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Impact of Minimum Wage on Firm Profitability in Estonia

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All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced.

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1. Abstract

Minimum Wage is a widely studied topic, however, the impact of Minimum Wage in firm performance, more specifically firm profitability is a topic which needs further research. This paper uses linked employee-employer data from Estonia for the years 2010-2018 to explore the impact of the increase in Minimum Wages on firm profitability indicators. The paper uses a difference-in-difference model to estimate the impact of minimum wage on firm profitability. The Return on Assets (ROA) Change and the Return on Equity (ROE) Change relative to the pre-policy year 2012 are negative and significant in all the years the minimum wage increased. The greatest decline in ROA is in 2018 at -2.5 percentage points and the ROE decline is more pronounced over time with a -5.8 pp change in 2013 and a -7 pp change in 2018.

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2: Introduction

The topic of Minimum Wages is of increasing importance, from a social, economic as well as political perspective. Most countries today have a minimum wage, whether the wage applies universally to all workers or to different economic sectors. According to the International Labour Organisation (ILO), the minimum wage is defined 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” (International Labour Organisation, 2014, p. 33).

Minimum wages aim to ensure a living wage for workers and thereby improve their welfare and through this reduce income inequality. The purpose of minimum wages is to establish a fair and equitable share of societal progress for everyone and help protect workers from unjustly low pay. They can also be part of efforts to reduce poverty and inequality, including the wage inequality between groups, for instance between men and women, between young and elderly, etc.

While the basic idea of minimum wage laws is to establish a wage floor for all workers, minimum wage regulations are diverse and can differ by country, region, industry, occupation or a combination of these factors (Desilver, 2021). Some countries may have a single minimum wage applied to all workers, for instance, France has a monthly minimum wage of 1554.58 Euros (Trading Economics, 2021) while others can have multiple minimum wage rates according to the sector, for example in South Africa the minimum wage rates for domestic workers differ from those of farmworkers (Business Tech, 2021). The minimum wages may also vary for types of workers, e.g. different rates may be applied for younger workers. For instance, in the UK, there are different wage rates for workers for ages 16-17, 18-20, 21-22 and 23 and above (Money Helper, n.d.).

It is also important to distinguish minimum wage setting from collective bargaining agreements, where minimum wages target the lowest paid workers while collective bargaining agreements can also increase the wages of workers already paid above the legal minimum. Furthermore, some countries do not have a statutory minimum wage but instead the wages for a majority of workers are determined by collective bargaining agreements.

Within Europe, for instance, the Nordic countries of Sweden, Denmark and Finland all have high collective bargaining coverage, that is 85%, 74% and 85% of workers in the private sector respectively and they do not have a statutory minimum wage (Eldring & Alsos, 2014, p.8).

Although the goal behind minimum wage laws is to promote welfare, equality and social inclusiveness, critics argue that its effects may be counterproductive by disrupting the labour market. To better understand and evaluate the effects of minimum wages, much research has been conducted over the past few decades, particularly on its effects on employment and wages, however, less research is available on minimum wages' effects on firm performance.

Existing literature on Minimum Wage (MW) effects on employment provides conflicting answers, with some arguing that it leads to negative employment effects (Brown et al., 1983; Neumark & Wascher, 2000) while others find that it may even lead to positive employment effects (Card & Krueger, 1995). There are different findings across countries and studies arising from differences in country dynamics and methodologies used. Several different studies on employment are discussed in more detail in Section 3.1.1 of the literature review.

The literature on MW effects on wages is more clear with most studies agreeing that MW raise the income of the lowest paid (Belman & Wolfson, 2014, p. 210) and by compressing the wage distribution (Lemos, 2004) on the left by establishing a wage floor, also lead to reduced wage inequality. These effects are briefly discussed in Section 2.1.2 of the literature review.

