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Abstract

We study the effects of North Macedonia's 2017 minimum wage reform – the largest in the country's history – using matched employer-employee administrative data covering the entire range of firms and employees, and a difference-in-differences design based on firms' pre-reform share of minimum wage workers. We examine changes in firm employment, wage levels, profitability, non-wage operating expenditures and productivity after the reform. Five results emerge. (i) We find no evidence of job losses, with employment increasing overall, and smaller increases for firms that were more sensitive to the minimum wage increase. (ii) Wages higher than the minimum increased on a widespread basis, with no difference between firms attributable to their relative exposure to the minimum wage increase. (iii) Profitability remained broadly unchanged, with no differences related to the minimum wage. (iv) Firms that were more sensitive to the minimum wage increase reduced non-wage operating costs to a greater extent. (v) Productivity rose, on average, with larger gains among more exposed firms. Overall, the evidence suggests that firms accommodated the higher minimum wage primarily through cuts in other operating expenses and productivity improvements, rather than through layoffs or profit compression, consistent with non-fully competitive wage-setting in a low labour-share economy. These results can serve as a useful benchmark for designing future minimum wage increases in economies with similar features.

Keywords: minimum wages, firm-level performance, productivity, North Macedonia, labour share

JEL classification: J38, D22

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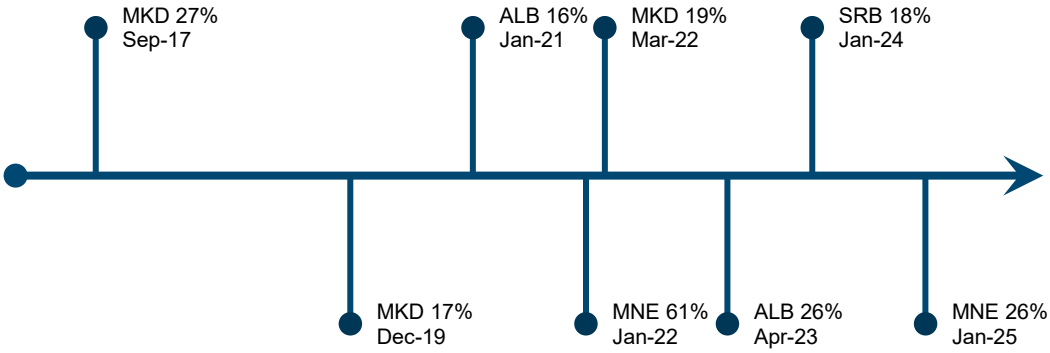
1. Introduction

In September 2017, North Macedonia implemented a substantial minimum wage reform, raising the statutory minimum by 27% – the largest increase in the country's history. The reform sparked intense public debate. Opponents argued that such a sharp rise would cause widespread layoffs, while supporters maintained that firms had ample room to absorb higher labour costs. The latter emphasised a persistent increase in the profit share of GDP since the transition period, which had left North Macedonia with one of the lowest labour shares of GDP in Europe. The reform resonated regionally as well. Several Western Balkan economies later enacted similar or larger increases (Figure 1 documents those of 15% and above).

Figure 1 / Timeline of minimum wage increases of 15% and above in Western Balkan economies since 2017



Source: Authors' calculation, using data from Eurostat and national minimum wage legislation.

Almost one decade later, we are able to assess the reform's effects. Using matched employer-employee administrative microdata covering the entire formal economy, we study how firm employment, wages, productivity, profitability and other operating expenses evolved after the reform, and how these changes varied according to firms' exposure to the minimum wage increase. We do so by using a difference-in-differences design that exploits differences across firms in pre-reform exposure to the minimum wage. We measure exposure in three ways: (i) as the share of workers paid at or below the new minimum wage level; (ii) as the share of the firm's total wage bill paid to those workers; and (iii) as the wage-bill share paid to those workers per hour worked.

Five results emerge. First, we find no evidence of job losses. Aggregate employment rose after the reform, although firms with higher pre-reform exposure to the minimum wage increase experienced weaker employment growth. Second, wages above the minimum increased on a widespread basis, with no difference between firms attributable to their degree of exposure to the minimum wage increase. Third, we find that profitability did not change materially after the reform, and we do not observe heterogeneous profit

effects across firms with different exposure. Fourth, we find that firms that were more exposed to the minimum wage increase had a higher reduction in non-wage operating expenditures, suggesting that these firms adjusted on the cost margin. Finally, firm-level productivity rose on average during the reform period, with larger gains among more exposed firms.

What do these results imply? First, they speak directly to North Macedonia's policy debate. Our findings suggest that the 2017 rise was not associated with job losses or profit compression at the aggregate level. Instead, firms with greater pre-reform exposure cut non-wage operating expenditures and raised productivity more than other firms, consistent with organisational efficiencies and increased labour productivity as a consequence of higher minimum wages. Taken together, the evidence aligns more closely with the 'absorption and efficiency' view than with predictions of widespread disemployment or profit erosion.

Second, the North Macedonia reform is informative for other developing economies with low wages and low labour shares. In settings where labour share is low, often implying sizeable profit cushions, firms have scope to accommodate higher statutory floors by reducing non-wage expenditures and improving efficiency, rather than by reducing employment or compressing profits.

Lastly, our results connect to the long-running debate on minimum wages. The traditional neoclassical view, grounded in a perfectly competitive labour market, suggests that firms have no power to influence wages and that each worker is paid according to their marginal product (Stigler, 1946). Under this framework, setting a minimum wage above the marginal product of some workers leads firms to reduce employment to maximise profits. By contrast, proponents of the minimum wage often rely on a model in which firms possess some degree of monopsony power – that is, market power on the demand side of labour that allows them to set wages below workers' marginal product (International Labour Organisation, 2016). In such settings, a higher minimum wage can increase wages with limited job losses, and in some cases even increase employment.

Our results can be interpreted as inconsistent with the traditional model and aligning with monopsonistic (or otherwise imperfect) wage-setting. If the post-reform floor had exceeded many workers' marginal products, we would expect disemployment and profit compression. Instead we observe rising aggregate employment, unchanged profitability, and adjustment via non-wage costs alongside productivity gains. The most plausible interpretation is that the pre-reform minimum was below workers' marginal product, and so the reform moved pay closer to workers' contribution, with firms absorbing part of the increase through efficiency improvements and cost reallocation.

Altogether, this analysis helps inform how future minimum wage increases can be designed, not only in North Macedonia, but also in other similar economies with market power on the side of employers, low wages and low labour shares.

