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Minimum wage reform and firms' performance – evidence from North Macedonia

Abstract

Minimum wage is an important redistributive tool and an important element of the employment strategies and social policies for overcoming poverty and reducing inequality. Even though the social dimension of the minimum wage concept is unquestionable, it also provokes frequent debates and discussions about the likely impact on firms' financial conditions and consequently, firms' profitability and performance. This research paper aims to investigate the economic impact of minimum wage increase on firms' average wages, number of employees, profitability and productivity in the case of North Macedonia. The analysis is conducted by using firm level data set and difference-in-difference (DD) estimation method. Our results showed that the increase in minimum wages didn't affect firms' profitability significantly and this result is robust to the changes in the sample and method of estimation. In addition we found that most likely Macedonian firms did absorb higher labour costs by increase in productivity and, in some sectors, with decline in employment.

JEL Classification Numbers: J31, J38, L25
Keywords: minimum wage, adjustment channels, firms' performance

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1. Introduction

ILO defines the minimum wage as "the minimum amount of remuneration that an employer is required to pay wage earners for the work performed during a given period, which cannot be reduced by collective agreement or an individual contract". The primary purpose of minimum wages is to protect workers against unjustifiably low pay. In policy making minimum wage is an important part of the social and employment policies and it is used as a redistribution tool for overcoming poverty and reducing inequality on different levels. The effectiveness of minimum wages depends on many factors - the coverage of the minimum wage across different genders, industry, occupations and type of contractual arrangements, the adequacy of the chosen level of minimum wage and the degree of compliance with the minimum wage regulation by the employers being some of them.

The theoretical and empirical literature on the economic effects is vast and numerous but consensus on the economic effects of minimum wage introduction and subsequent changes is yet to be reached. Moreover, effects differ not only between countries, regions, economic sectors and industries, but also between workers from different gender and age groups. For example, some studies conclude that the effect of minimum wages on workers and firms are only modest (see Dube et al., 2010), while others emphasize that minimum wages has significant negative effects for some particular employment types, such as low-skilled and young workers (see Neumark et al., 2014).

The minimum wage in North Macedonia was introduced for the first time in 2012 with the adoption of the Law on the minimum wage. Initially the minimum net wage was set to the level of 8,050 MKD for all workers, except for several labour intensive sectors where the minimum wage floor was set at a lower level but it was planned to increase progressively in a three year period. Since then the level was increased several times. In September 2017 universal minimum wage was set at 12,000 MKD for all economic sectors. With this change, minimum wage increased by 19.0%, which is the largest increase since the adoption of the Law on minimum wage. Minimum wage continued to increase forward, with additional record high increase of the minimum wage of 19.4% to be implemented in the period from April 2020 to March 2021.

The introduction of the minimum wage, as well as the subsequent increases, especially the more prominent ones heightened the debate about the likely economic impacts. Even though the social dimension of the minimum wage concept is unquestionable, there are discussions and critics whether minimum wage creates burden to enterprises by increasing their production costs and consequently, have negative effect on firms' profitability. However, the number of empirical studies with formal econometric research on the impact of minimum wage reforms in North Macedonia is rather limited. Moreover, as to the knowledge of the authors there are no studies that analyze the impact on firms' profitability and productivity. This research paper aims to fill this gap by investigating the economic impact of minimum wage increase in 2017 in North Macedonia on firms' average wages, number of employees, profitability and productivity. To that end, we are using firm level data from the Central Registry consisting of financial accounts (balance sheet and income statement) submitted by the firms for a period of 7 years, from 2013 to 2019. For the estimation we employed the difference-in-difference (DD) method in a panel setting. Structured in this way, the research also contributes to the existing literature on this topic by investigating the minimum wage phenomenon in a developing and transition country setting, where the nature of labor market is very different relative to developed country settings.

The paper is organized as follows. The next section gives an overview of the literature review on this topic. Discussion on the database main features is presented in section 3. In section 4 we discuss some stylized facts connected to the minimum wage dynamics, by sectors and firm size. The econometric analysis and discussion of the results is presented in section 5. Finally, in the last section the main findings are summarized.

2. Literature review

The literature that investigates the effects of minimum wage increases on firms' performance and economic outcomes is vast and numerous. Studies on this topic might be classified on theoretical and empirical studies. Given our research question in this section we will mostly concentrate on the empirical studies by giving only short overview of the most important theoretical models.

In general, there are four main theoretical models that analyze the economic effects of minimum wages – the competitive model, the dynamic monopsony model, the search and matching model, and the institutional model. The competitive model represents the baseline framework. The core implication of this model is that in perfectly competitive labour markets, setting minimum wages above the market clearing level reduces the demand for labour and employment. The second theoretical model is the monopsony model with market power and labour market frictions as embedded assumptions. In this model the impact of minimum wages on firms' decision-making process is not as straightforward as in the basic competitive model. The upward-sloping labour supply curve, where employment is an increasing function of wages, determines that both employment and wages rise in response to the binding minimum wage up to a competitive market level. Also, market power allows firms to pass one part of higher wages on to consumers by raising prices of final product. The search and matching model assume that unemployed workers search for jobs and firms, driven by profit maximizing objective, search for employees. These market imperfections, same as in the monoposony model, might in fact produce decline in unemployment when minimum wages increase - higher minimum wages may increase job search efforts, improve the matching process, and thus increase employment and overall efficiency. The fourth group of theoretical models are the institutional models that combine imperfect competition, labour market rigidities and behavioral economics principles. Economic agents are heterogenous, labour market is imperfectly competitive and operates under labour market institutions. Increase in the minimum wage may be neutralized by improving the overall efficiency, reducing organizational inefficiencies or by increasing the productivity of employees.

All in all, theoretical models suggest that the question on the likely impact of minimum wage increases is an empirical problem because firms have many adjustment channels at disposal that may be used to absorb the effects of higher labour costs. For example, increase in minimum wages might be compensated by reductions in non-wage benefits, reductions in training, changes in employment composition, higher prices, reduction in profits, improvements in efficiency and consequently, reduction in hours worked etc. Having in mind our research question, the empirical literature presented in this section is organized around the investigated economic outcomes and adjustment channels important for our research. As it will become evident from the discussed literature in the remaining part of this section, there is no general consensus on the most likely effects of minimum wages increase – results differ by countries, industries and even sectors. From a chronological

perspective, minimum wage research is dating back to the 1970s. Detailed chronological overview may be found in Card and Krueger (1995) and in Neumark and Wascher (2008); in this section we will focus only on more recent empirical studies.

The most popular adjustment channel that is investigated in the empirical literature is the likely impact of minimum wage changes on employment.. Existing studies indicate potential effects in both directions, though studies that find negative effect predominate. For example, Aaronson and French (2007) found that a 10 percent minimum wage increase leads to a 2.5 to 3.5 percent decline in employment. Dube, Lester and Reich (2010) investigated employment growth across different U.S. regions with different levels of the minimum wage and show that employment has lower growth rate in those parts of the country where minimum wages are higher. Sabia, Burkhauser and Hansen (2012) found that the increase in the New York state minimum wage resulted in decline in employment of younger less educated workers. On the other hand, some studies found positive or insignificant effect of minimum wages on employment. Giuliano (2013) investigates the minimum wage increase in the US in 1996 and found statistically insignificant effect. Similar result was found by Hirsch, Kaufman and Zelenska (2015). Positive effects on employment of minimum wages are found in studies such as Dickens et al. (1999) and Montenegro and Pagés (2004).

As the transmission to wages is concerned, Neumark and Wascher (2008) found that rise in minimum wages compress the lower tail of the wage distribution and have positive overall effect on average wages. Similar result was found by Hirch et al. (2015), Borjas (2004) and DiNardo, et al. (1996). Contrary to these results, some studies report that minimum wage increases may lead to compression in the upper tail of the wage distribution (high-wage earners), as well and possible, negative (or insignificant) spillover on average wages. Some authors argue that higher wage costs for low-wage workers (because of increase in the minimum wage floor) may be compensated by cutting the earnings of high-wage workers. In this context, Hirsch, Kaufman, and Zelenska (2015) report that almost half of the interviewed employers in their research responded that, given the increase in the federal minimum-wage, they "would delay or limit pay raises/bonuses for more experienced employees".