Finally, while a vast literature exists on MW effects on employment and wages, quite a bit less is available on its effects on firm performance. A particularly important variable of interest of firm performance is profitability and this paper uses Estonian data to explore the effects of minimum wages on firms' profitability. While there are very few studies relating MW to firm profitability, we summarise some of the literature in this area in Section 3.2.1. Some studies also point to the positive relationship between minimum wages and firm productivity (Riley & Bondibene, 2016, Mayneris et al., 2018) and in Section 3.2.2, we summarise research on this topic.

This paper aims to explore the impact of the Minimum Wage increase on firm profitability and to expand the literature on minimum wage research on firm performance.

Section 3.1 of the literature review summarises studies using individual level data and the sub-sections 3.1.1 and 3.1.1 provide an overview on the effects on employment and wages respectively. Section 2.2 covers research on firm-level studies and Section 2.2.1 explores findings from studies on effects of MW on profitability and prices. The next Section 2.2.2 briefly discusses literature on effects on firm productivity. Lastly, Sections 3.3 and 3.4 give a short overview of the wage setting process in Estonia and some of the research conducted on MW effects in Estonia.

3: Literature Review

The Literature Review that follows provides an overview of the effects of the national Minimum Wage (MW) at both the individual as well as firm-level. We want to examine and evaluate how MW affects employment and wages and also, how firms adjust in response to changes in minimum wage including changes in firm productivity, profitability, and wage inequality.

The MW raises the wage bill of affected firms and it is a natural question how firms are able to sustain higher wages induced by an increase in the MW. We theorise several possibilities: firstly, that an increase in MW leads to reduced profit margins (Draca et al., 2011). Another possibility is that firms simply pass on the higher wage costs to consumers through increases in price of their products or services. A third possibility is that an increase in minimum wages may lead to higher productivity (Riley & Bondibene, 2016) through improving efficiency. Furthermore, it can also affect employment (Neumark & Wascher, 2000), the wage distribution and thereby impact wage inequality (Dickens & Manning, 2004).

3.1: Studies using individual level data

3.1.1: Effects on Employment

Despite research spanning the past few decades on the minimum wage effects on employment, it is difficult to determine consensus when looking at individual papers. We first look at a few papers with conflicting results on the MW impact on employment and then discuss the conclusions from a published literature review (Neumark & Wascher, 2006) in order to understand the main findings of existing research.

A study by Gregg et al., (2014) examines if the U.K. national minimum wage affects employment for those who remain employed after a MW raise and finds a significant negative effect on a person's likelihood of remaining in the same job or with the same employer a year later. It also finds that a MW increase leads to reduced work hours and work weeks among those who remain with the same employer, reducing the overall positive effect

of the minimum wage on their annual pay. Other research in the US also supports negative employment effects (Sabia, 2009a,b; Thompson, 2009).

The results on employment effects are mixed, with some papers in the UK finding evidence of reductions in employment and work hours after minimum wage introduction (Machin et al., 2003) and also a reduction in employment retention among part-time female workers (Dickens et al., 2015). On the other hand, other studies (Stewart, 2004) in the UK find no significant adverse employment effects for any demographic group with Dolton et al. (2010) finding both small positive employment effects as well as no significant association of the MW on employment. Others like (Hirsch et al., 2015) conclude, in line with other industry-specific studies, that the measured employment and hours impacts of minimum wage are highly variable across establishments and in many or most cases not statistically significant.

A paper by Ropponen (2011) tries to reconcile a controversial result by David Card and Krueger in their paper (1994) where they concluded that a 1992 increase in the New Jersey minimum wage would be unlikely to have a negative effect on the total employment in New Jersey's fast food industry with negative employment effects suggested by Neumark and Wascher in their paper (2000). Ropponen studies employment effects of fast-food restaurants using a different and more flexible estimator than the ones used by Neumark & Wascher (2000) and Card & Krueger (1994). The employment effects are conditional on the restaurant employment levels and the author concludes that the employment effects are positive for small and negative for large fast-food restaurants. Thus, the results by Card & Krueger (1994) are not valid for large fast food restaurants and there is a positive employment effect for small fast food restaurants using the Neumark and Wascher (2000) data.