The rest of the paper is structured as follows. First, we summarise briefly the current state of affairs in the existing literature on minimum wages, indicating also how our study contributes to the existing knowledge. Second, we present the economic and social situation in North Macedonia at the time of the increase in the minimum wage, a motivation for our study. Next, we describe our dataset and methods and follow with our empirical analysis. The last section discusses our findings and sets out our conclusions.

2. Literature review

A large and growing body of empirical literature investigates minimum wage effects. Most of the studies are focused on the minimum wage effect on employment. Boockmann (2010) provides an excellent meta-analysis of these studies, concluding that the effects of minimum wages are heterogeneous between countries. Recent studies broaden the area of investigation, examining minimum wage effects on other outcomes: wage spillovers (e.g. Stewart, 2012; Gopalan et al., 2021; Engbom and Moser, 2022), poverty and inequality (e.g. Kapelyuk, 2015; Autor et al., 2016; Dube, 2019; Derenoncourt and Montialoux, 2021), inflation (e.g. Campos-Vazquez and Esquivel, 2020; Harasztosi and Lindner, 2019), firm profitability and value (e.g. Bell and Machin, 2018; Deng, 2020) and productivity (e.g. Riley and Bondibene, 2017; Nguyen, 2019; Dustmann et al., 2022).

In terms of methodology, early studies were mainly carried out on a time-series basis and correlated the outcome of interest (usually, employment) with the level of the minimum wage (see the meta-analysis of Card and Krueger, 1995). The studies conducted after the landmark paper of Card and Krueger (1994) were mainly cross-sectional, comparing differences between states or cities that were affected by minimum wage increases and states/cities that were not (Neumark and Wascher, 2002; Dube, Lester and Reich, 2010; Cengiz et al., 2019; Jardim et al., 2022).

State-of-the-art studies use firm-level data. Among them, two approaches can be distinguished. The first, used by most of the studies (Draca, Machin and Van Reenen, 2011; Skedinger, 2014; Yagan, 2015; Saez, Schoefer and Seim, 2019; Mayneris, Poncet and Zhang, 2018; Georgiadis et al., 2020; Dustmann, et al. 2022), is based on a orthodox difference-in-differences (DiD) framework, in which firms are either affected or unaffected by the minimum wage change, and where outcomes before and after the policy change are compared between these two groups.

This approach has recently been criticised by Brewer, Crossley and Zilio (2019), who argue that these DiD estimations focus on statistical rejection of the null hypothesis that the policy has no effects, without paying attention to the range of positive or negative effects that are consistent with the data. In other words, this approach answers whether the policy change has affected the outcome of interest or not, whereas the real question is the size of this effect: i.e. how much has the outcome of interest changed because of the policy change.

The second firm-level approach avoids this problem by using continuous DiD design, where treatment intensity varies across firms. It constructs a measure of how strongly each firm is affected by the policy (the policy ‘bite’) and relates this ‘bite’ to the outcome of interest (Kugler and Kugler, 2009; Giupponi and Machin, 2018; Harasztosi and Lindner, 2019; Dustmann et al., 2022). This approach produces a more direct estimate of the effect of interest, but its applicability depends on the availability of sufficiently detailed data.

The effects of the minimum wage in North Macedonia have been analysed by only a few studies. Jovanovik and Naumovski (2021) is the only study so far that has used firm-level data, assessing the

same episode of minimum wage increase as we do, from 2017. Jovanovik and Naumovski found that the minimum wage increase did not negatively affect firm profitability, and that firms absorbed the higher labour costs by enhancing productivity. However, they also observed a decline in employment, although only in certain sectors. While Jovanovik and Naumovski's study uses the same administrative firm-level data as we do, covering the full population of registered firms, its measure of exposure to the minimum wage increase is relatively limited. Specifically, it defines affected firms as those whose average pre-reform wage (in 2016) was below the new minimum wage level introduced in 2017. This effectively focuses on firms with low average wages, while potentially excluding firms with a sizeable low-wage segment but higher average wages because of high wage dispersion. Moreover, treatment is defined as binary, which raises the concern discussed above, as noted by Brewer, Crossley and Zilio (2019).

Petreski et al. (2019) used data from the Labour Force Survey and found that the 2017 increase in the minimum wage has had a positive impact on wages mainly up to and around the new minimum wage. They argue that the reform compressed wages by lifting the pay of workers who had earned less than the new minimum, while leaving largely unchanged the wages of workers who had already been earning around the new minimum wage level before the reform, so that the two groups' wages converged.

Trenovski et al. (2021) employed a panel-regression model to examine the relationship between the minimum wage and labour productivity in non-EU member countries (North Macedonia, Albania and Serbia), finding it to be strong and positive. In contrast, this relationship was weak and negative in EU member countries from the region (Bulgaria, Romania and Croatia). Finally, Petreski and Pehkonen (2024) investigated the role of the minimum wage in labour share dynamics. They argued that its impact is industry-specific: in labour-intensive, low-wage industries, the minimum wage increases workers' labour share, while in capital-intensive industries, it reduces the labour share.

Our contribution to the literature is at least threefold. First, we use matched employer-employee administrative data covering the full population of firms and workers in the formal sector, which allows us to analyse firm responses to a large minimum wage increase with a level of precision that is rarely available. In particular, we can measure firms' exposure to the reform in a precise and continuous way, capturing not only whether firms were affected by the increase in the minimum wage, but also how strongly they were affected. To our knowledge, no previous study has combined a full range of data with a continuous exposure design to study a minimum wage reform, either for North Macedonia or more broadly in the international literature.

