*	-2.738*	-2.705*
	(0.381)	(0.305)	(0.300)	(0.338)	(0.381)	(0.386)
Observations	2,079	1,890	1,701	1,512	1,323	1,134
F-Statistic	2,311.3	1,592.8	183.9	138.7	98.5	70.0
Overidentification Test	[0.42]	[0.752]	[0.088]	[0.411]	[0.207]	[0.117]
	6-Digit ISIC Industry Codes					
Entry Rate	-0.259	-0.616*	-0.847*	-0.721*	-1.038*	-0.966*
	(0.235)	(0.195)	(0.209)	(0.235)	(0.250)	(0.257)
Startup Employment Share	-0.574	-1.586*	-2.629*	-2.351*	-2.963*	-2.635*
	(0.385)	(0.308)	(0.301)	(0.336)	(0.381)	(0.393)
Observations	2,574	2,340	2,106	1,872	1,638	1,404
F-Statistic	2,359.4	1,626.0	187.8	141.6	100.5	71.4
Overidentification Test	[0.598]	[0.932]	[0.264]	[0.121]	[0.088]	[0.313]

Notes: Table shows the percentage change of startup (entry) rates and startup employment shares (fraction of total employment in age 0 firms) to one p.p. increase in minimum wage exposure at the industry level, following equation (2). Robust standard errors in parenthesis. Overidentification test reports the p-value (in brackets) for the null hypothesis that the instruments are valid (no misspecification). * p<0.05

5.4 Robustness Tests

Tables 10 and 11 provide a first set of robustness exercises for the results from estimating equation (1). Column 1 shows the baseline estimation. Columns 2 and 3 include one and two lags of minimum wage exposure, accounting for lagged minimum wage adjustments. Column 4 restricts to a balanced panel, exploring for compositional changes that could be driving the longer-term responses. Overall, the point estimates do not show strong difference between the specifications.

Table 10: Dynamic Responses Under Different Specifications

	Baseline (1)	One Lag (2)	Two Lags (3)	Balanced (4)
	Wagebill			
1	0.358*	0.355*	0.365*	0.457*
	(0.021)	(0.021)	(0.024)	(0.024)
Obs	120,310	117,460	102,474	105,719
3	0.783*	0.783*	0.757*	0.818*
	(0.031)	(0.031)	(0.036)	(0.032)
Obs	85,657	76,322	71,878	81,835
5	0.998*	1.011*	1.037*	0.998*
	(0.040)	(0.041)	(0.054)	(0.040)
Obs	57,805	47,353	46,667	57,805
	Employment			
1	-0.041*	-0.042*	-0.045	-0.001
	(0.020)	(0.020)	(0.025)	(0.023)
3	-0.086*	-0.087*	-0.097*	-0.087*
	(0.026)	(0.026)	(0.031)	(0.027)
5	-0.125*	-0.122*	-0.121*	-0.125*
	(0.035)	(0.035)	(0.043)	(0.035)
	Capital			
1	0.106*	0.111*	0.159*	0.158*
	(0.038)	(0.038)	(0.045)	(0.046)
3	0.340*	0.340*	0.417*	0.387*
	(0.059)	(0.059)	(0.071)	(0.062)
5	0.418*	0.428*	0.576*	0.418*
	(0.079)	(0.080)	(0.102)	(0.079)

Notes: Table shows estimated coefficients following equation (1). Columns 2 and 3 include one and two lags of minimum wage exposure. Column 4 restricts to a balanced panel. Robust standard errors in parenthesis.

Table 11: Dynamic Responses Under Different Specifications (Cont.)

	Baseline (1)	One Lag (2)	Two Lags (3)	Balanced (4)
	Revenues			
1	0.100*	0.097*	0.123*	0.169*
	(0.020)	(0.020)	(0.025)	(0.023)
3	0.273*	0.273*	0.269*	0.311*
	(0.031)	(0.031)	(0.036)	(0.032)
5	0.377*	0.385*	0.378*	0.377*
	(0.038)	(0.039)	(0.052)	(0.038)
	Profitabilitly			
1	-0.035*	-0.035*	-0.041*	-0.040*
	(0.008)	(0.008)	(0.010)	(0.009)
3	-0.058*	-0.058*	-0.058*	-0.065*
	(0.012)	(0.012)	(0.014)	(0.013)
5	-0.087*	-0.089*	-0.101*	-0.087*
	(0.016)	(0.016)	(0.020)	(0.016)
	Firm Exit			
1	0.115*	0.114*	0.103*	0.032*
	(0.011)	(0.011)	(0.013)	(0.008)
3	0.081*	0.081*	0.093*	0.043*
	(0.012)	(0.012)	(0.014)	(0.010)
5	0.064*	0.064*	0.074*	0.064*
	(0.013)	(0.013)	(0.016)	(0.013)

Notes: Table shows estimated coefficients following equation (1). Columns 2 and 3 include one and two lags of minimum wage exposure. Column 4 restricts to a balanced panel. Robust standard errors in parenthesis.

6 Implications

6.1 Elasticity of Substitution Between Capital and Labor

The firm-level labor share response to higher minimum wages depends on two main forces: the capital-labor substitution and the increase in wages induced by the policy. As explained by (Elsby et al., 2013), the production function technology determines the final effect. Specifically, the relationship between the labor share and the capital-labor ratios can be associated with the elasticity of substitution between capital and labor $\left(\sigma_{KL} = \frac{d\ln(K/L)}{d\ln(w/r)}\right)$. Under a Cobb-Douglas production function ($\sigma_{KL} = 1$), minimum wage increases would not have an impact on the labor share. In contrast, if labor is less substitutable than in the Cobb-Douglas case ($\sigma_{KL} < 1$), then the labor share would be increasing in the capital-labor ratio (and vice versa).

Therefore, I estimate a simple input demand model with imperfect competition in the output market based on Hamermesh (1993). In this framework, firms operate in monopolistic competition and they use capital and labor[25] to produce their differentiated good. The model provides intuition and connects the estimated reduced-form elasticities with two key structural parameters. The first one is, the elasticity of substitution between capital and labor, measuring the ease of substituting labor for capital within the production process. The second one is the absolute value of the output demand elasticity η, governed by the firm's constant markup. The elasticity of labor demand with respect to the minimum wage is:

$$\varepsilon^{L}_{MW} = -s_L\eta - (1 - s_L)\sigma_{KL} \tag{3}$$

The first term ($-s_L\eta$) is the scale effect, underscoring the output demand as a factor shaping the disemployment effects associated with the policy. Higher labor costs induce firms to reduce their employment levels, determined by the relative importance of labor (s_L). However, firms also increase their product prices. If the demand is inelastic enough ($\eta < 1$), revenues increase, reducing the employment demand adjustments. The second term ($(1 - s_L)\sigma_{KL}$) is the substitution effect. As minimum wages increase, capital becomes relatively cheaper, triggering input substitution.

Similarly, the capital elasticity with respect to the minimum wage combines the scale effect and the degree of substitutability between capital and labor:

$$\varepsilon^{K}_{MW} = (1 - s_L)(\sigma_{KL} - \eta) \tag{4}$$

Finally, the revenue response will combine both the change in prices and the change in quantities associated with higher minimum wages:

$$\varepsilon^{R}_{MW} = s_L(1 - \eta) \tag{5}$$

The output elasticity of demand determines the sign of the revenue response. An inelastic demand ($\eta < 1$) indicates that revenues do not fall in response to higher prices.