When discussing impact of minimum wage increase on firms' profitability, the outcome depends on all adjustments channels firms are using in order to absorb higher costs for labour. If no adjustment is undertaken (or the adjustments are not neutralizing in total the increased labour costs because of increases in the minimum wages) than profit will be reduced. Negative impact on firms' profitability have been found in Draca et al. (2011). In addition, Hirsch et al. (2015) find that the profitability growth of firms will most likely be reduced if the effect cannot be transmitted into higher prices. However, in practice what usually happens is that firms are trying to avoid losses and will undertake different adjustments in order to keep (or even increase) their profits. One possibility is to increase output prices. This result has been found in several empirical studies, though generally the conclusion is that the effect on total inflation is rather small. For example, Lemos (2008) surveys around 30 studies on the relation between minimum wages and prices and concludes that most studies found increase in food prices and overall prices by around 4% and 0.4%, respectively in response to 10% increase in US minimum wage. Similar result was found in Neumark and Wascher (2008) and Aaronson et al. (2008). In addition to higher prices, in order to sustain and increase profits firms might improve efficiency and productivity. Hirsch et al. (2015) in an interview study find that about 90 percent of the interviewed managers answered that they planned to respond to the minimum-wage increase with increased productivity from the workforce by cross-training, multi-tasking and tighter work schedules.

Empirical research on effects of minimum wage changes for transition and developing countries is mostly focused on the impact on employment and wages. As in the case of developed countries, the usual result is that minimum wage increases have detrimental effects on employment and hiring. This was confirmed in the case of Hungary (Kertesi and Köllő, 2002; Harasztosi and Lindner, 2019), Czech Republic and Slovakia (Eriksson and Pytlikova, 2004, Fialova and Mysikova, 2009), Estonia (Hinnosaar and Rõõm, 2003) and Slovenia (Vodopivec 2015). When it comes to wages positive wage effect is found for Hungary (Kézdi and Kónya, 2012, Harasztosi and Lindner, 2019), the Czech Republic and Slovakia (Eriksson and Pytlikova, 2004), Slovenia (Vodopivec 2015) and Estonia (Ferraro et al., 2016). Studies that investigate the impact on firms' profitability and performance in transition and developing countries are rather limited. Babiak, Chorna and Pertold-Gebicka (2019) find that the increase in minimum wages leads to a reduction in firms' profits. Harasztosi and Lindner (2019) exploit the large increase in minimum wage in Hungary in 2001 and find that the rise in minimum wage did have slight negative effect on firms' profitability. On the other hand, Cuong (2013) did not find any significant effect of minimum wage increase on firms' profitability in the case of Vietnam.

Another important research on the minimum wages and transmission channels for the CESEE region is the analysis by Bodnar et al. (2018). They use firm-level cross-country survey dataset compiled from a survey conducted within the third wave of the European Central Bank's (ECB) Wage Dynamics Network (WDN3) for eight Central and Eastern European countries: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia. More precisely, the authors are investigating several adjustment channels such as layoffs, cuts in hiring, price rises, cuts in non-labour costs, wage rises for employees earning above the minimum wage and improvements in productivity. Their finding suggest that the most popular adjustments undertaken by firms in CESEE region are cuts in non-labour costs, rises in product prices, and improvements in productivity.

In terms of methodology, early studies were using time-series techniques (see Card and Krueger, 1995) correlating some outcome variable, usually employment with the level of minimum wages. Second generation studies were cross-sectional, comparing differences between states or cities that were affected by minimum wage increases and state/cities that were not (Neumark and Wascher, 2002, Dube, Lester and Reich, 2010, Cengiz et al, 2019). More recent studies are using large micro datasets. Usually these are firm level datasets, though, not rarely there are studies that combine two or more datasets to provide richer analysis. For example, Giupponi and Machin (2018) combine two datasets (National Minimum Dataset for Social Care and Care Quality Commission registry) in order to obtain rich matched employer-employee data base. Deng (2017) follows similar approach when investigating effects of minimum wage increases in China by combining firm-level panel data from the annual industrial surveys with dataset on minimum wages at the county level. Studies based on micro data are using panel techniques or impact evaluation methods, such as difference-in-difference approach, propensity score matching techniques, and more recently, synthetic control methods.

3. Data

The analysis is based on firm level data from the Central Register. More precisely we are using financial accounts (balance sheet and income statement) submitted by the firms for a period of 7 years, from 2013 to 2019. In the first step of data selection, we included all firms from the non-financial sector. However, having in mind our research question - to evaluate the impact of 2017 minimum wage increase on firms' performance in North Macedonia – in the second step we kept only

firms that have data at least for 2016, 2017 and 2018. Given that firm-level data is often distorted by outliers, before continuing with the analysis, we cleaned the dataset from extreme values. The outlier cleaning was applied to two variables important for the analysis – average wages and wage growth. More specifically, we were looking at the average wage and the wage growth of individual firms and if these variables were higher than five interquartile ranges above or below the median of that sector in a specific year than that firm is eliminated from the sample.

The structured dataset after these changes consists of 268,007 observations for the 7-year period (on average around 40,000 firms per year). The firms are active in 18 different sectors of economic activities (according to NACE Rev.2). Looking further into the sample, on average for the 7-year period roughly 97.5% of the firms are micro and small (employing from 1 to 49 persons), 1.5% are medium sized firms (from 50 to 249 employees), and only 1% of the sample firms are large firms (employing 250 and more persons). As shown in Table 1[2], on average, over the period 2013-2018 firms included in the analysis represent around 53.4% of the total number of registered business entities in this period (the percentage of coverage varies between sectors from 20.2% to 81.8% in some sectors), employed around 45.2% of the total number of employed persons in the economy and created 31.8% of the total value added in the domestic economy. Additional information on the data set is available in Appendix 1.

Table 1. Average sample coverage by sectors of economic activity for 2013-2018 period

Sector	**Number of firms**	**% share of total number of firms**	**Number of employees**	**% share of Total number of Employees**	**% share of Total value added**
Agriculture, forestry and fishing	1,136	41.5	9,913	8.0	8.2
Mining and quarrying	130	69.9	3,365	49.7	85.0
Manufacturing	4,553	58.0	94,178	67.8	66.6
Electricity, gas, steam and air conditioning supply	93	57.6	5,903	58.1	68.3
Water supply; sewerage, waste management and remediation activities	185	66.7	10,223	83.9	91.4
Construction	2,829	61.5	25,972	50.8	51.1
Wholesale and retail trade; repair of motor vehicles and motorcycles	13,969	58.2	72,704	72.2	45.8
Transportation and storage	3,681	63.0	25,463	67.8	66.7
Accommodation and food service activities	1,925	42.3	13,464	50.3	51.1
Information and communication	951	59.4	10,748	81.0	70.3
Financial and insurance activities	243	57.9	980	10.2	4.5
Real estate activities	315	59.0	2,047	158.5	4.0
Professional, scientific and technical activities	2,797	43.0	12,016	85.4	49.1
Administrative and support service activities	735	45.3	14,073	106.8	65.5
Education	421	37.4	2,674	6.3	5.4
Human health and social work activities	2,716	81.8	10,985	28.2	21.9

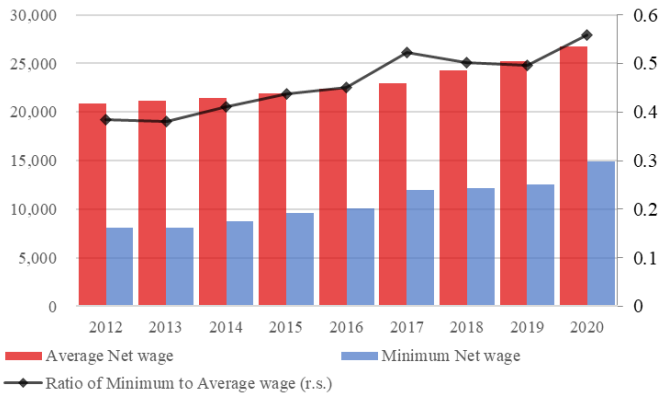
[2] At the moment of the analysis, data for 2018 is the last year for which the Central Registry provides data as final, while data for 2019 is treated as preliminary and subject to possible changes and corrections by the firms themselves.