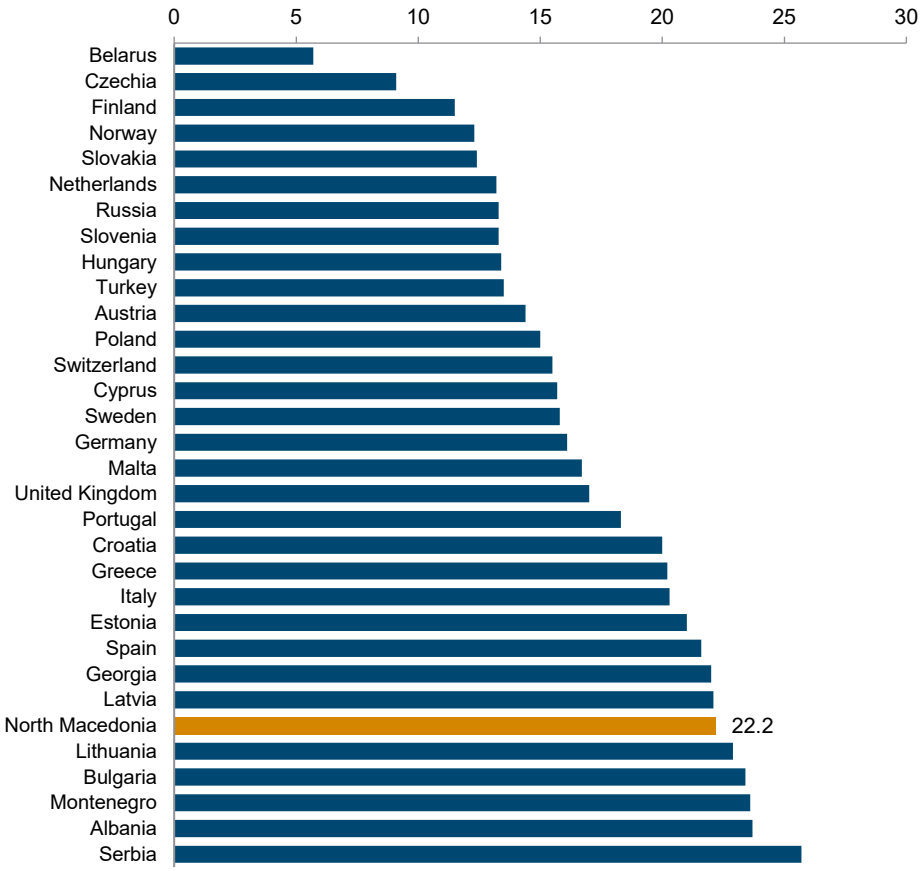
Second, we examine a wide set of firm-level outcomes – including employment, wages above the minimum, profitability, non-wage operating expenditures and productivity – which allows us to trace the main adjustment margins and to shed light on the mechanisms through which firms responded to the higher wage floor. This broader perspective goes beyond much of the existing literature, which typically focuses on a single outcome, most often employment.

Third, although our analysis is grounded in a specific policy episode, we place the findings in a wider context by discussing their implications for economies with low labour shares and similar institutional settings. In this way, the paper contributes not only to the country-specific literature on North Macedonia, but also to the broader debate on minimum wages, offering evidence that is relevant for both academic research and policy design in comparable economies.

3. Background

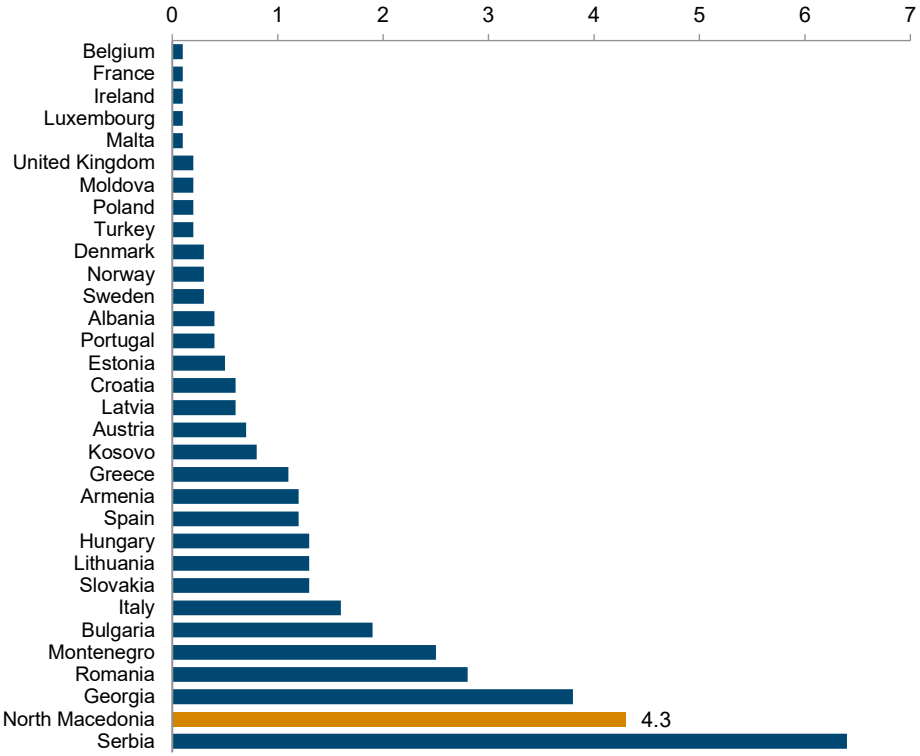
North Macedonia is a country with persistently high poverty, among the highest in Europe. In 2016, one year prior to the reform, the poverty headcount ratio at the national poverty line stood at 22.2%, ranking sixth-highest in Europe (Figure 2). The situation was even more severe when measured at the international poverty line of USD 1.90 of income per day: 4.3% of the population lived in absolute poverty, the second-highest share in Europe (Figure 3).

Figure 2 / Poverty headcount ratio at national poverty line (% of population), 2016



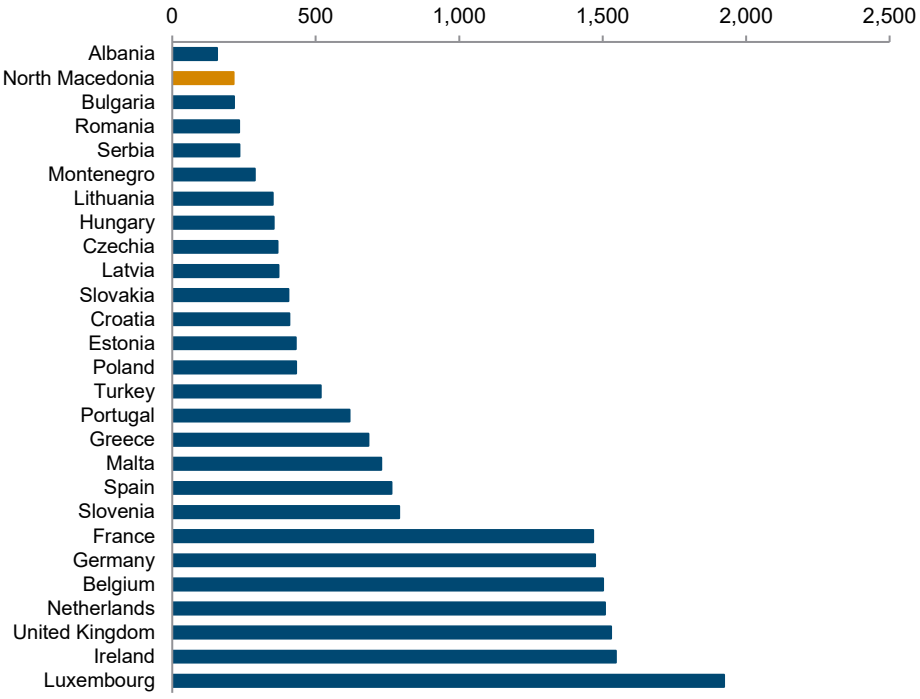
Source: World Bank.