To reconcile some of the conflicting evidence presented above, we briefly discuss the survey of minimum wage research by Neumark and Wascher (2006) which includes 102 different entries. They conclude that "the preponderance of the evidence points to disemployment effects (p. 121). They find that nearly two-thirds of the studies included in their review find negative employment effects. They also find that 85% of the most credible studies in their survey also point to negative employment effects.

In response to studies that find positive effects, Neumark and Wascher (2006) comment that most of the longer panel studies that include time and state variation find negative employment effects while most US studies that find positive or zero effects on employment are either short panel data studies or case studies on a specific state and industry. They suggest that some of the shorter panel studies may not have data for a time period sufficient enough to capture the full effects of minimum wage changes since the time needed by firms to adjust labour in the production process may be longer. They emphasize the importance of allowing enough time to observe the consequences of a change in the minimum wage. Furthermore, they underline some concerns raised in literature that the case study approach is problematic. There are concerns about whether the authors' own surveys provide accurate results and whether the 'natural experiments' (p. 122) in these studies are adequate. To conclude, the literature, when read critically and broadly, largely solidifies the view that MW reduces employment of low-skilled workers (Neumark & Wascher, 2006).

3.1.2: Effects on Wage Distribution and Inequality

Research also looks at the effect of minimum wages on the wage distribution and structure. When exploring the impact of MW on wage distribution, we would expect that it would truncate the wage distribution from the left as employers are now expected to pay the lowest earners a minimum wage. Dickens and Manning (2004) report evidence in the UK around the time of MW introduction that its overall effect on wage inequality is rather small (Machin, Manning and Rahman, 2003). Another study in the UK also finds that raising the MW is associated with reduced lower tail wage inequality in a systematic way each year since its introduction (Dolton, Bondibene and Wadsworth 2012).

Minimum wages increase the relative wages of the low paid and hence have a significant effect on the structure of wages (DiNardo, Fortin & Lemieux, 1996). Fajnzylber (2001) reports significant spillover effects from minimum wage increases, even for those earning as much as forty times the minimum wage. Lemos (2004) also finds positive effects of the minimum wage on wages at the median of the distribution for Brazil. A study on Estonia explored spillover effects and finds that the effects of minimum wage increase are most pronounced up to the twentieth percentile of the wage distribution. According to the authors, the minimum wage has had a beneficial effect on low-wage segments including women and

the elderly (Ferraro, Meriküll and Staehr, 2018). Barany's (2016) paper on the United States, using a general equilibrium model shows that the MW truncates the wage distribution and affects the bottom end of the wage distribution more, however, its impact on the top end is significant as well.

3.2: Studies using firm level data

A limitation of the bulk of literature in this field is the relative neglect of minimum wages' impact on firm performance. Furthermore, within the existing literature on MW effects on firm performance, there is more focus on the effects on productivity and not much is available on the effects on firm profitability which is the focus of this paper.

As rigidities in the labor market induced by minimum wage regulation may not only contribute to unemployment, but also hurt firms by reducing their flexibility of wage adjustment, we expect that minimum wages will negatively affect firm performance, for instance, by lowering profitability (Draca, Machin & Van Reenen, 2011). On the other hand, higher labour productivity (Riley & Bondibene, 2016) could compensate for some of the increased labour costs. Additionally, firms may pass on some of the higher costs to consumers in the form of increased prices (Du & Wang, 2019; Wadsworth, 2010).

Harasztosi and Lindner (2019) explore the impact of the minimum wage increase in Hungary on employment and also decompose the increase of minimum wage between consumers (75%) and firm owners (25%). They also find that firms in Hungary respond to the higher minimum wage by capital substitution for labour and also the employment effects are greater in industries where the firms are unable to pass the higher labour costs to consumers.