Sector	Number of firms	% share of total number of firms	Number of employees	% share of Total number of Employees	% share of Total value added
Arts, entertainment and recreation	257	20.2	6,081	53.3	33.6
Other service activities	1,078	24.7	2,787	23.5	14.5
Total	**38,012**	**53.4**	**323,575**	**45.2**	**31.8**

4. Minimum wage in North Macedonia and 2017 reform

The minimum wage in North Macedonia was introduced for the first time in 2012 with the adoption of the Law on the minimum wage defined as the lowest monthly amount that the employer was required to pay to the employees for a full-time work performed and accomplished norm. The concept is also applicable to part-time employees, being paid a proportional part of the minimum wage for the hours worked. Within the law, the minimum net wage was set to the level of 8,050 MKD (38.5% of national net average wage in 2012) for all workers, with somewhat discordant exclusion of three labour-intensive and low paying sectors, where an average gross wage was below 15,600 MKD in July 2011 as stipulated by the law (approximately 10,600 MKD net wage). For these sectors, engaged in manufacture of textiles, manufacture of wearing apparel and manufacture of leather and related products, the minimum wage was planned to increase gradually to the level of 77.8%, 85.2% and 92.6% of the minimum wage in 2012, 2013 and 2014, respectively. Since its introduction, the minimum wage has been raised several times. In the period 2014-2016, with the 2014 amendments of the Minimum wage law, the minimum wage was raised three times (to the level of 8,800 MKD in 2014, 9,590 MKD in 2015, and 10,080 MKD for 2016). At the same time the minimum wage in the labour-intensive sectors (textile, garment and leather industries) increased to 85.2%, 83.9%, and 89.3% of the minimum wage level of 2014, 2015 and 2016, respectively. In September 2017 universal minimum wage was set at 12,000 MKD for all sectors in the economy (52.4% of national net average wage, Figure 1). With this change minimum wage increased by 19.0%, which is historically the largest increase since the adoption of the Law on minimum wage. In 2018 and 2019 the minimum wage was additionally increased by 1.4% and 2.8%, respectively raising it to 12,507 MKD. Before the parliamentary elections in 2020, there was an additional record high increase of the minimum wage of 19.4% to be implemented from April 2020 to March 2021, increasing the minimum wage floor to 14,934 MKD, or to almost 56% of the average net wage for the first half of 2020.

Figure 1. Minimum and Average Net wage in MKD



In this paper we will focus on the economic impact of minimum wage increase in 2017 on firms' average wages, number of employees, profitability and productivity. The remaining of the section is organized as follows. First, we elaborate on the definition of the treatment group in our paper and its limitations. The second part of the section presents descriptive analysis of the data sample used in the empirical analysis in the context of 2017 minimum wage increase.

4.1. Treatment group definition

The empirical analysis in the research is done by using difference in difference analysis. One of the most important issue when conducting an analysis of this type is the definition of the so-called treatment (exposed) group. The treatment group consists of individuals/units most likely to be affected by the event under investigation. In our case these are the firms that are most likely to be affected by the new minimum wage level in October 2017. Precise definition of the treatment group requires data on individual laborers, alongside firm-level data. However, this data is rarely publicly available. In fact, most of the recent empirical literature on this topic is based only on firm level data (Draca et al. 2011, Mayneris et al. 2018, Nguyen 2017). The usual approach in this case is to calculate the firms' average wage and to use the number of firms with average wage below the new minimum wage floor as proxy for the treatment group. In our case, we include all firms with an average wage smaller than 12,000 MKD in 2016 (the new minimum wage floor introduced in 2017) in the treatment group. Firms with an average wage higher than 12,000 MKD are comprising the comparison (control) group and we expect that these firms were not affected significantly by the 2017 increase in minimum wage.

Before proceeding with the empirical analysis it must be acknowledged that the use of average wages as proxy for the group of firms paying wages below the minimum wage floor has several limitations. First, the same average wage in different firms is consistent with different wage distributions among workers. Second, as discussed by Cuong (2013) control groups which are defined to be exactly above the minimum wage floor can also include workers below the minimum wages. As a result, firms in these control groups can be affected by the minimum wage, and the impact estimate of the minimum wage can be biased towards zero. Third, in the administrative data wages and bonuses of employees are under one item. This might reflect in higher average wage than the true one. Fourth, the calculated average wage indicator does not take into account the eventual unreported compensation of work or cash wages in a case of tax evasion. Having in mind the percentage of adjustments to GDP for the Non-Observed Economy by the State Statistical Office (which was 17.4% of GDP in 2016) one might speculate that the number of firms involved in such practices is not negligible. All these limitations might influence the estimated impact of minimum wage increases on average wages, number of employees, productivity and firms' profitability.

To address these limitations we conducted several robustness checks presented in the empirical sections of this research by changing the definition of the exposed and comparison group. Also, to avoid strong impact of extreme under or above-performers in terms of the average wage level, as well as wage growth, the firms which are outliers have been removed from the sample. Last, we believe that large sample size (covering 53.4% of firms on average in the sectors, as well as 45.2% of employees in the sectors) is helpful in alleviating some of these limitations when estimating the effects of the 2017 minimum wage increase on the performance of firms. In addition, it is worth mentioning that Draca et al. (2011) check the consistency of the calculated treatment indicator with an individual data on laborers and workplaces from a stratified random sample and found out that both indicators

tend to correlate very well – around 87% of all minimum wage workers are located in the firms that pay below minimum wage threshold average wages.

4.2. Descriptive statistics

This subsection presents short descriptive analysis of the sample used in the research in the context of minimum wage and 2017 reform. The share of firms paying, on average, below 2017 minimum wage floor (12,000 MKD) declined from around 67% in 2013 down to 22% in 2019[3], as shown in **Error! Reference source not found.**. Parallel with the decline in the number of firms paying below minimum wage, we can see an increase in the average wage in our sample, with the highest increase in 2018 (5.7% rise of the wages). More precisely, the sample average wage in 2013, first year of the sample, was 11,621 MKD, growing on average at an annual rate of 4.7% until 2019, reaching 15,337 MKD in 2019. In order to account for the firm size, a weighted average wage was calculated, with the weights being the number of employees in each firm. Although the level differs, both sample average wages (weighted and non-weighted wage) display similar dynamics over the sample period (**Error! Reference source not found.**). Weighted average data of the sample shows that starting in 2013, the average wage was 14,564 MKD, growing on average at an annual rate of 5.5%, reaching 20,037 MKD in 2019.

[3] The average wage is a quotient from the division of (1) the wage bill (firms' costs for wages) by (2) the number of employees, which refers to "Average number of employees based on hours worked in the accounting period" in the annual financial accounts submitted to the Central Registry.

Number of firms paying below 2017 minimum wage also differs by firms' size (Figure 4 and Figure 5). Evidently, highest wages over the sample period are paid by large firms. For the whole sample period, on average, 91.3% of large firms paid wages higher than the 2017 minimum level. In addition, only the wages paid by large firms are close to or more than the national average (as well as over the weighted average wage of the sample). Medium firms pay wages above the weighted average wage of the sample, whereas small firms pay lowest wages. On average for the sample period, 85.6% of medium firms paid wages above the 2017 minimum wage, whereas this percentage is much lower between small firms. Namely, on average, over the whole sample period around 49.7% of small firms paid wages above the 2017 minimum level. On the other hand, small firms exhibit highest growth rate of wages for the sample period, 5.6% on average, compared to medium sized and large firms, where the average wages increase with an average rate of around 4.9% and 3.7%, respectively. The latter might be explained, as can be seen on Figure 5, by the fact that small firms were the most affected by the 2017 minimum wage reform.