I use the labor share of value added s_L observed in the data and the estimated mini-

[25] I abstract from other inputs such as materials to think in terms of value-added. Harasztosi and Lindner (2019) include materials in the same framework, which imposes an additional simplified structure that could be problematic, as it ignores simultaneous interactions between the three inputs. In fact, these authors estimate intermediate-input elasticities of substitution of zero and capital-labor elasticities between 2.3 and 3.4, outside the range found in the related literature. Future work, however, will be oriented in a structural model including these three inputs and more realistic features.

mum wage elasticities ($\varepsilon^L_{MW}, \varepsilon^K_{MW}, \varepsilon^R_{MW}$) to estimate the structural parameters $\Theta = (\eta, \sigma_{KL})$ by matching the elasticities predicted by the model and the empirical elasticities:

$$\hat{\Theta} = \arg\min_{\Theta} \left(m(\Theta) - \hat{m}\right)' W \left(m(\Theta) - \hat{m}\right)$$

With $m(\Theta)$ the vector of minimum wage elasticities as function of parameters Θ, $\hat{m}$ the vector of the empirical elasticities and W a weigthing matrix (variance-covariance matrix).

Table 12: Labor Demand Model Estimation

	All	**Manufacturing**	**Tradable**	**Non-Tradable**
		Outcome elasticities		
Employment Elasticity	-0.110	-0.115	-0.116	-0.088
Revenue Elasticity	0.35	0.31	0.28	0.40
Capital Elasticity	0.47	0.54	0.51	0.40
Share of Labor s_L	0.54	0.44	0.46	0.56
		Estimated Parameters		
Capital-Labor Substitution σ_{KL}	0.585	0.813	0.757	0.461
	(0.05)	(0.08)	(0.07)	(0.05)
Output Demand Elasticity η	0.095	0.116	0.154	0.053
	(0.13)	(0.14)	(0.13)	(0.13)
SSE	0.207	0.213	0.185	0.220

Notes: Table shows the estimated parameters of the labor demand model based on Hamermesh (1993), using a minimum-distance estimator. Standard errors in parenthesis and SSE denotes the weighted sum of squared errors.

Table 12 summarizes the main results and reports significant heterogeneity in the estimated elasticities and parameters across three main groups: all firms, manufacturing, and restaurants and retail. The estimated capital-labor elasticity of substitution is consistently below 1, in line with the estimated positive impact of minimum wages on the labor share. The computed value for all firms is 0.59 (s.e. 0.05). Manufacturing (0.81, s.e. 0.08) and tradable sectors (0.76, s.e. 0.07) exhibit a larger elasticity, while non-tradable sectors a smaller value (0.46, s.e. 0.05). This pattern is consistent with manufacturer workers more likely to perform routine tasks that are more substitutable for capital. But moreover, manufacturing firms produce more tradable goods, so the price adjustment channel is more limited than in services and non-tradable industries, stressing the input demand adjustment channel. The estimated elasticity of demand η supports this argument: the demand seems less inelastic in manufacturing and tradable sectors.

One additional advantage of estimating the capital-labor elasticity of substitution is that I can compare my results with the related literature more easily. Harasztosi and Lindner (2019) estimate an aggregate elasticity (including all firms) around 3.35, significantly higher than most of the literature estimating such a parameter under diverse contexts and strategies. Karabarbounis and Neiman (2014) calculate a value of 1.25 based on cross-country variation. Chen et al. (2019) estimates a value of 0.85 for the U.S. manufacturing sector within a minimum wage context.

6.2 Entry Dynamics and Aggregate Employment

I exploit the minimum wage policy to underline new entrants' relative importance in shaping aggregate employment dynamics. As discussed by Karahan et al. (2019), startups or age 0 firms are central elements of job creation. A decline in startup activity has dynamic consequences on aggregate employment by shifting the firm-age distribution of employment towards a more mature structure that, by nature, exhibit lower employment growth rates. I take the data and the results to a dynamic framework of aggregate employment developed by Pugsley and Şahin (2019). This model isolates the dynamic effects of startup activity and provides conditions to compute counterfactual levels compensating for the minimum wage's adverse effects on entry behavior.

Consider three main groups: startups, young firms y (1-10 years) and mature firms m (11 years and more). Let E_t^y, E_t^m and S_t the employment in young, mature and startups, respectively. Then, aggregate employment is $E_t = S_t + E_t^y + E_t^m$ and employment at each age group follows a law of motion:

$$
\begin{aligned}
E_t^S &= S_t \\
E_t^y &= \left(S_{t-1} + q_{t-1}^y E_{t-1}^y\right) x_t^y \left(1 + n_t^y\right) \\
E_t^m &= \left(\left(1 - q_{t-1}^y\right) E_{t-1}^y + E_{t-1}^m\right) x_t^m \left(1 + n_t^m\right)
\end{aligned}
$$

Where $q_{t-1}^y = \frac{\sum_{i=1}^9 E_{t-1}^i}{E_{t-1}^y}$, denotes the fraction of age group y employment in year $t-1$ that remains in the y group in year t, x_t^y and $x_t^m$are the firm survival rates. n_t^y and n_t^m captures the conditional employment growth rate. Let $\mathbf{E}_t = \left(S_t, E_t^y, E_t^m\right)'$the employment distribution across the age groups. Hence, the law of motion of the employment distribution follows:

$$\mathbf{E}_t = P_t' \mathbf{E}_{t-1} + (1,0,0)' S_t \tag{6}$$
$$\mathbf{E}_t = \sum_{j=0}^{\infty} \left(\prod_{k=0}^{j-1} P_{t-k} \right) (1,0,0)' S_{t-j}$$

Therefore, the employment distribution is shaped by entrant dynamics (S_t) and incumbent lifecycle dynamics (P_t). In particular, P_t is a transition matrix including survival rates (x_t^y, x_t^m) and conditional (on surviving) employment growth rates (n_t^y, n_t^m):

$$P_t \equiv \begin{bmatrix} 0 & x_t^y \left(1+n_t^y\right) & 0 \\ 0 & q_{t-1}^y x_t^y \left(1+n_t^y\right) & \left(1-q_{t-1}^y\right) x_t^m \left(1+n_t^m\right) \\ 0 & 0 & x_t^m \left(1+n_t^m\right) \end{bmatrix}$$

Then, a decline in new entrant activity drives a reallocation of employment towards incumbent firms, especially mature firms. If these incumbent firms exhibit slower growth rates, then employment growth would decline, expanding the effects of a decline in entry activity over time. More precisely, for the aggregate employment growth g_t, have:

$$g_t = \underbrace{s_{t-1}\left(1+g_t^s\right)}_{\text{Startup employment contribution}} + \underbrace{\left(1-\omega_{t-1}\right) g_t^y + \omega_{t-1} g_t^m}_{\text{Incumbent growth contribution}}$$
$$g_t = g_t^s \omega_t^s + (1-\omega_t^m) g_t^y + \omega_t^m g_t^m$$

Where $g_t^s = \frac{S_t}{S_{t-1}}$ is the gross rate, and ω_{t-1} measures the employment share of the current year t mature cohort in the previous year $t-1$:

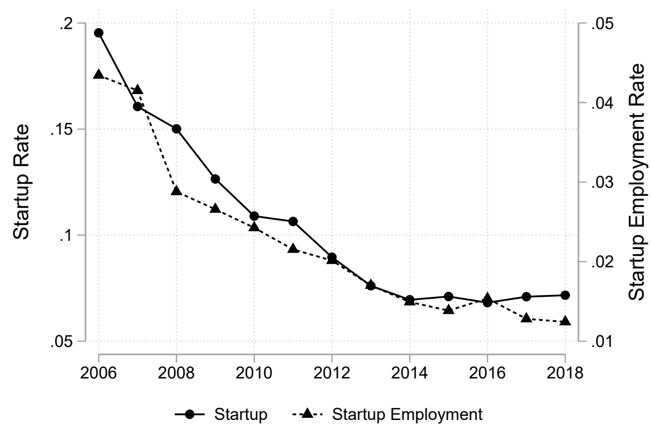
$$\omega_{t-1} = \frac{E_{t-1}^m + \left(1-q_{t-1}\right) E_{t-1}^y}{E_{t-1}}$$

Then, aggregate employment dynamics are the result of the contribution of startups and incumbents. Furthermore, the incumbent contribution is both the combination of mature firm dynamics and young firms. Some of these young firms are precisely startups that survived their first year in the market. A startup deficit, then, has an immediate and direct impact on aggregate employment growth through g_t^s and, if $g_t^s \neq g_t^y \neq g_t^m$, it has a lagged and growing effect through increases in the incumbent mature employment share ω_{t-1} and declines in the startup employment share s_{t-1}.