In a study on the UK, Bell and Machin (2018) conducted an event study analysis to explore the impact of an announcement of an unexpected increase of the national minimum wage on firms' stock prices. Their analysis finds that the announcement leads to significant falls in the stock market value of low-wage firms at the time of announcement as well as the next few days. The study also compares the fall in stock market value of firms to the fall in profitability in response to the wage cost shock that will be induced by the announcement and

finds that the expected profit decreased as well for firms affected by the minimum wage. Draca, Machin and Van Reenen (2011) study the impact of minimum wages on firm profitability, and use a difference-in-difference method to study the changes induced by the introduction of a UK national minimum wage in 1999. They find that minimum wages raise wages, but also significantly reduce profitability.

Wadsworth (2010) studies the effects of the minimum wage on the prices of UK goods and services. He uses company accounts data merged with labour force survey data for the period 1996-2007 and looks at the effect of the MW introduction in 1999 with upratings in subsequent years. The study does not find much evidence of price increases in the months immediately following a MW hike but finds that effects on prices appear to accumulate gradually over time. Over the longer term, prices in several sectors with a high proportion of minimum wage employees, for instance, take-away food, canteen meals, hotel services and domestic services, rose significantly more than prices in non-minimum-wage sectors. Du & Wang (2019) also explore how increasing minimum wages affect firm markup using data on Chinese manufacturing firms. Using data for the period 2001-2007, they find that the increasing minimum wages generate a positive and significant impact on the markup of Chinese firms with the higher minimum wages giving rise to significant increases in product price, R&D investment, and total productivity.

Another study in China by Long & Yang (2016) using three waves of a national survey of Chinese private firms finds that despite offsetting behaviors by the firms including cutting fringe benefits like pension and medical, injury and maternity insurance (p. 273) and laying off low-skilled workers and short-term workers (negative employment effect), they cannot fully mitigate the detrimental effects on firm profitability because of the wage rigidity introduced by minimum wage regulation. However, this study finds an asymmetric effect on firm performance of MW), with the detrimental effect being significant only under adverse market conditions, a result which is different from earlier studies (Draca et al., 2011) on MW effect on firm performance.

Riley and Rosazza-Bondibene, in their UK paper (2015) also find evidence to suggest that companies responded to increases in labour costs by raising labour productivity which were

associated with increases in total factor productivity, consistent with organisational change, training and efficiency-wage responses to increased labour costs from MW. Another paper on the UK (Rizov & Croucher, 2012) explores the link between firm labour productivity and the introduction of the national MW (Minimum Wage) over a period spanning more than 10 years. They use difference-in-differences analysis and report that overall, labour productivity has been significantly positively affected by the minimum wage in the long run though they also report evidence of substantial heterogeneity across and within sectors and across firm size groups.

Galindo-Rueda and Pereira (2004) in their report to the Low-Pay Commission also examine the effect of MW on British firms. They find an improvement in total factor productivity in low-paying sectors as a result of the introduction of MW in the UK, with the increases being more marked in larger firms. Mayneris et al. (2018) in their study on the 2004 China MW reform also found improvements in productivity. They found that immediately after the MW rise the firm-level survival probability fell and the wage costs rose for firms that were more exposed to MW hikes. The affected companies' productivity significantly improved, allowing them to absorb the cost shock without any change in their profitability and with limited job losses. They also found a slight negative effect on employment but this was compensated for by the gain in productivity, and also the profits were unaffected. Du & Wang (2019) also found that higher minimum wages give rise to significant increases in product price, R&D investment, and total productivity in China.

Ma et al. (2012) examined the relationship between changes in the minimum wage and firms' export behavior in China using firm-level data for manufacturing companies for the period 1998-2007. They report that an increase in the minimum wage is associated with a decrease in the probability of exporting goods and a decline in export sales, conditional on exporting. Furthermore, they observed a larger decline for firms with lower average wages and a lower capital-labor ratio.