Figure 3 / Poverty headcount ratio at USD 1.90 a day, 2011 PPP (% of population), 2016



Source: World Bank.

Figure 4 / Minimum wages (EUR per month), January 2016

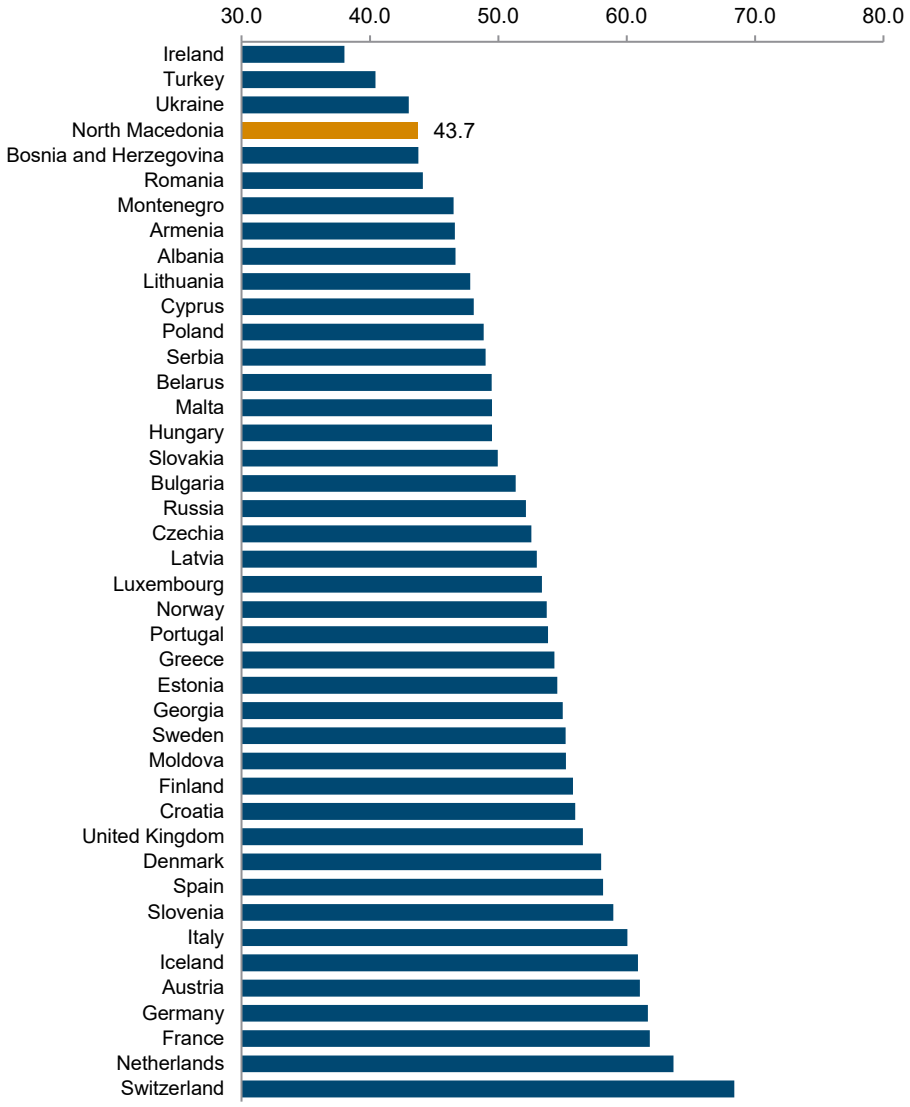


Source: Eurostat.

One of the key factors behind such high poverty rates is the generally low level of wages in the country. As shown in Figure 4, gross minimum wages in North Macedonia were the second-lowest in Europe in 2016. Similarly, the labour share of income in GDP (Figure 5) was among the lowest in Europe. Only 43.7% of national income generated in 2016 accrued to employees as compensation for labour. By comparison, more than half of European countries recorded labour shares above 50%, and in several cases, the share approached two-thirds.

The low wage level in North Macedonia can be partly attributed to the relatively low statutory minimum wage. The minimum wage was introduced in the country in 2012, as the lowest monthly gross salary an employer must pay for full-time work of eight hours a day (reduced proportionally for shorter working hours). It serves as the base wage, with additional compensations paid on top. It is defined as a gross salary, including personal income taxes and social insurance contributions.

Figure 5 / Labour share of GDP, comprising wages and social protection transfers (%), 2016



Source: International Labour Organisation.

The minimum wage applied to all employees across industries, but three labour-intensive sectors were initially subject to a lower minimum: manufacture of textiles (NACE C13); manufacture of wearing apparel (NACE C14); and manufacture of leather and related products (NACE C15). These industries traditionally paid the lowest wages and employed large numbers of workers, particularly women. The general level of the minimum wage was introduced at 39.6% of the previous year's average gross salary, which at the time of the introduction equalled 12,265 Macedonian denars (MKD, approximately EUR 200). The level for the three labour-intensive sectors was MKD 10,393 (EUR 170).

The minimum wage was adjusted upward each year thereafter (Table 1), while the lower level for the three sectors was maintained until 2017. In that year, a new social democratic government came to power and decided to raise the minimum wage substantially and equalise it across all industries. The new level was set at MKD 17,130 (about EUR 280), representing a 27% increase relative to the level previously applied to the labour-intensive sectors. This reform was by far the largest minimum wage increase in the country's history and is the one we analyse in this paper.

To prevent potential adverse effects from the 2017 increase, the government designed a support scheme for the affected companies. This lasted for a year, the aim of which was to ease the transition to the higher minimum wage. The support was equal to approximately half of the increase in the gross salary for the first six months, and a quarter of the increase for the next six months. It was conditional on several criteria, and applied only to labour-intensive firms, which do not have high profitability.

Table 1 / Evolution of the gross minimum wage in North Macedonia until 2017

Year	Minimum wage in the three labour-intensive industries* (MKD)	Minimum wage in other industries (MKD)
2012	10,393	12,265
2013	10,990	12,268
2014	11,696	13,410
2015	12,403	14,114
2016	13,540	14,739
2017	17,130	17,130

Note: The three labour-intensive industries include the manufacture of textiles, apparel, and leather and related products.
Source: Ministry of Labour and Social Affairs of the Republic of North Macedonia.