I exploit equation (6) to isolate the adverse effects of the new entrants decline induced by the minimum wage on aggregate employment. I estimate the effect of minimum wages on startup employment based on equation (2). Afterward, I compute a counterfactual sequence of startup employment $\{S_t^c\}_{t\geq 2008}$, defined as the startup employment excluding the estimated effect from the minimum wage. Then, I compute $\mathbf{E}_t^c = \left(S_t^c, E_t^{y,c}, E_t^{m,c}\right)'$ by solving forward equation (6) and using the actual P_t observed from the data. Finally, I get E_t^c, the aggregate employment level without the minimum wage effect on startups, and assuming no change in survival and conditional growth rates for young and mature firms from adding the missing entrants. I will later show that the computed average growth rates in the transition matrix are relatively stable over the analyzed period. Since I am using the actual transition matrix P_t, I am not entirely shutting down the minimum wage effects on aggregate employment as it could have some adverse impact on the incumbent margins. The counterfactual can be thought of as the economy we would have expected if the minimum wage did not decrease startups while other effects are still in place.

Similarly to the trend documented for the U.S. by recent empirical work (e.g., Haltiwanger et al. (2013); Decker et al. (2014); Pugsley and Şahin (2019)), Costa Rica also experienced a downward trend in the business creation rates, as highlighted by Figure 15.

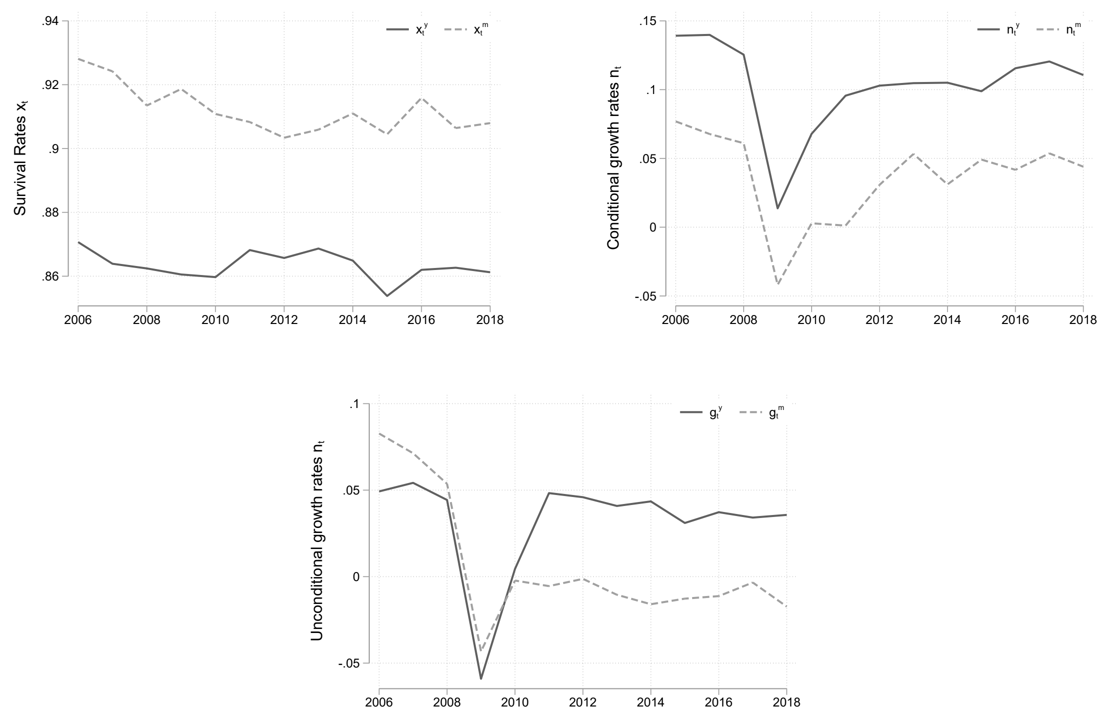
Figure 15: Startup Rates and Startup Employment Shares



Source: CR-LEED and REVEC

Figure 16 provides the main descriptive statistics on the survival and growth rates across the age groups. Consistent with related studies on firm dynamics, survival rates (x_t^y and x_t^m) are higher for mature firms and procyclical. Still, this rate is relatively stable along the analyzed period and for both the young and mature cohorts. Similarly, conditional on survival, mature firms exhibit lower employment growth rates (n_t^m), offsetting the lower survival rates observed for this age cohort. Both conditional rates are procyclical and, excluding the 2008-2010 period, the rates are stable. A similar dynamic pattern can be observed for the unconditional employment rates (g_t^y and g_t^m), as emphasized by Figure 16.

Figure 16: Minimum Wage Exposure and Firm Entry

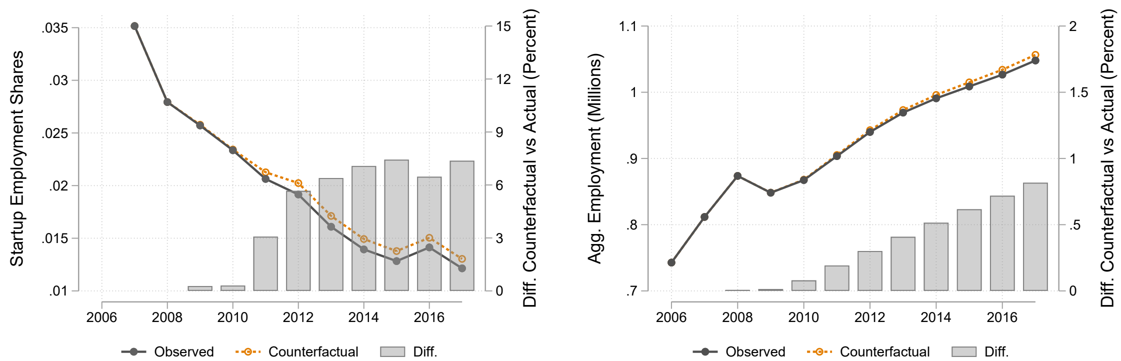


Notes: Figures show the survival rates x_t^a (fraction of young and mature firms that survived from the previous year), the conditional growth rates n_t^a (year-to-year growth rate of the cohort's average employment size) and the unconditional growth rates g_t^a (year-to-year employment growth rate within the age group).

Following the outlined strategy in Section 5, I exploit the results connecting exposure to the minimum wage and startup rates previously discussed to construct a sequence of the counterfactual startup employment rates. Taken 2006 and 2007 as given, I use the actual sequence of transition matrices P_t obtained from the data and the sequence of counterfactual startup employment shares $\{S_t^c\}_{t\geq 2008}$ to solve the model forward using equation (2). In other words, I construct a counterfactual economy in which the minimum wage did not have any incidence on entrants, while the survival and growth rates for young and mature firms do not change from what I empirically observe. Using the actual P_t is partially motivated by the stability in the average growth rates previously reported.

Figure 17 highlights the main results of this exercise. The first panel presents the observed and counterfactual startup employment shares, revealing that compensating for the missing entrants do not change the downward trend. By the end of the period, the difference between the startup employment levels and the counterfactual ones is around 7.3 percent, consistent with the regression results. The second graph shows the impact of the missing entrants due to the minimum wage. By the end of the period, employment would be 0.8 percent higher than the reported levels if there was no adverse incidence coming from the minimum wage.