3.3: Studies on the effects of the minimum wages in Estonia

We briefly discuss below existing literature on minimum wage effects in Estonia. Hinnosaar & Rõõm (2003) use individual level data from the Estonian Labour Force Survey (ELFS) for the period 1995-2000 to estimate the MW impact on employment and wages. They find that there is employment reduction for the group of workers directly affected by this change and furthermore, they also find that the rate of compliance with this regulation diminishes as a result of MW hike, which then increases the share of workers whose wages remain below the legally set minimum. Ferraro, Hännilane and Staehr (2018a), use data from the ELFS to estimate effects on employment. They find that the MW increase had no effects or very small effects on both directly affected workers as well as those indirectly affected. The results for these two studies are not in line with each other, however, some differences may have arisen due to the different time periods analysed, 1995-2000 (Rõõm 2003) versus 2013-2016 (Ferraro et al. 2018a) and also the different analysis methods used. The Minimum Wage increase during the 1990s was much larger than the changes for the period between 2013-2016.

A study by Hazans (2007) uses panel data analysis on the Baltic countries of Estonia, Latvia and Lithuania to explore workforce participation and discouragement and it suggests that increasing after-tax real minimum wage has a significant positive effect on labour force participation and reduces discouragement in Lithuania. A positive effect of MW is found in Estonia as well but only for teenagers of both genders and for young males. Furthermore, an additional finding was that ethnic minorities, especially females, in all three Baltic countries are less likely to be in the labour force.

Ferraro, Meriküll and Staehr (2018b) also use the ELFS micro data to explore minimum wage effects on wage inequality. Their analysis shows that the effects of minimum wage increase are most pronounced up to the twentieth percentile of the wage distribution. According to the authors, the minimum wage has had a beneficial effect on low-wage segments including women and the elderly (Ferraro, Meriküll and Staehr, 2018).

Meriküll and Tverdostup (2020) look at the gender wage gap in Estonia and find that there is a strong negative and statistically significant correlation between minimum wages and the

unexplained gender wage gap and that the increasing minimum wage has affected some of the decline in the unexplained gender wage gap.

Bodnár et al. (2018) use firm-level data obtained from a survey run in 2014 by 25 national central banks and analyses eight CEE countries including Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia. The study looks at firms' adjustment channels in response to MW increases. The findings suggest that the most popular adjustment channels are reductions in non-labour costs, rises in product prices, and improvements in productivity. Reduction in employment is less common and occurs mostly through reduced hiring rather than direct layoffs. The study also finds evidence of potential spillover effects on firms without minimum wage workers. About a quarter of the firms without any employees earning the minimum wage reported that an increase in prices, wages or productivity, or a reduction in non-labour costs were relevant responses to increases in the minimum wage. Some interesting points about Estonia from the WDN results are as follows: The Wage Dynamic Network survey results show that fewer than 5% employees of the average Estonian firm earn the minimum wage, whereas one third of a typical firm's workforce are employed at the minimum wage in Hungary and Romania, construction has the largest proportion of workers employed at the minimum wage in Estonia, Poland and Romania as opposed to manufacturing in Bulgaria, Lithuania and Hungary and business service in Latvia, Slovenia and Slovakia.

3.4: Wage Setting in Estonia

In Estonia, the Estonian Trade Union Confederation (EAKL) unites 18 trade unions and the main employers' organisation is the Estonian Employers' Confederation (ETKL) recognised as a national-level social partner, representing about 25% of Estonian companies (European Trade Union Institute, 2017). According to the (Estonian Work Life Survey 2015), trade union membership levels are low and decreasing every year and the collective bargaining coverage of employees has also decreased over the years. In 2015, 7% (Estonian Work Life Survey 2015) of employees were members of trade unions. Collective bargaining in Estonia takes place largely at the enterprise level and the minimum wage setting process is at the

national level which involves negotiations between EAKL and ETKL and any changes/raises are then brought into effect by governmental decree with changes in the minimum wage coming into effect from the first of January of the following year.