Figure 2. Number of firms paying below or above 2017 minimum wage floor

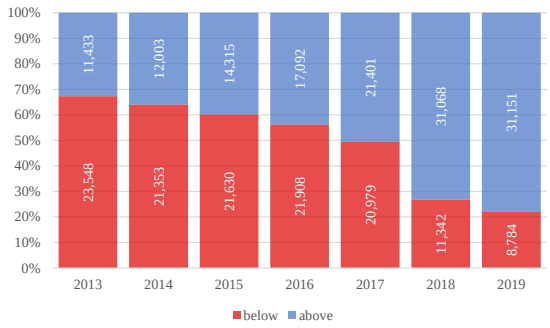


Figure 3. Average wages and annual percent change of the sample

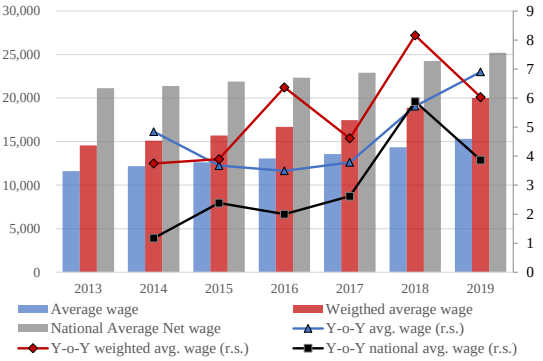


Figure 4. Weighted average wages of firms, by size

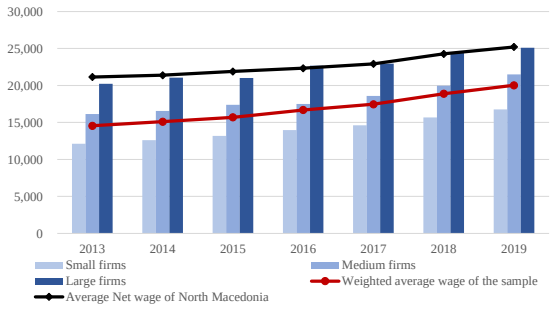


Figure 5. Share of firms by size, paying below or above 2017 minimum wage floor

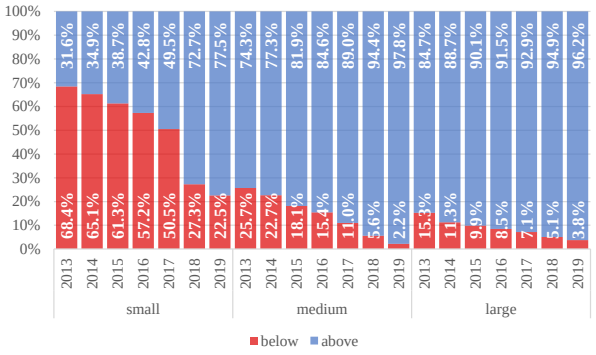
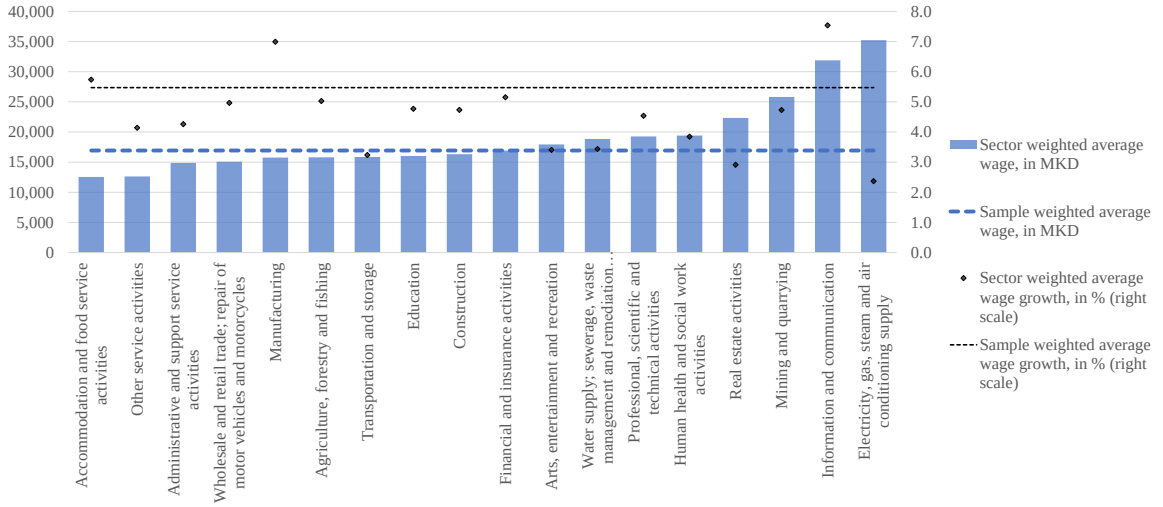
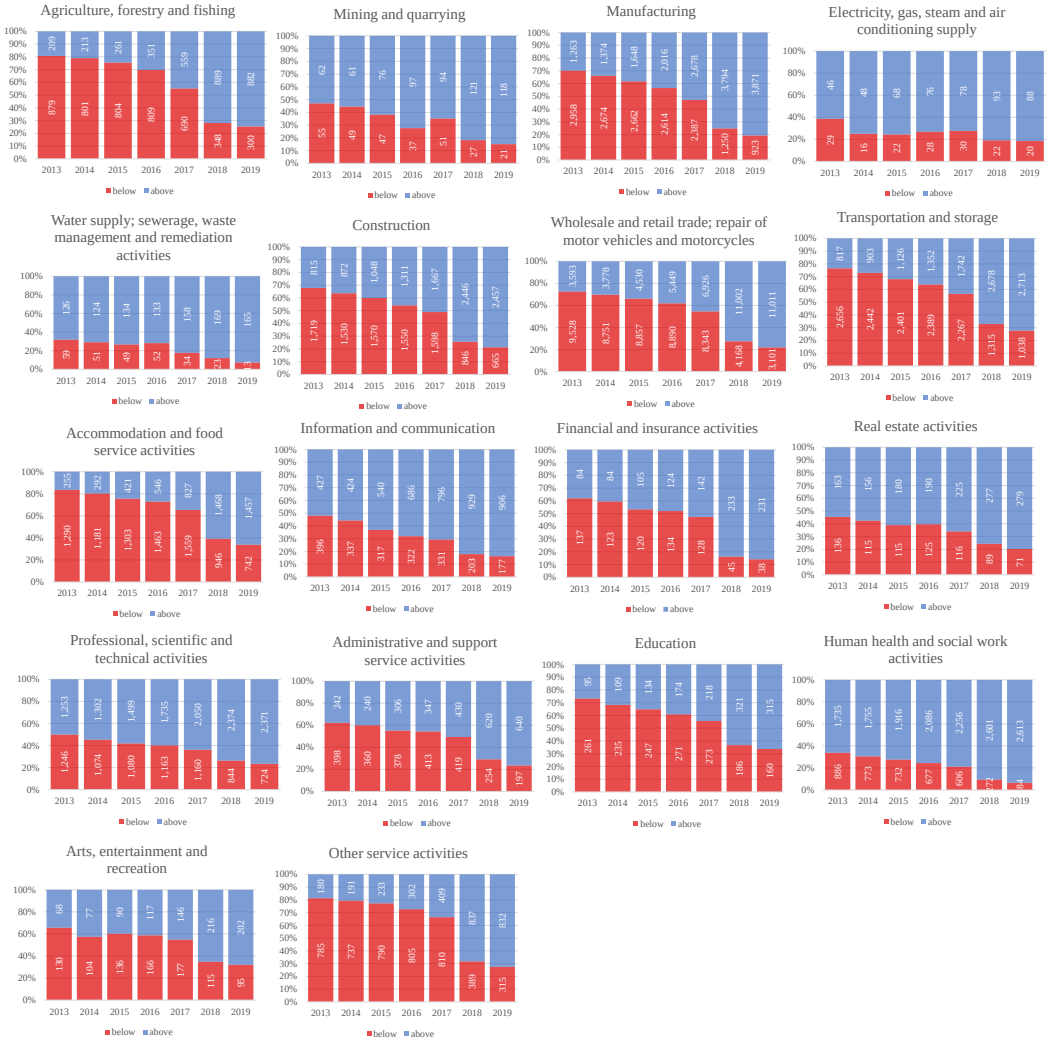


Figure 6. Average wage and growth rates for the sample period, by sector



When analyzed by sectors (Figure 6 and Figure 7), on average, for the 2013-2019 period, more than the half of the sectors in the sample, paid wages below the weighted average wage of 16,925 MKD, while 44.5% of firms paid below the 2017 minimum wage level. Lowest wages for the seven-year period (12,550 MKD) were being paid in the Accommodation and food service sector, where around 64.3% of firms paid wages below the minimum wage, marking this sector as the one with the largest share of firms paying below minimum wages. On the other hand, the Electricity, gas, steam and air conditioning supply sector has paid the highest wages (35,227 MKD), with 25.8% of firms paying below the 2017 minimum wage, on average over the sample period. Water supply, sewerage, waste management and remediation activities sector is the sector where the share of firms paying below 2017 minimum wage level is lowest (of 21.8%). When it comes to dynamics, wage growth was ranging between 2.4% to 7.5% across different sectors, on average over the sample period. From the individual sectors, lowest yearly growth rate of 2.4% was recorded in the Electricity, gas, steam and air conditioning supply sector, while highest growth rate (of 7.5%) in the Information and communication sector. Besides these extremes, one important finding from this short sectoral wage growth overview is that sectors with lowest wages experienced relatively higher wage growth over the sample period. For example, in the Manufacturing sector and Accommodation and Food service sector, sectors that are in the left half of the distribution as shown in Figure 6, wages grew with above rates of 7% and 5.7%, respectively.