4. Data and descriptive analysis

Our dataset is constructed by merging two distinct databases. The first is the Monthly Calculation for Integrated Payment (MPIN) database of the Public Revenue Office, which provides individual-level data on gross wages for all formally employed people in North Macedonia, along with additional details such as hours worked, taxes, social contributions and each firm's tax number. This data pertains to wages paid for January 2017 (i.e. before the minimum wage was increased in September of that year). The second database is from the Central Registry of North Macedonia, which contains firm-level annual financial accounts, including specific elements of firms' balance sheets and income statements, for 2016 (the year before the reform) and 2018 (the year after). This dataset encompasses variables such as the number of employees, income, assets, industry classification and geographical information (municipality and region). Together, the databases are matched, based on the tax number of each firm, and provide comprehensive information on all firms and all wages paid formally in the Macedonian economy.

In the merged database, we included employees who worked part-time and normalised wages to reflect full-time employment. We excluded from the sample firms with annual revenues below MKD 20,000 (approximately EUR 350). Additionally, the financial sector and self-employed individuals were excluded, owing to differences in reporting standards.

The database contains approximately 45,000 firms and 366,000 individuals. Some 67,000 employees received wages equal to or below the new minimum (18.3% of all workers). The total wage bill for individuals with wages below the new minimum amounts to 10.5% of the total wage bill in the country.

Figure 6 illustrates the distribution of workers with wages below the new minimum, based on specific firm characteristics, including size, profitability, labour intensity, productivity and industry. Panel (a) shows that 57% of the affected workers are in micro firms, 27% in small firms, 12% in medium firms and 5% in large firms.[1] Panel (b) shows that most of the workers with wages below the new minimum – around 60% – are employed in firms with medium profitability, slightly more than 20% in firms with low profitability and slightly less than 20% in firms with high profitability.[2] Panel (c) indicates that workers with wages below the new minimum are disproportionately concentrated in labour-intensive firms – 65% are in firms with high labour intensity, around 25% in firms with medium labour intensity and slightly less than 10% in firms with low labour intensity.[3] Panel (d) shows that more than 50% of workers with wages below the new minimum work in low-productivity firms, 37% in medium-productivity firms and 11% in high-productivity firms.[4]

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1 Firm size follows the standard definition based on the number of employees (micro: 1-9; small: 10-49; medium: 50-249; large: 250 or more).

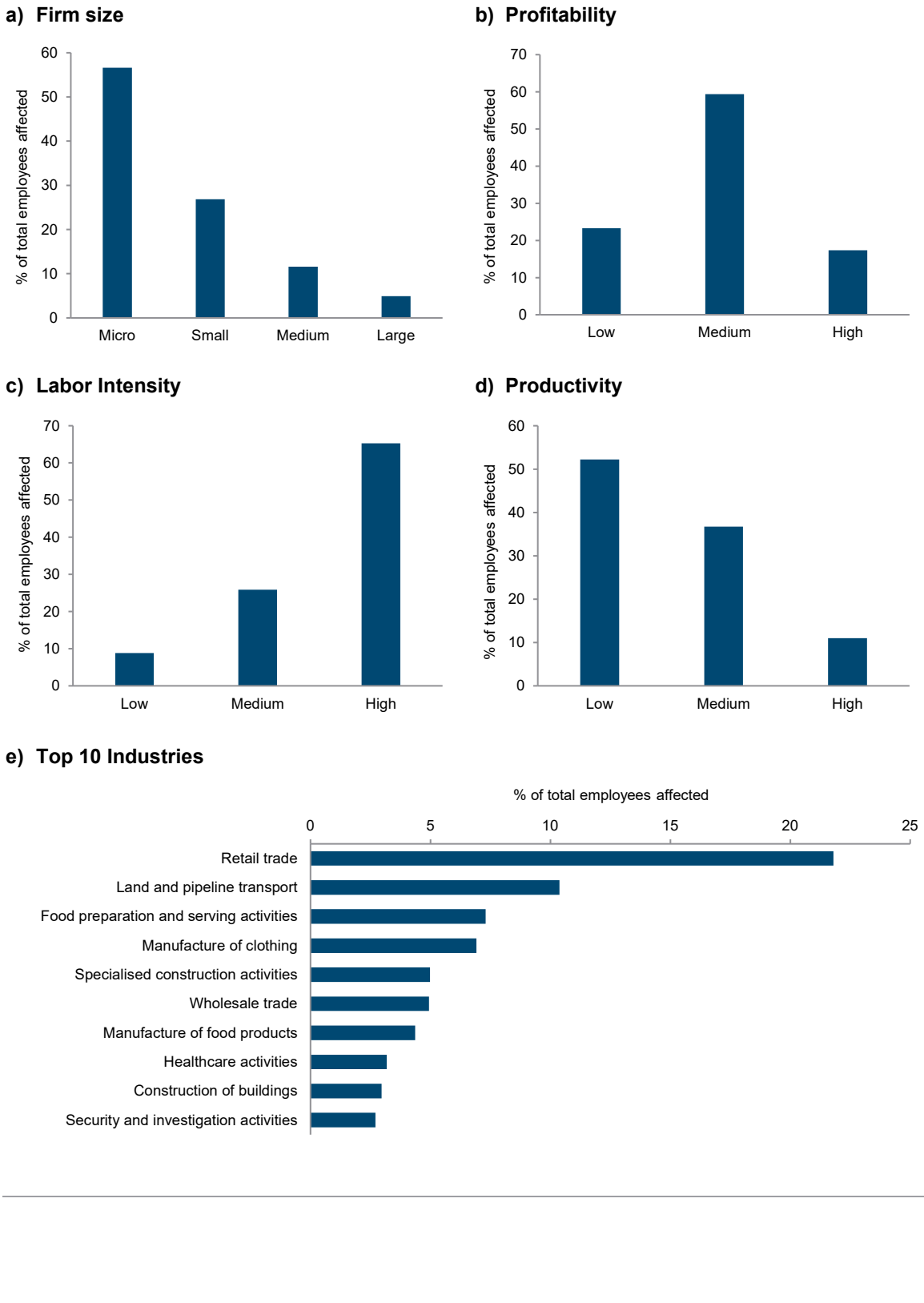
2 Low-profitability firms are defined as firms with negative profits. Medium-profitability firms have a profit to revenue ratio between 0% and 10%. High-profitability firms have a profit to revenue ratio above 10%.

3 Low labour-intensity firms have a labour to value added ratio below 33%, medium labour-intensity firms between 33% and 66%, and high labour-intensity firms above 66%.

4 Productivity is proxied by value added per unit of labour cost. Low-productivity firms are in the bottom third of the distribution; medium-productivity firms are between the 33rd and 66th percentiles; high-productivity firms are above the 66th percentile.