The minimum wage in Estonia in 2011 was 278.02 Euros, 584 Euros in 2021 and is set to rise to 654 Euros in 2022. Figure 1 below shows the evolution of the minimum wage over the years along with the average wage and the ration of the minimum wage to average wage. The minimum wage as a proportion of the average wage has grown over the years with most recent data from 2020 showing the minimum wage is 40% or 0.4 of the average wage.

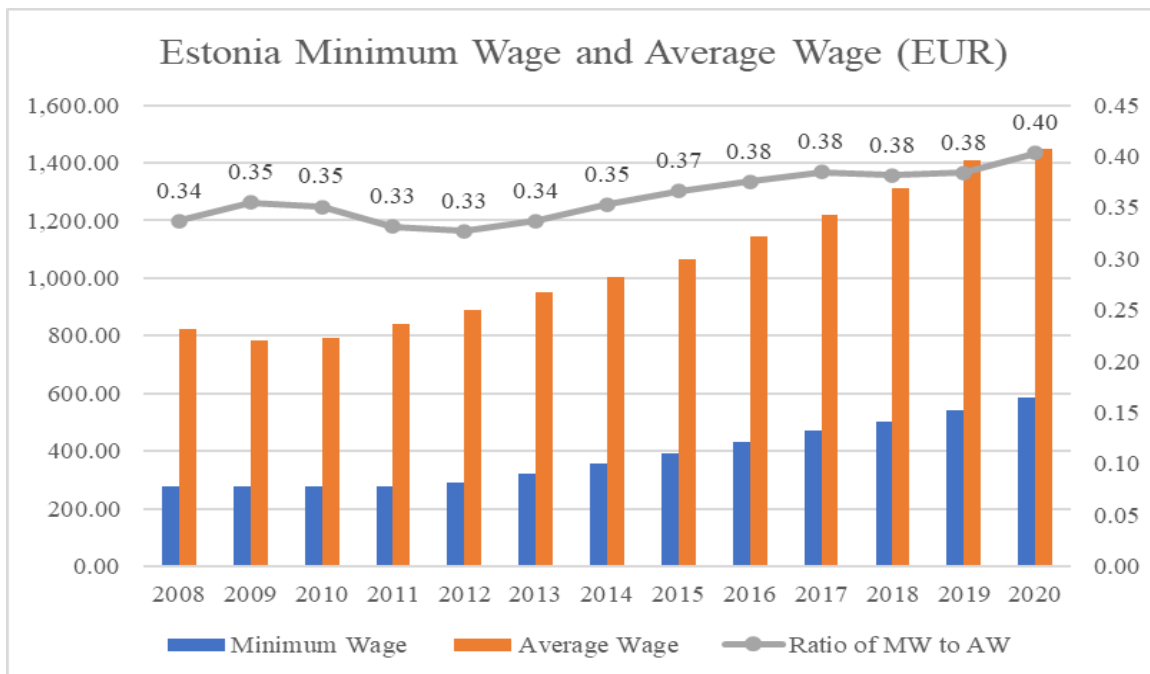


Figure 1. The ratio of Minimum Wage to Average Wage

Source: Statistics Estonia

Table 1 shows that Estonia does not show a dramatic increase in Minimum Wage as in Hungary (Harstozi & Lindner, 2019), resulting in starkly different control and treatment periods. The Minimum Wage does increase at a faster rate than the Average Wage during the treatment period ranging from 6-11% while the Average Wage increases at a rate of approximately 3-8%.

Table 1. Growth of Average and Minimum Wage in Estonia

Year	Average Wage	Average Wage Growth (%)		Minimum Wage Growth (%)
2008	825.23		278.02	
2009	783.81	-5.02	278.02	0
2010	792.31	1.08	278.02	0
2011	839.00	5.89	278.02	0
2012	887.00	5.72	290.00	4.31
2013	949.00	6.99	320.00	10.34
2014	1005.00	5.90	355.00	10.94
2015	1065.00	5.97	390.00	9.86
2016	1146.00	7.61	430.00	10.26
2017	1221.00	6.54	470.00	9.30
2018	1310.00	7.29	500.00	6.38
2019	1407.00	7.40	540.00	8
2020	1448.00	2.91	584.00	8.15