Figure 7. Number of firms paying below or above minimum wage, by sectors



5. Econometric analysis

In this section we present the econometric analysis on the effects of 2017 minimum wage increase on employment, average wages, profitability and productivity. For this purpose we employed difference-in-difference estimation in a panel setting. Alongside the core results obtained on the basis of whole sample, we also perform the same analysis on specific subsamples by firm size and sectors. Finally, the last subsection includes several exercises to check the robustness and stability of our results.

5.1. Methodology

Following Draca et al. (2011) and Mayneris et al. (2018) we evaluate the impact of 2017 minimum wage increase on firms' performance in North Macedonia by using difference-in-difference (DD) estimation in a panel setting.

DD estimation compares treatment and control groups in terms of outcome changes over time relative to the outcome observed in the pre-intervention period. For example, in a two-period setting, where t=0 is the period before the event (intervention, reform, program etc.), t=1 is the period after the event and Y_t^T and Y_t^C are the respective outcomes of the treated and control groups in time t, DD will estimate the average impact of the event in the following way:

$$DD = E(Y_1^T - Y_0^T | T_1 = 1) - E\left(Y_1^C - Y_0^C | T_1 = 0\right) \quad (1)$$

In equation (1), T_1 = 1 denotes treatment (or individuals/units that will be affected by the event) in period t=0, whereas T_1 = 0 denotes untreated units.

DD estimate can also be calculated within a regression framework as presented in equation (2). The most important parameter to be estimated is the parameter of the interaction term β because it gives the average DD effect of the program. This is equivalent to calculated DD term in equation 1. Variable T_{i1} shows the treatment group and t is time trend equal to one in the period after the implementation of the program and zero otherwise.

$$Y_{it} = \alpha + \beta T_{i1} t + \rho T_{i1} + \gamma t + \varepsilon_{it} \quad (2)$$

The preceding two-period model can be generalized with multiple time periods and DD effect can be estimated by using panel fixed-effects model. This model has one clear advantage over the two-period model – it controls for heterogeneity in observed characteristics over a multiple-period setting. In our research we use this approach and, similarly to Mayneris et al. (2018), we estimate the following model:

$$Y_{k,t}^f = \alpha Exposed_t^f + \beta Exposed_t^f * Reform_t + Z_t^f + \mu_f + k_{kt} + \epsilon_{k,t}^f \quad (3)$$

Having in mind our central question – to evaluate the impact of 2017 minimum wage increase – we compare the relative performance of "exposed" (treated) firms vs "non-exposed" (control group) within different sectors before and after 2017 accounting for firm-level time-invariant characteristics (firm fixed effects). Variable $Y_{k,t}^f$ stands for outcomes such as average wages, profitability, employment and productivity (total factor productivity - TFP and labor productivity - LP) of firm f in sector k at time t. All outcome variables are directly extracted/constructed from the Central Registry database. Average wages are calculated by dividing wage bill (firms' costs for wages) with the number of workers. For profitability, same as in Draca et al. (2011) and Nguyen (2017), we use the gross profit margin, defined as gross profit to revenue ratio. Employment is the number of workers by firms as reported in the Central Registry database. To construct TFP we follow the same approach as in Jovanovic (2018) and Jovanovic (2020). More precisely, TFP is calculated as a residual from

Cobb-Douglas type of production function with the production function parameters α (labour share) and β (capital share) being estimated using the Ackerberg, Caves and Frazer – ACF (2006) method. We apply the estimated values (α was estimated to be 0.76, whereas β was estimated to be 0.13, for labour and capital, respectively) to the Cobb-Douglas production function to derive the TFP implicitly assuming stability of the production function parameters over the whole sample period. LP is calculated as firm value added per employee.

Variable $Exposed_t^f$ is equal to one if firm's average wage was below 12,000 MKD in 2016 and zero otherwise, same as previously explained. Moreover, the exposure status is constant over time for a given firm which is in line with our research question to investigate one specific episode that occurred at a given moment in time. However, this induces multicollinearity between the $Exposed_t^f$ variable and the firm fixed effects, and therefore, this variable is automatically excluded from our regression. Nevertheless, the coefficient of interest is β – the interaction parameter which gives the impact of the 2017 minimum wage increase on outcomes variable, whereas $Reform_t$ is a dummy variable equal to 0 in 2013-2016 period, and 1 in the period after the minimum wage increase (2018 and 2019).

In addition to the basic DD terms our model includes a set of control variables (Z_t^f) such as wage bill to profit ratio and capital to sales ratio, firm fixed effects (μ_f), sector dummy variables (k_{kt}), as well as time dummies for each year.

5.2. Results

In this section we present the results of the econometric analysis. As outlined previously we try to identify the effects of 2017 increase in minimum wage on several firms' performance variables such as average wages, profitability, employment, TFP and LP. Baseline results are reported in Table 2.

Table 2. Minimum wages and firms' performance variables

	ln*(average wage)*	gros profit margin	ln*(tfp)*	ln*(employment)*	ln*(labour productivity)*
Exposed firm * Refom	**0.0509*** **	0.2484	**0.0172** **	**-0.0309*** **	**0.0181** **
	[0.0037]	[0.7604]	[0.0058]	[0.0052]	[0.0057]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	195131	195233	177342	195233	195233
r2	0.0699	0.0002	0.0353	0.0539	0.0297

Notes: The data cover the 2013-2019 period. Standard errors in parantheses (*p<0.05 **p<0.01 ***p<0.001) are clustered by firm. The firm- level controls include capital to sales ratio, wage bill to profit ratio, as well as dummies for sectors, firm's size and time. "Exposed" is a dummy variable for the average wage in the firm in 2016 being lower than the minimum wage in 2017. "Reform" is a dummy variable eqauls to 1 for t > 2017.

The key variable of interest is the interaction between the firm-level exposed dummy and the reform dummy variable (*Exposed firm * Reform*). As explained in the previous section, this variable measures the pre/post-reform gap in a specific outcome variable between the exposed and control

group of firms. Less technically, the interaction variable shows the effect of the increase of the minimum wage in 2017 on the performance variable.

Turning to the estimated results, we obtained negative coefficient on employment which means that the increase of the minimum wages in 2017 led to drop in firms' employment by 3.1%, all other things being equal. This result is in line with the predictions of the core competitive model and with the findings in majority of the empirical literature that increase in minimum wages results in decline in employment. However, the magnitude of the effect is somewhat smaller than the one found in other studies. For example, Aaronson and French (2007) found that a 10 percent minimum wage increase leads to a 2.5 to 3.5 percent decline in employment, whereas in our case almost 20% increase in the minimum wage in 2017 is followed by decline in employment by 3.1%. Interestingly, despite the fact that most empirical studies estimate negative effect on employment from higher minimum wage floors, in survey analysis interviewed employers do not point out the decrease in employment as the most popular adjustment channel to be undertaken by firms (Hirsch, Kaufman and Zelenska, 2015; Bodnar et al., 2018; Ramadani and Naumovski, 2015). For example, wage and price setting survey of Macedonian firms (Ramadani and Naumovski, 2015), conducted in the first half of 2014, found that during a wage shock, such as the permanent increase in minimum wages, 74.2% of firms adjust non-labour costs, 10% reduce number of temporary employees, 4.8% reduce the number of permanent employees, 4.9% reduce hours worked per employee, while the remainder 6.1% of the firms adjust the flexible components of the wages. In our case, as we will see from the additional results presented below, this negative and significant coefficient comes only from two economic sectors.

As the transmission to wages is concerned, we found that the 2017 reform increased average wages by 5.1%, all other things being equal. Competitive labor market model suggest that wage floors raise the wages of the low paid workers, and consequently, firms' average wages (Borjas, 2004). This finding is in line with DiNardo, et al. (1996), Neumark and Wascher (2008), Kézdi and Kónya (2012), Harasztosi and Lindner (2019), and Ferraro et al., (2016).