Figure 17: Counterfactual Analysis on Firm Entry and Minimum Wages



Notes: Figure on the left shows the observed and the counterfactual startup employment shares, estimated based on the results from equation (2) and the dynamic framework described in Section 5.

7 Conclusions

This paper exploits rich administrative datasets to estimate the effects of minimum wages on firms. Costa Rica's distinctive occupation-based minimum wage setting and high binding policy provide unique conditions for exploring different mechanisms. The policy's extensive coverage stretches the analysis to economic sectors in which standard minimum wage policies would not be binding or would have a modest impact. The worker-level detail of the data and the administrative coverage on firms allow me to construct firm-level exposure measures and accurately identify firm entry and exit.

The paper shows that higher minimum wages induce firms to increase their labor shares (proportion of value-added paid to workers). The positive effect moderates as firms reduce their employment levels and increase their capital-labor ratios by expanding their capital stocks. Moreover, minimum wage increases hurt firm profitability, stressing the policy's redistributional effects. In other words, raising the minimum wage leads to a transfer of rents from firms (lower profits) to workers (higher labor shares). The paper also finds that firms increase their revenues and report labor productivity improvements, suggesting that the firm output does not significantly decline in response to the policy and supporting the estimated positive impact in the labor share.

Regarding business dynamics, this paper establishes that firm exit is an important adjustment channel for firms. The paper also documents athat higher minimum wages reduce the number and the size of new entrants. I exploit this incidence to emphasize the role of new firms in shaping aggregate employment dynamics. I find that aggregate employment is 0.8 percent lower due to the missing entrants induced by the policy.

The paper represents a necessary first step for a rich research agenda on the macroeconomic impact of minimum wages. For example, despite the disemployment effects on surviving firms being small, higher minimum wages could have sizeable employment flows (job-to-job transitions, hiring, and separation rates). Work in progress is addressing this research question. Besides, the estimated firm responses represent valuable inputs to develop a structural analysis of firm input demand choice under imperfectly competitive labor and product markets. This analysis would shed light on the estimated capital-labor substitution and revenue responses assessed in this paper. In particular, the revenue responses suggest that the output demand channel is relevant in explaining how firms absorb higher minimum wages. Future work is oriented in this direction. Finally, the paper shows that firms respond through multiple mechanisms, potentially leading to ambiguous welfare effects. This paper then opens the door for a general equilibrium analysis to capture the policy's macroeconomic impact. However, this analysis should consider that higher minimum wages increase the income of low-paid workers, which could have additional effects on firms and the aggregate economy through higher consumption rates.

Finally, this paper provides useful information for the vigorous debate around the minimum wage. As shown by the paper, the policy's incidence is multidimensional. The discussion should not limit to disemployment effects exclusively. Moreover, policymakers must consider that labor market regulation, such as minimum wages, represents a burden to firms and a higher entry barrier for startups. A decline in firm creation has sizable employment consequences and can jeopardize social mobility, especially in developing countries.

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Appendix

A Information Sources and Data Construction

This appendix provides details on the datasets used throughout the paper. To access Costa Rica's administrative data, it is necessary to follow a security protocol to protect the confidentiality of the information.

A.1 Monthly Employer-Employee Dataset (CR-LEED)

The first source of information is a monthly linked employer-employee data (CR-LEED) that I construct using raw firm-level monthly records reported to the Costa Rican Social Security Fund and secured by the Central Bank of Costa Rica (BCCR). Each month, employers are required to report accurate information on individual monthly earnings for tax collection and pension contribution purposes. Misreporting is heavily fined, and workers have strong incentives to make sure their information is correct, as otherwise it would negatively impact their future pension and access to social security benefits. The reports' purpose implies that the dataset omits part of the informal sector as it only covers individuals that contribute to social security. The information begins in January 2006 and ends in December 2017.

I exclude from analysis retired workers, self-employed workers and individuals that are voluntarily insured (people that contribute to the system to obtain the various social benefits)[26]. I exclude workers that consistently report a monthly wage of less than 90% the minimum wage minimorum —the lowest legal wage floor[27]. I exclude matches that last less than three consecutive quarters and firms that survive less than three consecutive quarters (around 2% of remaining observations).

The data encompasses individual variables such as the personal legal identifier (*cédula de identidad*), gender, age and nationality. Regarding the characteristics of the job match, the dataset covers the monthly earnings, occupation codes (5 digit codes consistent with the International Standard Classification of Occupations -ISCO[28]), sick-leave

[26]The law establishes a "minimum tax base", a monthly wage that every employer and worker must contribute to access the health and pension system. Such value fluctuated between 50 and 60 percent of the lowest minimum wage.

[27]I exclude them from constructing the minimum wage exposure measures, but I keep them as part of the number of workers employed by the firm when estimating the disemployment and capital/labor substitution effects.

[28]ISCO organizes jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job.

indicator and the geographic location of both the worker and the employer. Likewise, it includes the legal tax identifier of the employer, economic activity and firm type (private company, state-owned, household).

A.2 Corporate Income Tax Returns (REVEC)

The second administrative dataset consists of the universe of corporate income tax declarations from 2005 to 2018. Costa Rica's legislation requires all corporations and individuals with an economic activity to file the D-101 tax declaration (*Declaración Jurada del Impuesto Sobre la Renta*) to the Ministry of Finances. The report combines information on revenues, expenditures (administrative costs, cost of goods sold, capital depreciation, interest payments and others), assets (net and fixed) and profits. Firms are classified with the same legal identifier as the one used for employers in the CR-LEED dataset. The Ministry of Finances imposes significant fines for not filing the tax declarations and several financial institutions and business promoting agencies oblige firms to fulfill their tax obligations to access credit, subsidies and other benefits. Additionally, firms are classified using a 4-digit ISIC Rev. 4 classification code. Moreover, the BCCR internally combines the REVEC with other data sources to include exports, imports, an indicator of whether the firm operates under a Free Trade Zone agreement, among others. This dataset is heavily used by the Central Bank of Costa Rica to produce macroeconomic indicators and guide monetary policy, so different internal divisions correct inconsistencies and check for the robustness of the information.

The BCCR classifies firms into two groups: a corporate group (share ownership) and a firm group (share ownership and behaves as a single firm). Since this structure could introduce some noise into the job flows and the relationship between the minimum wage policy and firm characteristics, I collapse firm groups into a single observation, adding up pertinent measures while keeping fixed characteristics such as sector, location or industry from the firm within the group with the highest sales.

A.3 Minimum Wage Exposure Measure

I followed Sorkin (2018); Crane et al. (2019); Song et al. (2019), Engbom and Moser (2018), Lachowska et al. (2020) and literature within to construct the relevant datasets exploited for the different estimations. I also benefited from guidance by the Economic Research Department and the Economic Analysis Department of the Central Bank of Costa Rica (BCCR) to have a better understanding of the information reported by firms in their raw reports.

I exploit the monthly employer-employee dataset to construct the minimum wage exposure measures. The main challenge is to overcome the lack of hours worked information, which is a limitation that is usually observed in other employer-employee datasets.

Almost all employers consistently report either if the worker is working part-time or is under a paid-leave. I restrict the analysis to workers consistently employed full-time to construct the firm-level exposure measures. Some workers report multiple jobs within a month, so I consider the one with the highest wage. If wages are the same across the employers, then I keep the observation that (i) maximizes the employment spell, (ii) the employer information is also included in the REVEC dataset or (iii) quality of information is higher. Since this paper heavily relies on worker flows and productivity measures, I implement a two-step procedure to clean the unique employer identifiers. Otherwise, I can end up with an overstatement of flows that could bias the results. First, the BCCR identifies groups of firms with common owners and that behave as a single unit. I use this information and treat firms in these groups as a single one by assigning the ID of the firm with the highest sales reported during the entire period of study. The second step follows Sorkin (2018) and comes from the fact that firm identifiers can change because of administrative errors, changes in ownership, and others that were not accurately identified in the first stage. Sizeable groups of workers moving from employer A to employer B in consecutive periods likely reflect errors in the administrative data rather than a genuine set of flows. Hence, I correct employer identifiers by assuming that if 70% or more of employer A's workers moved to employer B, then either employer B is a relabeling of employer A or employer B acquired employer A.