4: Data

We use Estonian Business Registry Data which was available at the time of the study for the period 1998-2018. The data was anonymized so that firms are not identifiable i.e. the identifying features (company name, registry code) have been removed, but companies can be traced over time. All the financial data is available in Euros, the data before 2010 was in Estonian kroons and has been converted to euros using the fixed exchange rate of 15.6466 Estonian kroons being equal to one euro. The dataset comprises information at the enterprise level (i.e. not at the level of establishments or plants) and includes annual data on enterprises such as total payroll costs, number of employees, etc.

The dataset consists of administrative data compiled from various sources including the Centre of Registers and Information Systems, the Estonian Tax and Customs Board, the Eesti Pank (the central bank of Estonia) and Enterprise Estonia (EAS). The Business Registry Data is combined with Estonian Customs and Tax Office (TSD) Data on the paid payroll data and Foreign Trade data files to calculate variables on goods and services exports. All the company-level datasets include the unique company identifier variable (`sa_id`) which enables us to merge the different datasets. The employee-level datasets include the unique individual's identifier variable (`ik_id`) that enables to trace the individuals over time.

For our calculations and analysis, we use the years 2010-2012 as the 'policy-off' or pre-policy period i.e. years when the minimum wage did not change and use the years 2013-2018 as the 'policy-on' period i.e. the years when the minimum wage increased every year.

We have also used Estonian Tax and Customs Board, MTA TSD data in this analysis. We consider all employees to have one main job, which is the highest paid and since the TSD data is monthly, we consider the impact on wages in January. Data on employees' background characteristics is linked from the population register and the 2011 census, while data on people's jobs are taken from the Estonian Business Registry Data. The data cover the period 2006-2019. We use data from the period 2010-2012 as a control group since the minimum wage does not significantly increase in this period.

The use of January data on wages is somewhat arbitrary and the use of the wage data of some other months might be more justified, e.g. the use of the wage data of October might be justified based on the fact that the Structure of Earnings Survey collects and reports the wage from October.

The Table 2 below presents some descriptive statistics of the dataset we use. Most statistics are calculated for the years 2010-2012 which is the pre-policy period when minimum wage did not significantly increase.

The mean firm age i.e. the time for which firms were operating on average in 2012 was 2.2 years. The profits to turnover ratio in our pre-policy period was negative at -0.985. The Firm average wage growth for our sample relative to 2012 was positive with the wage growth for males being higher than that of females. The average number of employees in a firm in our sample is 8.2. The monthly average wage for 2010-2012 is 315.34 Euros while the minimum wage during this time was 278(2010-2011) Euros and 290 Euros (2012).

Table 2. Descriptive Statistics of Firm Variables

Variable Name	Mean	Standard Deviation	Number of Observations
Firm age in 2012	2.176	0.749	1613254
Profits to turnover 2010-2012	-0.985	201.672	1093318
Firm average wage growth rel. to 2012	0.153	0.426	324219
Firm average males wage growth rel. to 2012	0.167	0.469	233440
Firm average females wage growth rel. to 2012	0.142	0.419	216914
Number of employees (tax data)	8.296	51.67	561774
Firm average wage	315.341	247.816	473241
Operating profit per employee	4044.633	986983.125	741208
Net income per employee	4692.956	953157.125	737646

Profits to turnover	0.044	0.659	1226402
Return on Equity	-1.307	1341.229	1554734
Return on assets	-7.903	2555.37	1554421
Share of minimum wage earners	0.375	0.424	473241
Share of minimum wage earners in 2010-2012	0.276	0.341	687477

5: Methodology

We use difference-in-difference methodology to estimate the effects of the increase in minimum wages on firm profitability. The period 2010-2012 is the control period where minimum wages did not change¹ and the years 2013-2018 are the treatment period where the minimum wages increased every year.