Regarding the effect of 2017 minimum wage increase on firms' profitability we didn't find any significant effect on the profit margin. In other words, 2017 minimum wage reform didn't affect profitability of Macedonian firms in either direction. This result is not in line with the core competitive model. However, as discussed in the literature review section, firms usually undertake different adjustment strategies to absorb the increase in labour costs and to keep their profits unchanged (or even increase to increase their profits). One adjustment channel according to our results is the decline in employment, as stated above. Alternatively, firms have the possibility to increase output prices. However, this hypothesis is not tested in our case given that we don't have data on prices at a firm level. Nevertheless, a survey analysis conducted on a sample of Macedonian firms suggest that in the presence of minimum wage shock majority of the firms do not adjust output prices (Ramadani and Naumovski, 2015). In addition, our analysis reveals another important adjustment channel. Namely, research showed that firms might try to absorb minimum wage cost shock by improving managerial skills, efficiency of the production process and overall productivity (Draca, 2011). Hirsch et al. (2015) show that a rise in minimum wages creates pressure on managers to increase labour productivity by cross-training, multi-tasking and tighter work schedules. Our empirical results are in line with the productivity adjustment channel. Parameters on both productivity indicators are estimated as positive and statistically significant – 2017 minimum wage increase led to higher LP by 1.8% and higher TFP by 1.7%, respectively.

In the remaining of the section we try to identify whether effects of minimum wage increase differ depending on firm's size (Table 3) and economic sector (Table 4).

Table 3. Minimum wages and firms' performance variables by size

	ln*(average wage)*	gross profit margin	ln*(tfp)*	ln*(employment)*	ln*(labour productivity)*
Micro and small firms					
Exposed firm * Refom	**0.0494*****	-0.0663	**0.0132***	**-0.0295*****	**0.0143***
	[0.0039]	[0.6281]	[0.0060]	[0.0054]	[0.0059]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	189183	189285	171443	189285	189285
r2	0.0677	0.0001	0.0128	0.0182	0.0120
Medium and large firms					
Exposed firm * Refom	**0.0550*****	3.9359	0.0047	0.0150	0.0060
	[0.0116]	[9.3137]	[0.0256]	[0.0245]	[0.0272]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
N	5948	5948	5899	5948	5948
r2	0.1124	0.0046	0.019	0.0699	0.0216

Notes: The data cover the 2013-2019 period. Standard errors in parantheses (*p<0.05 **p<0.01 ***p<0.001) are clustered by firm. The firm- level controls include capital to sales ratio, wage bill to profit ratio, as well as dummies for sectors and time. "Exposed" is a dummy variable for the average wage in the firm in 2016 being lower than the minimum wage in 2017. "Reform" is a dummy variable eqauls to 1 for t > 2017. Firms are classified into small, micro, medium and large by using Central Registry clasiffication which is based on three criteria – number of employees, revenues and assets as defined in the Law on Trade Companies, Article 470.

Table 3 shows that the whole sample results are actually driven by the effects that the reform had on micro and small firms. Firms from this group experienced increase in average wages, higher TFP and LP and lower employment due to the 2017 minimum wage increase. Besides the direction of the impact, the magnitude of the estimated coefficients is also similar to the one estimated for the whole sample (effect are estimated slightly smaller only for the productivity indicators). Interestingly when it comes to medium and large firms, results suggest that the 2017 reform didn't have any significant impact on firms' profit, productivity and employment. Significant effect was estimated only for the average wages.

Table 4. Minimum wages and firms' performance variables by sectors

	ln*(average wage)*	gross profit margin	ln*(tfp)*	ln*(employment)*	ln*(labour productivity)*
Manufacturing					
Exposed firm * Refom	**0.0702*****	-0.7031	**0.0515****	-0.0380	**0.0470***
	[0.0138]	[0.4538]	[0.0191]	[0.0198]	[0.0193]
N	24605	24619	23088	24619	24619
r2	0.0361	0.0079	0.0337	0.0644	0.0360
Other industry					
Exposed firm * Refom	0.0649	-2.3944	-0.0062	0.1122	-0.0331
	[0.0558]	[2.3755]	[0.0820]	[0.0627]	[0.0834]
N	2102	2104	2027	2104	2104
r2	0.0458	0.0053	0.0819	0.046	0.075
Construction					
Exposed firm * Refom	**0.1104*****	-0.7757	**0.1017*****	-0.0093	**0.1047*****
	[0.0155]	[4.3844]	[0.0236]	[0.0205]	[0.0233]
N	14852	14862	13716	14862	14862
r2	0.1445	0.0009	0.0567	0.0570	0.0504
Trade					
Exposed firm * Refom	**0.0733*****	**-0.6873***	**0.0692*****	**-0.0477*****	**0.0573*****
	[0.0072]	[0.3476]	[0.0126]	[0.0100]	[0.0122]
N	69392	69428	61367	69428	69428
r2	0.0945	0.0020	0.0264	0.0449	0.0225
Transport					
Exposed firm * Refom	**0.0885*****	-0.4536	**0.0597***	-0.0410	**0.0653****
	[0.0147]	[0.5250]	[0.0241]	[0.0226]	[0.0234]
N	19701	19707	18573	19707	19707
r2	0.0499	0.0100	0.0474	0.0700	0.0408
Other services					
Exposed firm * Refom	**0.0871*****	2.1028	**0.0519*****	**-0.0377*****	**0.0699*****
	[0.0059]	[2.3820]	[0.0081]	[0.0076]	[0.0080]
N	58360	58390	52675	58390	58390
r2	0.0827	0.0003	0.0565	0.0510	0.0449

Notes: The data cover the 2013-2019 period. Standard errors in parantheses (*p<0.05 **p<0.01 ***p<0.001) are clustered by firm.All models include firms' fixed effects. The firm-level controls include capital to sales ratio, wage bill to profit ratio, as well as dummies for size and time. "Exposed" is a dummy variable for the average wage in the firm in 2016 being lower than the minimum wage in 2017. "Reform" is a dummy variable eqauls to 1 for t > 2017. Manufacturing includes sector C; other industries B, D and E; construction F; trade G, transport H and other services include sectors I, J, K, L, M, M, O, P, Q, R, S and T.

Sectoral analysis reveals some interesting findings (Table 4). First, in all sectors (with the exclusion of other services) 2017 reform led to higher average wages (estimated impact ranges from 7% in manufacturing and trade to 11% in construction), as well as improved TFP (estimated impact ranges from 5% in manufacturing and other services to around 10% in construction) and LP (estimated impact ranges from 5% in manufacturing to 10% in construction). Having all this in mind, we can conclude that construction is the sector with the most pronounced positive impact from minimum wage reform, whereas manufacturing is the sector where improvements are the smallest. Second, when it comes to profitability, sectoral results confirm that there is no significant impact among different sectors, same as the baseline results. The only exception is trade were the 2017 reform contributed to a 0.7 percentage points decline in profit margin. Third, it seems that the estimated negative impact on employment in the baseline results is driven by two sectors – trade and other services; in all other sectors the reform didn't have any significant effect on employment.

5.3. Robustness check

This section includes several exercises in order to check the robustness and stability of our results. The first exercise refers to the definition of the treatment (exposed) and control group. Namely, as previously explained, our definition of treatment and control group on the basis of firms' average wage has some limitations. To check the consistency of our results, we defined different thresholds for the treatment and control groups and re-estimated the baseline model. More specifically, we use two more floors for the treatment group – firms with average wages below 11,000 MKD and 10,000 MKD and one more floor for the control group – firms with average wage above 18,000 MKD. In addition, we also specify the treatment and control group as ranges - treatment group consists of firms paying average wages between 10,000 MKD and 12,000 MKD and control group consists of firms paying average wages between 12,000 MKD and 15,000 MKD. The results in Table 5 show that the difference-in-difference estimates obtained in different specifications confirm similar effect on firms' performance indicators.