As for industries, the largest share of workers with wages below the new minimum – around 22% – is employed in retail trade. Transportation follows, with around 10%. Food preparation and serving, and the manufacture of clothing each account for around 7%, while construction, wholesale trade and the manufacture of food each account for around 5%.

Figure 6 / Distribution of minimum wage earners by type of firm



5. Methodology

We apply the continuous difference-in-differences (DiD) design explained previously (Kugler and Kugler, 2009; Giupponi and Machin, 2018; Harasztosi and Lindner, 2019; Dustmann et al., 2022), comparing changes in outcomes between firms with different degrees of exposure to the 2017 minimum wage increase. Our baseline exposure measure is firms' pre-reform minimum wage 'bite', defined as the headcount share of workers paid at or below the post-reform minimum. Specifically, the *bite* of firm i is:

$$bite_i = \frac{\#\ of\ employees\ with\ wage\ below\ the\ new\ minimum\ in\ Jan\ 2017}{\#\ of\ employees\ in\ Jan\ 2017}$$

We also use two alternative definitions of exposure: the share of the firm's total wage bill paid to workers at or below the post-reform minimum; and the same wage-bill share after normalising wages by hours worked. All bite measures are constructed using pre-reform data, i.e. using wage data for January 2017.

Using this variable, we estimate the following two-period model:

$$y_{it} = b_0 + b_1\, D_t + b_2\, (D_t \times bite_i) + b_3 x_{it} + \eta_i + e_{it},$$

where y_{it} represents the outcome of interest for firm i in year t (total employment, average wages excluding minimum wage earners, productivity, profitability and other expenses); D_t is a post-reform dummy (equal to 1 in 2018 and 0 in 2016); $bite_i$ is the firm's pre-reform minimum wage bite as defined above; x_{it} is a vector of control variables (log of assets, revenues, expenditures and number of employees, if they are not the dependent variable), η_i captures firm fixed effects, and e_{it} is the error term.

The coefficients b_1 and b_2 are of primary interest. b_1 captures average post-reform change in the outcome of interest for firms with bite = 0 (i.e. unaffected firms), which reflects common changes between 2016 and 2018. b_2 captures the differential post-reform change in the analysed outcomes for firms with higher exposure to the minimum wage reform (i.e. those with a larger bite). This interaction term provides our estimate of the policy's effect, isolating the impact of the reform from common changes over time.

6. Empirical results

Table 2 reports the DiD estimates for firm-level employment. We find that the post-reform dummy variable b_1 (reported as *dum* in the table) has a positive coefficient, ranging between 0.47 and 0.52 in the specifications with control variables (columns 4-6). This gives the average change in employment between 2016 and 2018 for a zero-exposure firm (bite = 0). That means that firms with no workers earning below the new minimum increased employment, on average, by about half an employee over the period, consistent with an overall expansion in employment.

The interaction terms between the post-reform dummy and the measure of exposure to the reform, b_2 (*dum_bite, dum_bite_w, dum_bite_wn* in the table) have a negative and statistically significant coefficient across all definitions. Using the specification in column 4 (b_1 = 0.522, b_2 = -0.730), the predicted change in employment for a firm that has exposure of 30% is ≈+0.303. Thus, a firm with a bite of 30% is predicted to increase employment by around 0.3 employees on average, compared with about 0.5 for a firm with zero exposure. The value for a firm with exposure of 50% is still positive, at ≈+0.157. The implied exposure at which the predicted change crosses zero is around 72% (=0.522/0.730). This is a very high exposure level, given that the average bite in the economy is around 18%.

Taken together, the results indicate that overall employment rose between 2016 and 2018, with the gain slightly smaller in more exposed firms. It approaches zero only if a firm had more than 70% of its employees at below-minimum wages, which is an extremely high share. Importantly, even at relatively high exposure levels (e.g. 30-50%), the point estimates still imply positive employment changes. This result is robust across alternative exposure definitions and with standard firm-level controls.

Table 3 shows the DiD estimates for the wage of other (non-minimum wage) workers. The post-reform variable b_1 (reported as *dum* in the table) is positive and highly significant across all specifications. In columns 1-3, the estimated increase for a zero-exposure firm (bite=0), is MKD 2,875-2,963. In the specifications with controls (columns 4-6), it remains sizeable at MKD 2,219-2,313, and highly significant. This implies that, among firms with no direct exposure to the reform, wages of higher-paid workers increased markedly between 2016 and 2018, by about MKD 2,200-2,900 on average, consistent with broad-based wage growth over the period.

The interaction between the post-reform dummy and the measure of exposure to the reform, b_2 (*dum_bite*, *dum_bite_w*, and *dum_bite_wn* in the table), is small and not statistically significant under any of the three bite definitions. This means that the change in wages for the non-minimum wage earners was not systematically different in firms that were more exposed to the minimum wage rise. In other words, the results suggest that the 2017 reform did not lead firms to reduce wages of non-minimum wage workers in order to compensate for the higher minimum wage.

Table 2 / The effect of the minimum wage reform on firm-level employment

	Dependent variable: number of employees					
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
dum	0.737***	0.722***	0.689***	0.522***	0.503***	0.474**
	(0.173)	(0.171)	(0.167)	(0.194)	(0.192)	(0.187)
dum_bite	-0.719**			-0.730**		
	(0.306)			(0.349)		
dum_bite_w		-0.705**			-0.705**	
		(0.308)			(0.351)	
dum_bite_wn			-0.676**			-0.688*
			(0.320)			(0.366)
lAssets				0.420***	0.419***	0.421***
				(0.147)	(0.147)	(0.147)
lRev				1.348***	1.348***	1.349***
				(0.383)	(0.383)	(0.383)
lExp				1.422***	1.422***	1.420***
				(0.433)	(0.433)	(0.433)
Constant	8.284***	8.284***	8.283***	-27.33	-27.31	-27.26
	(0.0939)	(0.0939)	(0.0939)	(20.16)	(20.16)	(20.16)
Observations	85,949	85,949	85,949	76,163	76,163	76,163
R-squared	0.000	0.000	0.000	0.008	0.008	0.008
No. of companies	45,233	45,233	45,233	41,453	41,453	41,453

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 / The effect of the minimum wage reform on other wages