Next, I define an annual dominant employer: the employer for which the worker had the highest total earnings in the calendar year. Afterward, I track the earnings stability across quarters to mark atypical observations (values 5% outside the quarter or the annual average within the employment match). Basically, this involves bonifications[29], overtime payment, sick leaves, and months covering extra pay periods[30]. If the standard deviation of the remaining observations within the quarter is less than 5% the average wage of these remaining observations, then I substitute the atypical value with the average of the remaining months within the quarter, otherwise I exclude these observations from the next steps. Next, I construct quarterly earnings. I code each month into two mutually

[29] Public and a limited fraction of private-sector workers have the *scholar wage*, an extra monthly wage being paid in January to help families to cover school entrance expenses. Additionally, all employers must pay a 13th monthly wage, called the *aguinaldo,* each December to all workers and such a payment is exempted from any payroll and social insurance tax. Consequently, some firms include such extra payment even though it is not mandatory.

[30] For example, when the worker is paid every two weeks, some months will include three payments instead of two.

exclusive categories: full-month (earnings from the employer are in months $t-1$, t and $t+1$) or continuous (if earnings are in months $t-1$ and t or t and $t+1$). I take the average of full-month wages for each quarter. If the worker does not have full-month wages, then the average of continuous wages. I avoid using "discontinuous" months, neither full nor continuous, to construct the quarterly wage. Most of these observations are very transitory job matches that introduce unnecessary noise to the data, and they represent less than 2% of the remaining data.

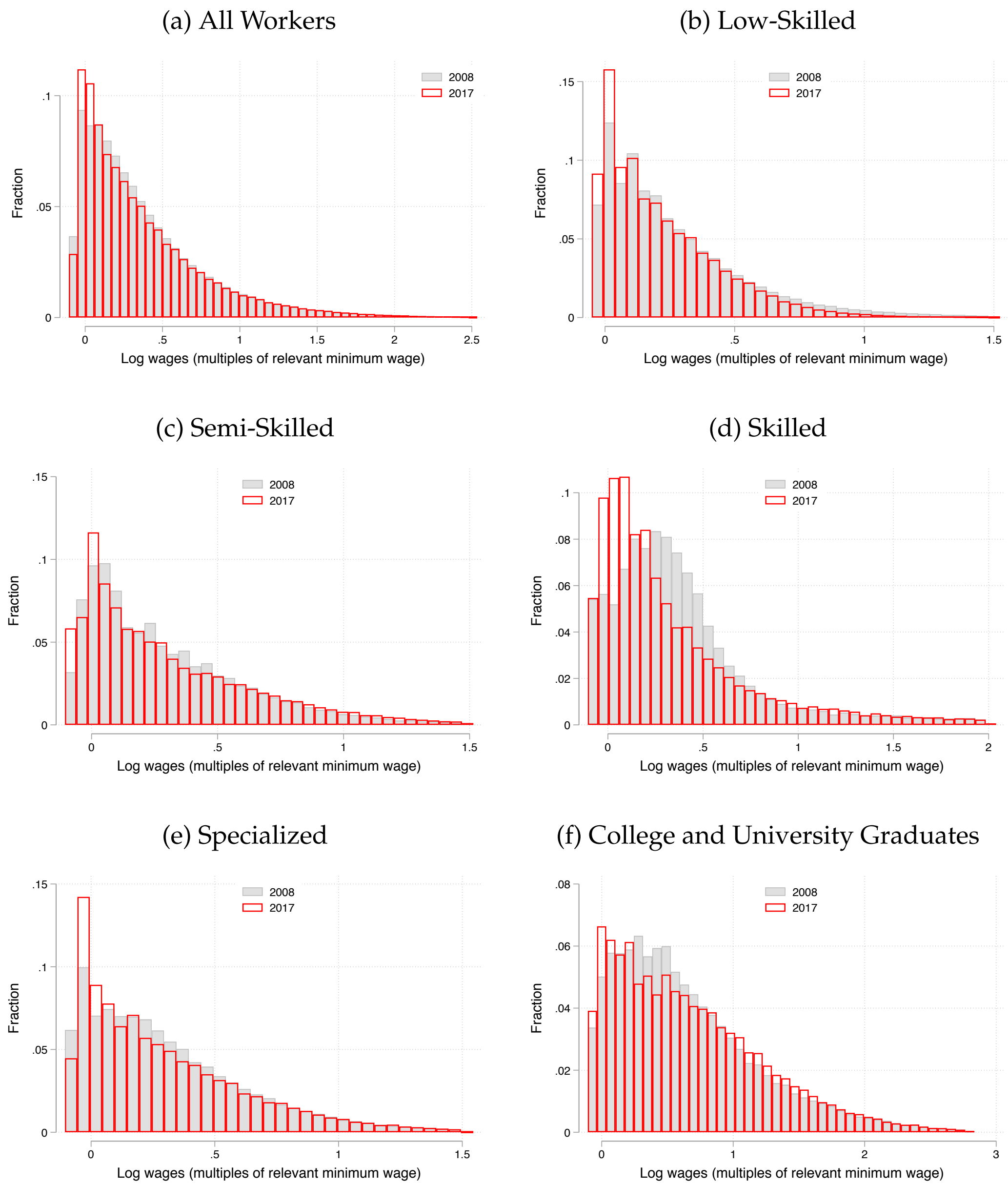
I use the quarterly dataset to estimate minimum wage exposure. I take the quarter wage of each worker in the first quarter of the calendar year, and I estimate the gap between the reported salary and the corresponding minimum wage for the next year.

A.3.1 Classifying occupations according to relevant minimum wage

I use official minimum wage decrees to map the occupation to the corresponding minimum wage. These decrees are highly segregated, consisting of specific information for over 200 occupations (see Appendix B.3 illustrating the information distributed by the Ministry of Labor and Social Security (MTSS) and seen by employers). However, these documents do not have occupational codes consistent with the data, just job titles. To minimize errors, I complement the decrees with a handbook of occupational profiles supplied by the Social Security Fund Administration (CCSS, 2014) that suggests how to connect minimum wages and occupational codes. I also acknowledge the support of the Compliance Assistance Program of the MTSS, an internal division helping workers and firms on how to fulfill the minimum wage requirements, to associate occupations and the respective legal wage floor.

B Supplementary Figures and Tables

Figure B.1: Wage Distribution by Occupational Groups



(a) All Workers

(b) Low-Skilled

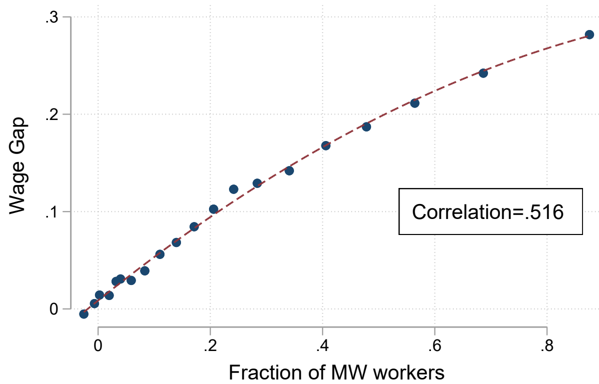
(c) Semi-Skilled

(d) Skilled

(e) Specialized

(f) College and University Graduates

Figure B.2: Employment-based and Wage-based Exposure Measures



Notes: Figure shows the correlation between the employment-based and the wage-based measure of exposure to the minimum wage.