Table 5. Minimum wages and firms' performance variables – different treatment and control groups

	ln*(average wage)*	gross profit margin	ln*(tfp)*	ln*(employment)*	ln*(labour productivity)*
Control group - average wage > 18000 MKD					
Treatmant group - average wage < 12000 MKD					
Exposed firm * Refom	**0.0815*****	0.7264	**0.0316*****	**-0.0392*****	**0.0329*****
	[0.0061]	[1.4909]	[0.0093]	]0.0091]	[0.0093]
N	163945	164040	148402	164040	164040
r2	0.0647	0.0001	0.0335	0.0540	0.0281
Control group - average wage > 12000 MKD					
Treatmant group - average wage < 11000 MKD					
Exposed firm * Refom	**0.0528*****	0.2768	**0.0176*****	**-0.0322*****	**0.0180****
	[0.0038]	[0.7958]	[0.0058]	[0.0052]	[0.0057]
N	184855	184951	167895	184951	184951
r2	0.0685	0.0002	0.0358	0.0544	0.0300
Control group - average wage > 12000 MKD					
Treatmant group - average wage < 10000 MKD					
Exposed firm * Refom	**0.0535*****	-0.5215	**0.0159*****	**-0.0348*****	**0.0166****
	[0.0039]	[0.5478]	[0.0059]	[0.0053]	[0.0058]
N	171664	171759	155838	171759	171759
r2	0.0667	0.0004	0.0366	0.0549	0.0306
Control group - average wage > 12000 MKD and < 15000 MKD					
Treatmant group - average wage > 10000 MKD and < 12000 MKD					
Exposed firm * Refom	**0.0172*****	4.0487	**0.0180***	-0.0098	**0.0187***
	[0.0059]	[3.3071]	[0.0101]	[0.0089]	[0.0099]
N	44212	44223	40717	44223	44223
r2	0.0854	0.0004	0.0631	0.3774	0.057

Notes: The data cover the 2013-2019 period. Standard errors in parantheses (*p<0.05 **p<0.01 ***p<0.001) are clustered by firm. All models include firms' fixed effects. The firm-level controls include capital to sales ratio, wage bill to profit ratio, as well as dummies for sectors, size and time. "Exposed" is a dummy variable for the average wage in the firm in 2016 being lower than the defined treshold. "Reform" is a dummy variable equals to 1 for t > 2017.

Second robustness exercise considers the method of estimation. Our baseline method is difference-in-difference estimation in a panel setting in order to take advantage of the time variability and to increase the degree of freedom by enlarging the sample. However, given that we investigate one specific event – increase in the minimum wage in 2017 it is possible to perform the estimation in a cross section setting by using data only for 2016 and 2018.

Table 6. Minimum wages and firms' performance variables – cross section data

	ln*(average wage)*	gros profit margin	ln*(tfp)*	ln*(employment)*	ln*(labour productivity)*
Exposed firm * Refom	**0.1702*** **	-4.0287	**0.1132*** **	**-0.0683*** **	**0.1309*** **
	[0.0054]	[3.7964]	[0.0087]	[0.0098]	[0.0087]
N	58332	58332	53162	58332	58332
r2	0.4513	0.0008	0.3741	0.5129	0.3481

Notes: Estimation is performed by using data for 2016 and 2018. Standard errors in parantheses (*p<0.05 **p<0.01 ***p<0.001) are clustered by firm. The firm-level controls include capital to sales ratio, wage bill to profit ratio, as well as dummies for sectors, firm's size and time. "Exposed" is a dummy variable for the average wage in the firm in 2016 being lower than the minimum wage in 2017. "Reform" is a dummy variable equals to 1 for t =2018.

Results (Table 6) remain stable and the general conclusions are the same – minimum wage increase in 2017 increased firms' average wages and productivity and had negative impact on employment. Firms' profit are unaffected. Compared to our baseline results, all effects are slightly more pronounced. This is expected given that in this model we are concentrated only on the effects in 2018 - the period immediately after the event.

6. Conclusion

The goal of this paper was to investigate the economic impact of minimum wage increase in 2017 in North Macedonia on firms' average wages, number of employees, profitability and firms, productivity. To that end, we used firm level data from the Central Registry consisting of financial accounts (balance sheet and income statement) submitted by the firms for a period of 7 years, from 2013 to 2019. The econometric analysis is conducted by employing DD estimation method in a panel setting.

Despite debates on possible detrimental effects of minimum wage increase on firm's performance, our analysis showed that 2017 increase in minimum wage didn't have any significant effects on firms' profitability. This result is in line with theoretical models and empirical studies that suggest existence of several adjustment channels usually used by firms to absorb higher labour costs and to keep their profits unchanged. One adjustment channel according to our results is the decline in employment. Namely, the coefficient on employment is estimated as negative, though, when compared to similar studies the magnitude of the effect is rather modest. More importantly, our analysis reveals another adjustment channel undertaken by Macedonian firms. Literature suggest that firms might try to absorb minimum wage cost shock by improving managerial skills, efficiency of the production process and overall productivity. In line with this theoretical predictions, parameters on both productivity indicators are estimated as positive and statistically significant suggesting that Macedonian firms increased their productivity as an answer to higher labour costs. This is valid not only for LP, but also for TFP with both effects being estimated similar in magnitude.

More disaggregated analysis showed that the whole sample results are actually driven by the effects that the reform had on micro and small firms. Firms from this group experienced increase in average wages, higher TFP and LP and lower employment due to the 2017 minimum wage increase. Large and medium sized firms didn't have any significant effect of the reform, the only exception being increased average wages. Looking by sectors, generally firms in all sectors reveal positive effect on average wages, as well as improvements in TFP and LP and generally, statistically insignificant

effect on profitability. Interestingly, sectoral analysis reveals that the estimated negative impact on employment in the whole sample results seems to be driven by only two sectors – trade and other services; in all other sectors the reform didn't find any significant effect on employment.

The research and its findings have several contributions. First, being one of the few papers on this topic, this research shed some light on the minimum wage phenomenon and its impact on firms' performance in our economy. Second, this is one of the few papers on Macedonian economy that explores the advantages of the microdata as an efficient way to fill "aggregate data gaps" and as such it widens the pull of microdata research in the case of our country. Third, the paper adds to the empirical literature on this topic by investigating the minimum wage phenomenon in a developing and transition country setting, where the nature of labor market is very different relative to developed country settings.

7. References

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8. Appendix 1
Statistical characteristics of the sample

Table 7. Number of firms by sectors

Sector	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Agriculture, forestry and fishing	1,088	1,014	1,065	1,160	1,249	1,237	1,182
Mining and quarrying	117	110	123	134	145	148	139
Manufacturing	4,221	4,048	4,310	4,630	5,065	5,044	4,794
Electricity, gas, steam and air conditioning supply	75	64	90	104	108	115	108
Water supply; sewerage, waste management and remediation activities	185	175	183	185	192	192	178
Construction	2,534	2,402	2,618	2,861	3,265	3,292	3,122
Wholesale and retail trade; repair of motor vehicles and motorcycles	13,121	12,529	13,387	14,339	15,269	15,170	14,112
Transportation and storage	3,473	3,345	3,527	3,741	4,009	3,993	3,751
Accommodation and food service activities	1,545	1,473	1,724	2,009	2,386	2,414	2,199
Information and communication	823	761	857	1,008	1,127	1,132	1,083
Financial and insurance activities	221	207	225	258	270	278	269
Real estate activities	299	271	295	315	341	366	350
Professional, scientific and technical activities	2,499	2,376	2,579	2,898	3,210	3,218	3,095
Administrative and support service activities	640	600	684	760	849	874	837
Education	356	344	381	445	491	507	475
Human health and social work activities	2,621	2,528	2,648	2,763	2,862	2,873	2,797
Arts, entertainment and recreation	198	181	226	283	323	331	297
Other service activities	965	928	1,023	1,107	1,219	1,226	1,147
Total	**34,981**	**33,356**	**35,945**	**39,000**	**42,380**	**42,410**	**39,935**
Total according to official SSO data	**71,290**	**70,659**	**70,139**	**71,519**	**71,419**	**72,315**	**75,914**
Share of sample data in total official SSO data, in percent	**49.1**	**47.2**	**51.2**	**54.5**	**59.3**	**58.6**	**52.6**