	Dependent variable: wage of others					
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
dum	2,875***	2,963***	2,911***	2,219***	2,313***	2,250***
	(213.6)	(211.7)	(208.5)	(229.4)	(227.3)	(224.0)
dum_bite	81.75			344.9		
	(779.3)			(815.2)		
dum_bite_w		-697.1			-419.1	
		(874.7)			(913.6)	
dum_bite_wn			-264.7			147.7
			(941.4)			(981.7)
lAssets				466.5**	471.4**	468.1**
				(192.8)	(192.7)	(192.8)
lRev				902.2*	904.6*	903.0*
				(535.7)	(535.7)	(535.7)
lExp				8,370***	8,369***	8,370***
				(626.7)	(626.7)	(626.7)
lEmp				-18,617***	-18,606***	-18,614***
				(526.1)	(526.1)	(526.1)
Constant	26,016***	26,016***	26,016***	-85,991***	-86,119***	-86,039***
	(132.1)	(132.1)	(132.1)	(27,799)	(27,799)	(27,798)
Observations	62,303	62,303	62,303	56,397	56,397	56,397
R-squared	0.008	0.008	0.008	0.077	0.077	0.077
No. of companies	32,585	32,585	32,585	30,375	30,375	30,375

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 reports the DiD estimates for firm profitability. The post-reform coefficient b_1 (reported as *dum*) is close to zero across specifications (about −0.015 to +0.099) and is not statistically different from zero. This implies that, for firms with zero exposure to the minimum wage increase ($bite = 0$), average profitability did not change in a measurable way between 2016 and 2018.

Similarly, the interaction between the post-reform dummy and our measure of the exposure to the reform, b_2 (reported as *dum_bite, dum_bite_w, dum_bite_wn*) is small (about -0.039 to -0.022) and uniformly statistically insignificant under all three bite definitions. This implies that firms that were more exposed to the minimum wage rise did not experience a systematically different profitability trajectory than firms that were less exposed. Taken together, the results suggest that the 2017 minimum wage reform did not have a measurable effect on firm profitability, either on average or differentially across firms depending on their pre-reform exposure to the minimum wage increase.

Table 4 / The effect of the minimum wage reform on firm profitability

	Dependent variable: profit					
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
dum	-0.0110	-0.0107	-0.0152	0.0990	0.0983	0.0958
	(0.0900)	(0.0888)	(0.0866)	(0.107)	(0.105)	(0.103)
dum_bite	-0.0361			-0.0287		
	(0.159)			(0.191)		
dum_bite_w		-0.0385			-0.0276	
		(0.160)			(0.193)	
dum_bite_wn			-0.0285			-0.0224
			(0.166)			(0.200)
lAssets				0.238***	0.238***	0.238***
				(0.0811)	(0.0811)	(0.0811)
lExp				-0.820***	-0.820***	-0.821***
				(0.143)	(0.143)	(0.143)
lEmp				1.111***	1.111***	1.111***
				(0.219)	(0.219)	(0.219)
Constant	-0.144***	-0.144***	-0.144***	7.372	7.373	7.375
	(0.0487)	(0.0487)	(0.0487)	(11.05)	(11.05)	(11.05)
Observations	85,580	85,580	85,580	75,970	75,970	75,970
R-squared	0.000	0.000	0.000	0.003	0.003	0.003
No. of companies	45,022	45,022	45,022	41,423	41,423	41,423

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 reports the DiD estimates for firms' other operating expenditures. The post-reform coefficient b_1 (reported as *dum*) is positive in the baseline specifications without controls (columns 1-3), at around 354,000 to 372,000, and is statistically significant. However, once firm-level controls are added (columns 4-6), the coefficient becomes much smaller (106,000 to 122,000) and is no longer statistically significant. Thus, for firms with no exposure to the reform, the evidence for an increase in other expenditures between 2016 and 2018 is weak once observable firm characteristics are accounted for.

By contrast, the interaction between the post-reform dummy and the measure of exposure to the reform, b_2, is negative and statistically significant across all three bite definitions (about -321,000 to -327,000). Using the specification with control variables from column 4 (b_1= 121,563, b_2= -323,240), the predicted change for a firm with 30% exposure is ≈ 24,591, while for a firm with 50% exposure, it is -40,057. The

implied break-even exposure at which the predicted change crosses zero is around 0.376 (121,563/323,240). Results based on the wage-bill and hours-normalised exposure measures are very similar (columns 5-6).

Taken together, these estimates suggest that more exposed firms reduced – or at least restrained – other operating expenditures relative to less exposed firms, consistent with firms partially absorbing the wage shock through adjustments in non-wage cost components.

Table 5 / The effect of the minimum wage reform on firms' other expenditures

	Dependent variable: other expenditures					
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
dum	371,507***	366,995***	354,459***	121,563	118,277	105,534
	(91,324)	(90,142)	(87,966)	(87,601)	(86,452)	(84,443)
dum_bite	-326,132**			-323,240**		
	(161,476)			(157,866)		
dum_bite_w		-326,101**			-327,375**	
		(162,501)			(159,119)	
dum_bite_wn			-321,120*			-320,985*
			(168,630)			(165,503)
lAssets				-103,510	-104,012	-103,390
				(66,882)	(66,888)	(66,883)
lRev				2.768e+06***	2.768e+06***	2.768e+06***
				(101,514)	(101,514)	(101,514)
lEmp				-3.090e+06***	-3.091e+06***	-3.090e+06***
				(177,156)	(177,157)	(177,157)
Constant	1.835e+06***	1.835e+06***	1.834e+06***	-3.295e+07***	-3.294e+07***	-3.291e+07***
	(49,381)	(49,381)	(49,381)	(9.092e+06)	(9.092e+06)	(9.092e+06)
Observations	85,646	85,646	85,646	75,957	75,957	75,957
R-squared	0.000	0.000	0.000	0.028	0.028	0.028
No. of companies	45,193	45,193	45,193	41,419	41,419	41,419

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 gives the DiD estimates for total factor productivity (TFP).[5] The post-reform coefficient b_1 is positive and statistically significant across all specifications: 0.086-0.087 in columns 1-3 and 0.073-0.075 in columns 4-6. This means that firms with no minimum wage workers in January 2017 saw their TFP rise by 7-9% between 2016 and 2018.

The interaction between the post-reform dummy and our measure of exposure to the reform, b_2 (reported as *dum_bite, dum_bite_w, dum_bite_wn*), is positive and statistically significant across all three bite definitions, with a magnitude of around 0.03. This means that a firm with exposure of 30% experienced a TFP increase of roughly 0.9 percentage points more than a firm with zero exposure. For a firm with 50% exposure, the additional increase is around 1.5 percentage points. Taking the results from column 4, a firm with zero exposure saw its TFP rise by about 7.4%, while a firm with 30% exposure is predicted to see a rise of about 8.3%, and a firm with 50% exposure about 8.9%.

[5] We measure firm-level total factor productivity as a Solow residual from a Cobb–Douglas production function, using value added as output, employment as labour input, assets as a proxy for capital, and sector-level labour share as labour elasticity.