Figure B.3: Minimum Wage Decree, 2017

Panadero	TC	¢	10.877,41
Parrillero	TSC	¢	10.680,80
Pastelero	TC	¢	10.877,41
Pedimentador Aduana, Vapores	TE	¢	12.829,63
Peinadora	TC	¢	10.877,41
Peón Agrícola Labores Livianas	TNC	¢	9.822,07
Peón Agríc Labores Pesadas (6 hrs.)	TNC	¢	9.822,07
Peón de Bodegas Frías	TC	¢	10.877,41
Peón de Camión Distribuidor	TNC	¢	9.822,07
Peón de Carga y Descarga	TNC	¢	9.822,07
Peón de Construcción	TNC	¢	9.822,07
Peón de Jardín	TNC	¢	9.822,07
Peón en General	TNC	¢	9.822,07
Periodista *		¢	775.161,64
Pilero (Lavador de Platos)	TNC	¢	9.822,07
Pintor Automotriz	TE	¢	12.829,63
Pintor de Brocha Gorda	TC	¢	10.877,41
Pistero	TSC	¢	10.680,80
Pizzero (Cocina Pizzas Preparadas)	TSC	¢	10.680,80
Portero *	TNCG	¢	293.132,67
Prensista de Artes Gráficas	TE	¢	12.829,63
Preparador documentos, Ag. Aduana	TE	¢	12.829,63
Programador de Computación	TE	¢	12.829,63
Programador en Radioemisoras	TE	¢	12.829,63
Proveedor *	TCG	¢	331.516,22
Quemador de Marcos (Serigrafía)	TC	¢	10.877,41
Quemador de Planchas	TE	¢	12.829,63
Recamarera	TNC	¢	9.822,07
Recepcionista *	TSCG	¢	315.364,86
Recibidor de docu, Ag. Aduana	TE	¢	12.829,63
Recolectores de Café Cajuela		¢	935,19
Recolectores de Coyol	Kilo	¢	30,75
Relojero	TC	¢	10.877,41
Repartidor de Cargas Livianas	TNC	¢	9.822,07
Repartidor-Propagandista	TNC	¢	9.822,07
Repostero	TC	¢	10.877,41
Sabanero	TNC	¢	9.822,07
Salonero	TNC	¢	9.822,07
Sastre (Prendas a la Medida)	TE	¢	12.829,63
Secretaria *	TCG	¢	331.516,22
Secretaria*	TMED	¢	347.405,37
Secretaria*	DES	¢	462.406,00
Secretaria*	Bach	¢	524.477,85
Secretaria*	Lic	¢	629.395,00
Sellista (Artes Gráficas)	TC	¢	10.877,41
Servicio Doméstico *		¢	178.703,50
Soldador (Soldaduras Especiales)	TE	¢	12.829,63
Soldador en General	TC	¢	10.877,41
Tapicero	TC	¢	10.877,41
Taxista 30% Entradas Brutas (ó si se Interrumpe el Servicio)		¢	11.615,26
Talleres Dentales (Operarios)	TC	¢	10.877,41
Técnico de Educación Superior *	TEdS	¢	428.138,90
Técnico en Aire Acondicionado	TC	¢	10.877,41
Técnico en Aparatos Ortopédicos	TES	¢	19.910,28
Técnico en Lentes de Contacto	TES	¢	19.910,28
Téc. Refrigeración Doméstica-Indus.	TES	¢	19.910,28
Técnico en Registros Médicos *	TCG	¢	331.516,22
Técnico Máq. Coser Ind. Especiales	TES	¢	19.910,28
Técnico Medio Educ. Diversificada *	TMED	¢	347.405,37
Técnico Reparación Audio y Video	TES	¢	19.910,28
Técnicos en Salud *	TEdS	¢	428.138,90
Tejedora Manual de Prendas, Muebles	TC	¢	10.877,41
Telefonista *	TSCG	¢	315.364,86
Tornero en Madera	TC	¢	10.877,41
Tornero en Metal	TE	¢	12.829,63
Tractorista (Oruga o Llanta)	TC	¢	10.877,41
Tramitador - Abridor Aduanal	TSC	¢	10.680,80
Vagonetero	TC	¢	10.877,41
Verdulero	TSC	¢	10.680,80
Zapatero	TC	¢	10.877,41

Estos salarios contienen un incremento del **1.14 %** para todas las categorías del Decreto en relación con los salarios mínimos del periodo anterior, excepto para servicio doméstico ya que se le otorgo un **1.50%.**

Para efectos de los Salarios Mínimos el instrumento para la clasificación de ocupaciones son los Perfiles Ocupacionales aprobados por el Consejo Nacional de Salarios. De conformidad con ellos se ha elaborado esta guía ilustrativa que contiene algunas ocupaciones clasificadas por Personal Técnico del Departamento de Salarios, en el entendido de que se basan en las tareas típicas conocidas, por lo que un puesto determinado podría tener una clasificación distinta según sus características y responsabilidades específicas.

Esta lista está disponible en: www.mtss.go.cr
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MINISTERIO DE TRABAJO Y SEGURIDAD SOCIAL

DEPARTAMENTO DE SALARIOS

Lista de ocupaciones clasificada por el personal técnico del Departamento

SALARIOS MÍNIMOS
SECTOR PRIVADO
PRIMER Y SEGUNDO SEMESTRE 2017

Decreto N°40022-MTSS, publicado en La Gaceta 230, Alcance N°278 del 30 de NOVIEMBRE del 2016. Rige 1º de enero del 2017.

SIGLAS Y SALARIOS MÍNIMOS:

TNC:	Trabajador no Calificado	¢ 9.822,07
TSC:	Trabajador Semicalificado	¢ 10.680,80
TC:	Trabajador Calificado	¢ 10.877,41
TE:	Trabajador Especializado	¢ 12.829,63
TNCG:	Trabajador no Calificado Genéricos	¢293.132,67*
TSCG:	Trabajador Semicalificado Genéricos	¢315.364,86*
TCG:	Trabajador Calificado Genéricos	¢331.516,22*
TMED	Técnico Medio Educación Diver.	¢347.405,37*
TEG:	Trabajador Especializado Genéricos	¢372.288,99*
TEdS:	Técnico de Educación Superior	¢428.138,90*
DES:	Diplomados de Educación Superior	¢462.406,00*
Bach:	Bachiller Universitario	¢524.477,85*
Lic.:	Licenciado Universitario	¢629.395,00*
TES:	Trabajador Especialización Superior	¢ 19.910,28

* **Salario mensual.**
El que no tiene ninguna indicación, está por jornada ordinaria.

CONSULTAS DE SALARIOS AL CORREO:
consulta.salarios@mtss.go.cr
salario.minimo@mtss.go.cr

Para mayor información y debido a que se han hecho circular algunas listas alteradas, se sugiere consultar personalmente en la Oficina de Salarios, en Barrio Tournon del Edif. Benjamín Núñez 50 metros sureste sobre calle paralela, Edificio Anexo, al Ministerio de Trabajo y Seguridad Social, Segundo Piso.

Teléfono: 2256 2221 Fax: 2257 4633.