Table 8. Number of firms by sectors and firm size

Sector	Firm size	2013	2014	2015	2016	2017	2018	2019
Agriculture, forestry and fishing	small	1,059	987	1,036	1,130	1,214	1,207	1,154
	medium	21	19	20	20	21	18	18
	large	8	8	9	10	14	12	10
Mining and quarrying	small	104	97	106	120	130	130	124
	medium	5	5	9	5	6	8	4
	large	8	8	8	9	9	10	11
Manufacturing	small	4,010	3,839	4,093	4,386	4,794	4,775	4,508
	medium	137	139	144	165	182	179	187
	large	74	70	73	79	89	90	99
Electricity, gas, steam and air conditioning supply	small	66	55	78	91	89	91	84
	medium	4	4	5	6	10	14	13
	large	5	5	7	7	9	10	11
Water supply; sewerage, waste management and remediation activities	small	155	146	156	157	163	161	147
	medium	21	20	18	17	18	19	20
	large	9	9	9	11	11	12	11
Construction	small	2,463	2,329	2,538	2,760	3,160	3,191	3,020
	medium	47	48	46	61	66	59	60
	large	24	25	34	40	39	42	42
Wholesale and retail trade; repair of motor vehicles and motorcycles	small	12,848	12,278	13,125	14,059	14,949	14,849	13,763
	medium	178	164	173	185	219	222	255
	large	95	87	89	95	101	99	94
Transportation and storage	small	3,419	3,294	3,466	3,686	3,952	3,921	3,671
	medium	30	29	35	35	36	46	53
	large	24	22	26	20	21	26	27
Accommodation and food service activities	small	1,530	1,457	1,706	1,988	2,362	2,388	2,177
	medium	11	12	14	17	21	21	18
	large	4	4	4	4	3	5	4
Information and communication	small	798	736	831	974	1,086	1,089	1,039
	medium	11	11	12	16	23	23	24
	large	14	14	14	18	18	20	20
Financial and insurance activities	small	214	199	218	247	260	266	259
	medium	1	1		1		3	1

Sector	Firm size	2013	2014	2015	2016	2017	2018	2019
	large	6	7	7	10	10	9	9
Real estate activities	small	285	257	281	302	323	344	328
	medium	4	4	4	2	4	5	8
	large	10	10	10	11	14	17	14
Professional, scientific and technical activities	small	2,469	2,347	2,551	2,867	3,182	3,190	3,066
	medium	9	8	11	11	9	7	10
	large	21	21	17	20	19	21	19
Administrative and support service activities	small	623	584	673	745	834	853	813
	medium	8	7	6	8	9	13	15
	large	9	9	5	7	6	8	9
Education	small	350	337	374	439	485	501	469
	medium	5	5	5	4	4	4	5
	large	1	2	2	2	2	2	1
Human health and social work activities	small	2,616	2,523	2,643	2,757	2,854	2,864	2,788
	medium	4	4	4	6	6	7	8
	large	1	1	1		2	2	1
Arts, entertainment and recreation	small	177	160	204	261	300	309	273
	medium	13	13	13	11	12	11	13
	large	8	8	9	11	11	11	11
Other service activities	small	964	927	1,023	1,105	1,219	1,226	1,146
	medium	1	1		1			1
	large				1			
Total		**34,981**	**33,356**	**35,945**	**39,000**	**42,380**	**42,410**	**39,935**

Table 9. Number of employees by sectors

Sector	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Agriculture, forestry and fishing	9,224	9,283	9,634	10,273	10,510	10,553	10,144
Mining and quarrying	3,171	3,096	3,316	3,317	3,359	3,929	3,773
Manufacturing	80,232	81,184	91,031	95,923	107,170	109,529	107,875
Electricity, gas, steam and air conditioning supply	3,555	3,553	3,447	8,282	8,318	8,263	8,242
Water supply; sewerage, waste management and remediation activities	10,001	10,162	10,302	10,296	10,181	10,393	9,875
Construction	22,652	22,472	24,859	28,599	28,823	28,425	26,322
Wholesale and retail trade; repair of motor vehicles and motorcycles	64,382	64,964	69,926	75,941	80,051	80,962	80,166
Transportation and storage	24,131	24,136	26,340	24,631	25,554	27,986	27,446
Accommodation and food service activities	10,553	10,782	12,612	14,291	16,294	16,253	15,849
Information and communication	8,009	8,229	9,536	11,675	13,464	13,577	13,617
Financial and insurance activities	694	739	929	1,125	1,157	1,238	1,199
Real estate activities	2,076	1,973	1,911	1,957	2,046	2,317	2,259
Professional, scientific and technical activities	10,012	10,408	11,232	12,437	13,849	14,159	14,022
Administrative and support service activities	11,574	13,187	13,710	12,975	16,443	16,546	17,786
Education	2,220	2,355	2,493	2,868	2,941	3,167	2,899
Human health and social work activities	9,667	9,711	10,464	10,985	12,473	12,608	11,621
Arts, entertainment and recreation	4,400	5,246	5,864	6,515	7,017	7,442	7,661
Other service activities	2,519	2,480	2,761	2,908	3,049	3,007	2,880
Total	**279,072**	**283,960**	**310,367**	**334,998**	**362,699**	**370,354**	**363,636**
Total according to official SSO data	**678,838**	**690,188**	**705,991**	**723,550**	**740,648**	**759,054**	**797,651**
Share of sample data in total official SSO data, in percent	**41.1**	**41.1**	**44.0**	**46.3**	**49.0**	**48.8**	**45.6**

Table 10. Value added percent share of sectors in the sample

Sector	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Agriculture, forestry and fishing	3.0	2.9	2.9	2.9	2.9	2.8	2.8
Mining and quarrying	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Manufacturing	12.5	12.6	12.4	12.2	12.2	12.1	12.2
Electricity, gas, steam and air conditioning supply	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Water supply; sewerage, waste management and remediation activities	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Construction	7.6	7.6	7.7	7.7	8.1	8.2	8.2
Wholesale and retail trade; repair of motor vehicles and motorcycles	36.9	36.8	36.4	36.0	35.3	35.0	34.7
Transportation and storage	9.9	10.0	9.8	9.6	9.4	9.4	9.3
Accommodation and food service activities	4.3	4.4	4.7	5.1	5.5	5.6	5.4
Information and communication	2.5	2.4	2.6	2.8	2.9	2.9	2.9
Financial and insurance activities	0.6	0.6	0.6	0.7	0.6	0.7	0.7
Real estate activities	0.9	0.8	0.8	0.8	0.8	0.9	0.9
Professional, scientific and technical activities	7.2	7.2	7.3	7.5	7.7	7.7	7.9
Administrative and support service activities	1.9	1.9	2.0	2.0	2.1	2.1	2.2
Education	1.0	1.0	1.0	1.1	1.1	1.2	1.2
Human health and social work activities	7.4	7.5	7.3	7.1	6.7	6.8	7.0
Arts, entertainment and recreation	0.6	0.6	0.6	0.7	0.8	0.8	0.7
Other service activities	2.6	2.6	2.7	2.7	2.7	2.7	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 11. Value added share of Total value added of domestic economy, by sector, in percent

Sector	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Agriculture, forestry and fishing	7.5	6.5	7.1	8.4	10.2	9.4
Mining and quarrying	84.4	93.7	91.7	78.9	77.8	83.4
Manufacturing	68.2	60.8	64.7	67.1	69.5	69.1
Electricity, gas, steam and air conditioning supply	34.0	37.8	45.2	83.1	87.6	121.9
Water supply; sewerage, waste management and remediation activities	105.1	85.1	87.2	87.1	95.3	88.3
Construction	46.0	38.0	42.0	55.4	63.1	62.2
Wholesale and retail trade; repair of motor vehicles and motorcycles	50.1	43.5	45.4	47.4	44.7	43.9
Transportation and storage	76.7	68.7	69.9	60.9	58.4	65.7
Accommodation and food service activities	51.4	47.9	53.3	47.7	51.8	54.2
Information and communication	60.0	58.7	63.8	80.3	78.1	80.7
Financial and insurance activities	3.6	4.0	4.5	4.8	4.6	5.6
Real estate activities	5.0	3.2	3.5	3.9	4.4	4.1
Professional, scientific and technical activities	49.9	42.2	47.4	49.0	52.2	53.8
Administrative and support service activities	72.8	67.2	65.0	58.6	64.7	64.4
Education	5.0	4.4	5.2	5.5	6.0	6.3
Human health and social work activities	21.1	19.1	20.2	19.5	25.6	25.9
Arts, entertainment and recreation	34.3	27.5	29.7	32.8	37.3	39.8
Other service activities	15.7	14.1	14.4	14.0	14.6	14.2
Total	30.0	27.2	29.6	32.7	34.9	36.1

Figure 8. Weighted average wages in MKD, by sectors