Altogether, these findings suggest that productivity improved more in firms that were more exposed to the minimum wage increase. This could reflect higher worker productivity or changes in firm organisation or technology.

Table 6 / The effect of the minimum wage reform on total factor productivity (TFP)

	Dependent variable: total factor productivity					
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
dum	0.0866***	0.0859***	0.0867***	0.0741***	0.0732***	0.0749***
	(0.00543)	(0.00536)	(0.00525)	(0.00425)	(0.00420)	(0.00411)
dum_bite	0.0261**			0.0296***		
	(0.0106)			(0.00820)		
dum_bite_w		0.0299***			0.0340***	
		(0.0107)			(0.00830)	
dum_bite_wn			0.0299***			0.0315***
			(0.0112)			(0.00868)
lRev				0.460***	0.461***	0.460***
				(0.00898)	(0.00898)	(0.00898)
lExp				-0.162***	-0.162***	-0.162***
				(0.0106)	(0.0106)	(0.0106)
dum_bite_w		0.0299***			0.0340***	
		(0.0107)			(0.00830)	
dum_bite_wn			0.0299***			0.0315***
			(0.0112)			(0.00868)
Constant	9.393***	9.393***	9.393***	2.593***	2.595***	2.587***
	(0.00299)	(0.00299)	(0.00299)	(0.466)	(0.466)	(0.466)
Observations	60,714	60,714	60,714	60,591	60,591	60,591
R-squared	0.018	0.018	0.018	0.426	0.426	0.426
No. of companies	35,104	35,104	35,104	35,035	35,035	35,035

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To summarise the econometric results, we find that the 2017 minimum wage reform did not lead to a measurable decline in firm employment. In fact, employment increased between 2016 and 2018, with only slightly smaller gains in more exposed firms. Wages of non-minimum wage workers also rose substantially over this period, and this wage growth was not systematically different in more exposed firms, suggesting no clear evidence that firms offset higher minimum wage costs by cutting pay above the minimum. Profitability remained broadly unchanged regardless of exposure. Instead, more exposed firms reduced other operating expenditures and recorded somewhat stronger productivity gains. Overall, the results suggest that firms in North Macedonia absorbed the higher minimum wage shock largely through reduction of non-wage operating expenses and productivity improvements, and not through layoffs or lower profitability.

7. Discussion and conclusions

In September 2017, North Macedonia implemented a substantial minimum wage reform, raising the statutory minimum by 27% – the largest increase in the country's history. The reform also equalised the minimum wage across sectors by setting the gross monthly minimum at MKD 17,130 and abolished the lower minimum that had previously applied to three labour-intensive industries (textiles, apparel and leather).

In this paper, we examine how firms in North Macedonia adjusted to this increase, using matched employer-employee administrative records covering the entire formal sector in the country. We apply a difference-in-differences design that exploits cross-firm variation in pre-reform exposure to the minimum wage. In essence, we compare changes in outcomes between firms that had no workers earning below the new minimum before the reform and firms for which a larger share of the workforce was directly affected.

We find that employment rose on average between 2016 and 2018, with gains only modestly smaller in more exposed firms and turning slightly negative only at very high exposure levels. Wages of non-minimum wage workers increased broadly over the same period, with no systematic differences between firms with higher exposure and firms with lower exposure, suggesting that firms did not reduce other wages to compensate for the higher minimum wage. Profitability did not change materially, with no evidence that more exposed firms experienced systematically different profit dynamics. Instead, more exposed firms adjusted on the cost side by reducing other operating expenditures. Productivity increased, on average, with larger gains among more exposed firms, consistent with adjustment through efficiency improvements and re-optimisation.

Several mechanisms can help to explain these findings. As already mentioned, the reform was implemented alongside a temporary support scheme intended to ease adjustment for affected firms. It may be the case that this subsidy scheme deterred firms from firing workers. However, evidence suggests that take-up of the subsidy was limited (Dodevska, 2019), implying that it is unlikely to be the sole explanation for the absence of measurable job losses.

A second explanation is that part of the adjustment may have occurred at the boundary between formal and informal work, for instance through a reduction in envelope wages. North Macedonia has long faced challenges related to undeclared work and informality, with envelope wages widely used to supplement formally declared pay. A higher statutory minimum wage can, in principle, induce firms to shift compensation from envelope wages to formally reported wages, raising declared earnings without necessarily increasing total labour compensation. However, standard measures of informality do not point to a sizeable decline in the informal economy in North Macedonia following the 2017 reform. The World Bank informal economy database shows virtually no change in its size after 2017 (Elgin et al., 2021).

The most likely explanation, therefore, is that firms had sufficient room to absorb the wage shock, given the economy's low labour share and the presence of buffers in costs and mark-ups. This allowed

adjustment to take place primarily through trimming non-wage expenditures, reorganising production and raising productivity, rather than through employment reductions.

In policy terms, the main message is that a large minimum wage increase in small open economies with low labour shares, does not necessarily translate into job losses or profit compression. In our analysis, firms appear to have absorbed the higher minimum wage largely through cost reallocation and efficiency improvements. This has two practical implications. First, future minimum wage increases can be designed with this in mind: large adjustments are more likely to be absorbed where there is scope for non-wage costs to be trimmed and efficiency gains to be realised. Second, attention should focus on firms with very high exposure to the minimum wage increase, where employment is more sensitive and cost pressures are likely to be more binding. More broadly, the findings are consistent with wage-setting that is not fully competitive, implying that a higher wage floor that more accurately reflects the contribution made by workers can raise pay with limited adverse firm-level outcomes.

Three limitations are worth noting. First, the analysis covered only the formal sector and only a medium-term window (2016-2018), so informal adjustments, longer-run technology adoption and price pass-through are not directly observed. Future work can extend the panel beyond 2018, to assess longer-run responses. Second, we did not study household welfare, poverty or inequality. This can be addressed by linking firm records to household surveys (e.g. EU-SILC, income/expenditure) and exploiting sectoral/regional variation to map firm effects to distributional outcomes. Finally, as with any single-country episode, the findings may not be applicable to all countries or contexts. The mechanisms documented here are most relevant where profit buffers exist and non-wage costs can be reallocated. Replicating the research in neighbouring Western Balkan economies and other low labour-share settings would help to determine how generally applicable the North Macedonia's findings are.

Despite these limitations, the study offers an economy-wide example of how a large statutory increase was accommodated in a low labour-share setting. It provides a practical benchmark for designing future minimum wage updates, and for determining the most appropriate focus of attention in such cases: highly exposed firms, for which adjustment pressures are likely to be strongest.

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