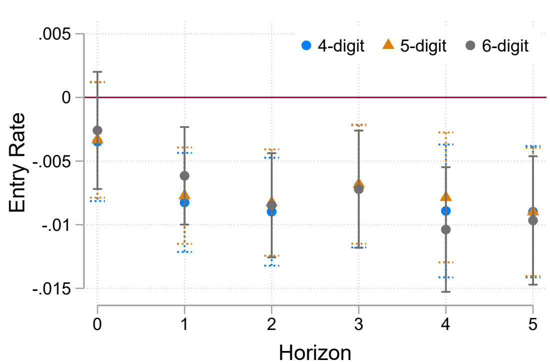
Acomodador (cines, teatros, etc.)	TNC	¢	9.822,07
Agente de Aduana o Vapores	TES	¢	19.910,28
Agente de Ventas *	TCG	¢	331.516,22
Albañil	TC	¢	10.877,41
Alistador Automotriz (lijador)	TSC	¢	10.680,80
Aplanchador (plancha tipo casera)	TNC	¢	9.822,07
Aplanchador con Equipo de Vapor	TC	¢	10.877,41
Analista de Crédito*	TCG	¢	331.516,22
Asistente de Abogacía *	TEG	¢	372.288,99
Asistente de Auditoría *	DES	¢	462.406,00
Asistente de Consultorio Médico	TC	¢	10.877,41
Asist. Domicilio/Ancianos **(cuidados especiales)**	TE	¢	12.829,63
Auxiliar Agente de Aduana, Vapores	TE	¢	12.829,63
Auxiliar de Contabilidad*	TCG	¢	331.516,22
Auxiliar Dental	TE	¢	12.829,63
Ayudante de Cocina	TSC	¢	10.680,80
Ayudante de Mecánico general	TSC	¢	10.680,80
Ayudante de Operario, Construcción	TSC	¢	10.680,80
Bachiller Universitario *	Bach	¢	524.477,85
Baqueano	TSC	¢	10.680,80
Bartender (Coctelero)	TC	¢	10.877,41
Bodeguero (Encargado) *	TSCG	¢	315.364,86
Bodeguero (Peón) *	TNCG	¢	293.132,67
Boletero	TSC	¢	10.680,80
Cajero *	TCG	¢	331.516,22
Cajista de Artes Gráficas	TE	¢	12.829,63
Calderetero (Operador de Caldera)	TC	¢	10.877,41
Calderetista (Mantenimiento)	TE	¢	12.829,63
Camarógrafo de Prensa	TES	¢	19.910,28
Cantante de Música Popular	TC	¢	10.877,41
Cantinero	TSC	¢	10.680,80
Capitán de Embarcación	TE	¢	12.829,63
Carnicero Empleado Despacho	TSC	¢	10.680,80
Carnicero Destazador	TC	¢	10.877,41
Carpintero	TC	¢	10.877,41
Cerrajero	TC	¢	10.877,41
Chapulinero	TC	¢	10.877,41
Chequeador Agenc Aduana, Vapores	TE	¢	12.829,63
Chequeador de Buses	TNC	¢	9.822,07
Chofer de Bus (no cobrador)	TC	¢	10.877,41
Chofer de Tráiler	TE	¢	12.829,63
Chofer de Vehículo Liviano	TSC	¢	10.680,80
Chofer de Vehículo Pesado	TC	¢	10.877,41
Chofer Microbús (menos de11pasaj.)	TSC	¢	10.680,80
Chofer-Cobrador de Bus	TE	¢	12.829,63
Cobrador de Buses	TNC	¢	9.822,07
Cobrador *	TSCG	¢	315.364,86
Cocinero	TC	¢	10.877,41
Confección Muestras de Ropa	TE	¢	12.829,63
Conserje *	TNCG	¢	293.132,67
Contador Privado *	TMED	¢	347.405,37
Contador Privado *	DES	¢	462.406,00
Contador Privado *	Bach.	¢	524.477,85
Contador Privado *	Lic.	¢	629.395,00
Cortador de tela	TC	¢	10.877,41
Cosedor Piezas /Prendas a Máquina	TC	¢	10.877,41
Costurera (Modista)	TE	¢	12.829,63
Counter (Vendedor de Pasajes) *	TCG	¢	331.516,22
Dealer (Distribuidor de cartas)	TNC	¢	9.822,07
Demostrador (Display)	TNC	¢	9.822,07
Demostrador-Vendedor	TSC	¢	10.680,80
Dependiente	TSC	¢	10.680,80
Dependiente Café Internet	TSC	¢	10.680,80
Despachador Agencia Aduana, Vapores	TE	¢	12.829,63
Diagramador en Artes Gráficas	TE	¢	12.829,63
Dibujante en Artes Gráficas	TE	¢	12.829,63
Dibujante de Ingeniería, Arquitectura *	TCG	¢	331.516,22
Digitador	TC	¢	10.877,41
Diplomado Parauniversitario *	DES	¢	462.406,00
Diplomado Universitario*	DES	¢	462.406,00
Ebanista	TE	¢	12.829,63
Educador Aspirante sin Título *	TEG	¢	372.288,99
Electricista	TC	¢	10.877,41
Electromecánico	TE	¢	12.829,63
Empacador; Etiquetador	TNC	¢	9.822,07
Empleado de Despacho	TSC	¢	10.680,80
Empleada Doméstica*		¢	178.703,50
Encargado (indica acomodo parqueo)	TNC	¢	9.822,07
Encargado de Limpieza en General	TNCG	¢	293.132,67
Encargado de Limpieza en Piscinas	TNC	¢	9.822,07
Enc. Mantenim. Correctivo Cómputo	TE	¢	12.829,63
Enc. Mantenim. Preventivo Cómputo	TC	¢	10.877,41
Encargado de poner Discos (Disjokey)	TNC	¢	9.822,07
Encargado de Cámaras Frigoríficas	TSC	¢	10.680,80
Encargado Mantenimiento Edificios	TC	¢	10.877,41
Encerador de Carros	TNC	¢	9.822,07
Encuadernador - Empastador	TC	¢	10.877,41
Encuadernador en Fino	TE	¢	12.829,63
Encuadernador en Rústica	TSC	¢	10.680,80
Encuestador *	TSCG	¢	315.364,86
Enderezador Automotriz	TC	¢	10.877,41
Engrasador de Autos	TSC	¢	10.680,80
Ensamblador de Computadoras	TSC	¢	10.680,80
Envasador Manual	TNC	¢	9.822,07
Esparcidor de Plaguicidas (6hrs)	TNC	¢	9.822,07
Estampador en Textil (Serigrafía)	TC	¢	10.877,41
Esteticista	TE	¢	12.829,63
Estibador por Kilo de frutas y vegetales		¢	0,0675
Estibador por Movimiento		¢	355,84
Estibador por Tonelada		¢	83,44
Estilista	TC	¢	10.877,41
Florista	TC	¢	10.877,41
Fontanero	TC	¢	10.877,41
Fotocopiador (Centro fotocopiado)	TSC	¢	10.680,80
Fotógrafo de Prensa	TE	¢	12.829,63
Fotomecánico de Artes Gráficas	TE	¢	12.829,63
Fotomontador (Artes Gráficas)	TE	¢	12.829,63
Fresador (Metalmecánica)	TE	¢	12.829,63
Fumigador (Doméstica)	TSC	¢	10.680,80
Fundidor	TC	¢	10.877,41
Futbolista Primera División	TE	¢	12.829,63
Futbolista Segunda División	TC	¢	10.877,41
Gondolero	TNC	¢	9.822,07
Graduado del INA *	TMED	¢	347.405,37
Guarda *	TSCG	¢	315.364,86
Guarda Custodio Valores-Portavalores	TCG	¢	331.516,22
Guía Turístico	TC	¢	10.877,41
Guillotinista (Guillotina Eléctrica)	TC	¢	10.877,41
Guillotinista (Electrónica programable)	TE	¢	12.829,63
Hojalatero	TC	¢	10.877,41
Horneador (Horno Electrónico program)	TSC	¢	10.680,80
Hornero	TC	¢	10.877,41
Inspector de Cámaras	TE	¢	12.829,63
Instructor de Bailes Populares	TC	¢	10.877,41
Jardinero (Crear Jardines)	TC	¢	10.877,41
Jefe de Cocina (Chef)	TE	¢	12.829,63
Jefe de Saloneros (Maitre)	TE	¢	12.829,63
Joyero	TC	¢	10.877,41
Laboratorista Civil	TC	¢	10.877,41
Laboratorista Clínico	TC	¢	10.877,41
Laqueador (Muebles y Similares)	TC	¢	10.877,41
Lavador de Cabello	TNC	¢	9.822,07
Lavador de Carros	TNC	¢	9.822,07
Levantador de Texto (Artes Gráficas)	TE	¢	12.829,63
Licenciado Universitario *	Lic.	¢	629.395,00
Limpiador de Tanques Sépticos	TC	¢	10.877,41
Linotipista (Artes Gráficas)	TC	¢	10.877,41
Liquidador Agencia Aduana, Vapores	TE	¢	12.829,63
Llantero	TSC	¢	10.680,80
Locutor de Radioemisora	TE	¢	12.829,63
Locutor de Televisión	TES	¢	19.910,28
Luminotécnico TV	TES	¢	19.910,28
Maestro de Obras (Construcción)	TE	¢	12.829,63
Manicurista; Maquilladora	TC	¢	10.877,41
Maquinista de Embarcaciones	TC	¢	10.877,41
Marinero	TNC	¢	9.822,07
Masajista	TC	¢	10.877,41
Mecánico General	TC	¢	10.877,41
Mecánico Precisión	TE	¢	12.829,63
Mecánico Máquinas de Coser Industrial	TE	¢	12.829,63
Mecánico de Máquinas de hacer Telas	TE	¢	12.829,63
Mensajero *	TNCG	¢	293.132,67
Misceláneo *	TNCG	¢	293.132,67
Misceláneo en Hogares Tercera Edad	TNC	¢	9.822,07
Montacarguista	TSC	¢	10.680,80
Mucama	TNC	¢	9.822,07
Musicalizador en Radioemisoras	TE	¢	12.829,63
Niñera, excepto en el Hogar del Niño	TNC	¢	9.822,07
Niñera en el Hogar del Niño **(Servicio Doméstico)**		¢	178.703,50
Oficial de Mesa (panadería)	TC	¢	10.877,41
Oficinista (General) *	TSCG	¢	315.364,86
Operador de Cabina de Radioemisora	TE	¢	12.829,63
Operador de "Araña" (Serigrafía)	TC	¢	10.877,41
Operador de Carrusel	TC	¢	10.877,41
Operador de Computación	TE	¢	12.829,63
Operador de Draga	TE	¢	12.829,63
Operador de Grúa Estacionaria	TE	¢	12.829,63
Operador de Máquina de Lavar Ropa	TC	¢	10.877,41
Operador de Maquinaria Pesada	TC	¢	10.877,41
Operador de Máquinas en General	TC	¢	10.877,41
Operador de Planta Transm. Radio	TC	¢	10.877,41
Operador de Prensa Rotativa	TES	¢	19.910,28
Operador de Radio-Taxi	TC	¢	10.877,41
Operador de Escogedoras de Café	TC	¢	10.877,41
Operador Escaner separador colores	TES	¢	19.910,28
Operario en Construcción	TC	¢	10.877,41
Ordeñador a Mano	TNC	¢	9.822,07

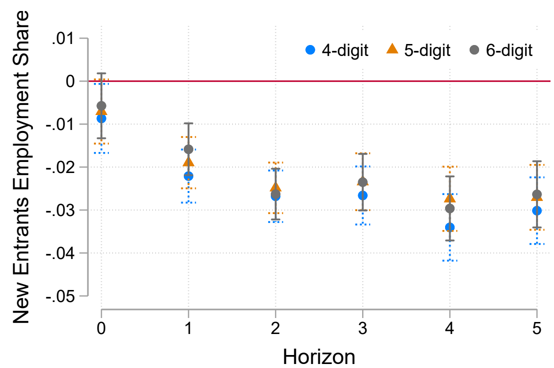
Table B.1: Nominal Minimum Wage by Economic Sector

	Agriculture	Manufacturing	Construction	Trade	Transportation, Storage & Information	Services	Generic
2006	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2007	111.3	111.2	111.2	111.2	111.2	111.2	111.2
2008	122.9	122.9	122.9	122.9	122.9	123.3	122.9
2009	141.7	141.7	142.1	142.1	141.5	143.0	140.8
2010	151.8	151.8	152.2	152.2	151.5	153.2	150.8
2011	162.1	162.2	162.7	162.7	161.8	163.7	161.0
2012	172.0	172.9	173.7	173.7	172.3	174.2	170.9
2013	183.6	184.5	185.5	185.5	183.9	186.0	182.4
2014	195.2	196.1	197.1	197.1	195.5	197.7	193.8
2015	207.5	206.9	208.5	208.5	205.8	209.0	203.4
2016	210.8	210.2	211.8	211.8	209.1	212.5	206.7
2017	214.3	213.7	215.3	215.3	212.6	216.6	210.1
Real % Change (2006-2017)	22.8	22.5	23.4	23.4	21.8	24.1	20.4

Notes: January 2006=100. Table shows the average minimum wage by main economic sector, using the minimum wage by occupation and weighting by the corresponding employment share in each industry.

Figure B.4: Minimum Wage Exposure and Firm Entry



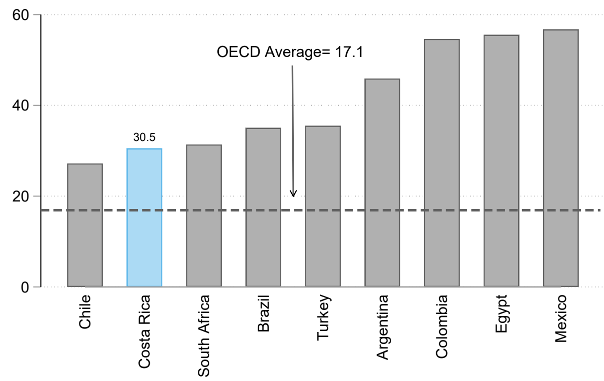


Notes: Figures show the estimated impulse response functions to minimum wage exposure, alongside 95% confidence intervals. Regressions include industry-level controls and 2-digit industry and year dummies.

C Informal Sector

Costa Rica has a large informal economy. As described in Figure C.1, informality is relatively high in absolute terms but relatively small than other middle-income countries.

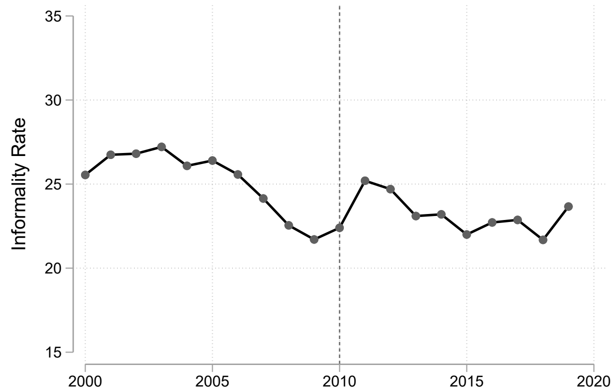
Figure C.1: Informality Rates, 2016



Notes: Informality defined by OECD to include workers not paying social security contributions or whose business is not registered. Unweighted average of informality rates for 24 OECD countries (Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom).
Source: OECD

The size of the informal labor market is usually measured using diverse sets of household surveys. Figure C.2 shows that the evolution of labor informality rates between 2000 and 2019, defined as workers whose employers do not direclty pay Social Security taxes and, therefore, would not appear in the administrative datasets used in this research. Overall, there is no clear evidence of an expanding informal sector, despite the minimum wage increase. According to OECD (2017, 2018), before 2004 and 2010, informality followed a downward trend due to subsidized social insurance payments for self-employed workers.

Figure C.2: Informality Rates



Notes: Fraction of employed workers in the informal sector. Horizontal line denotes a methodological change in the household surveys
Source: National Institute of Statistics and Census (INEC)