In order to assess the effects of changes in the minimum wage, a distinction must be made between companies affected and those not affected (or less and more affected) by changes in the minimum wage. We use the period 2010–2012 - as the reference period and the later period as the impact period. We use the variable, the average share of employees receiving the national minimum wage in 2010–2012, where a higher value of this indicator is expected to be related to a greater impact of raising the minimum wage on firms. This means that if the minimum wage has a positive effect on the variable under consideration (for instance, the company's net income), the corresponding variable should be assessed in the regression analysis with a positive sign (and also be statistically significant). Thus, this approach is based on the approach of Harasztosi and Lindner (2019) and that of Ferraro and Soosaar (2020) to study the impact of changes in the minimum wage on the productivity of the enterprise (Ferraro & Soosaar, 2020), but also differs from it in different details and tries different methodological options.

Estimation Equation

The main equation we use for our regression estimation is below:

$$y_{i,t} - y_{i,2012} = \alpha + \beta EXPOSURE_{i,2010-2012} + \gamma X_{i,t} + \epsilon_{i,t}$$

Where,

the index i denotes company i

the index t denotes the time period i.e. year

the vector $X_{i,t}$ includes the other control variables

¹ In 2012, MW increased by only 10% so we do not include this year as part of the policy period in our calculations.

and the $\epsilon_{i,t}$ is the error term.

The two main variables we use to measure impact on firm profitability are Return on Equity (ROE) and Return on Assets (ROA). On the left hand side of the equation, $y_{i,t}$ stands for our profitability measure, ROE or ROA. Therefore, our dependent variable is the change in the values of our profitability measures or the ROA or ROE relative to its value in 2012. In case of other dependent variables, for instance, the capital intensity, they are expressed as the percentage change. Our explanatory variable of key interest is the variable $EXPOSURE_{i,2010-2012}$ that measures the assumed exposure of company i , to the minimum wage increases.

In our difference-in-difference framework, we expect that the change in the profitability measure is larger for companies that are more affected by the minimum wage increase. In case the exposure is measured by the share of minimum wage recipients or the share of employees earning below the median wage, we would expect the coefficient β to be negative. In case the exposure is measured by the company's average wage level, we would expect the coefficient β to be positive in case minimum wage has an effect on profitability, as companies with higher wage level have lower share of minimum wage earners (or more generally, lower share of low-wage earners) and are thus expected to be less affected by the minimum wage increase. The list of control variables follows from what has been used in earlier studies (Ferraro & Soosaar, 2020) and what is available in the Estonian firm-level datasets (primarily the business registry). The list of the control variables used includes the firm age and firm age squared in 2012, labour costs share in turnover in 2012, average log capital intensity in 2012, average return on equity in 2010-2012, dummy variable for the company being foreign-owned in 2012, the average log depreciation to turnover in 2010-2012, average ratio of profits to turnover in 2010-2012, average share of labour costs in value-added over the years 2010-2012. In order to account for the companies' location and the industry affiliation, all of the regressions include the fixed effects for the 1-digit EMTAK 2008 (corresponding to NACE Rev 2) industry classificatory and the 5 Estonian NUTS 3 regions (Northern Estonia, Central Estonia, North-Eastern Estonia, Western Estonia, Southern Estonia).

Figure 2 below shows two indicators of the share of minimum wage earners based on the average wage level of the company. The wage levels of companies are divided into 20 groups. The first group includes companies at 5% of the lowest average wage companies. The second group includes companies that are between 5% and 10% in terms of wage levels, and so on. The figure shows that the two indicators are very closely linked. In companies with the lowest wage level, most employees receive the minimum wage, but among companies with the highest wage level, the share of those receiving the minimum wage is quite modest. Thus, it can be assumed that companies with a wage level higher than the median average wage of companies will be affected very little by the increase in the minimum wage. Hence, we also use the average wage level of the company in calculations to distinguish between companies with higher and lower exposure to the increase in minimum wage.

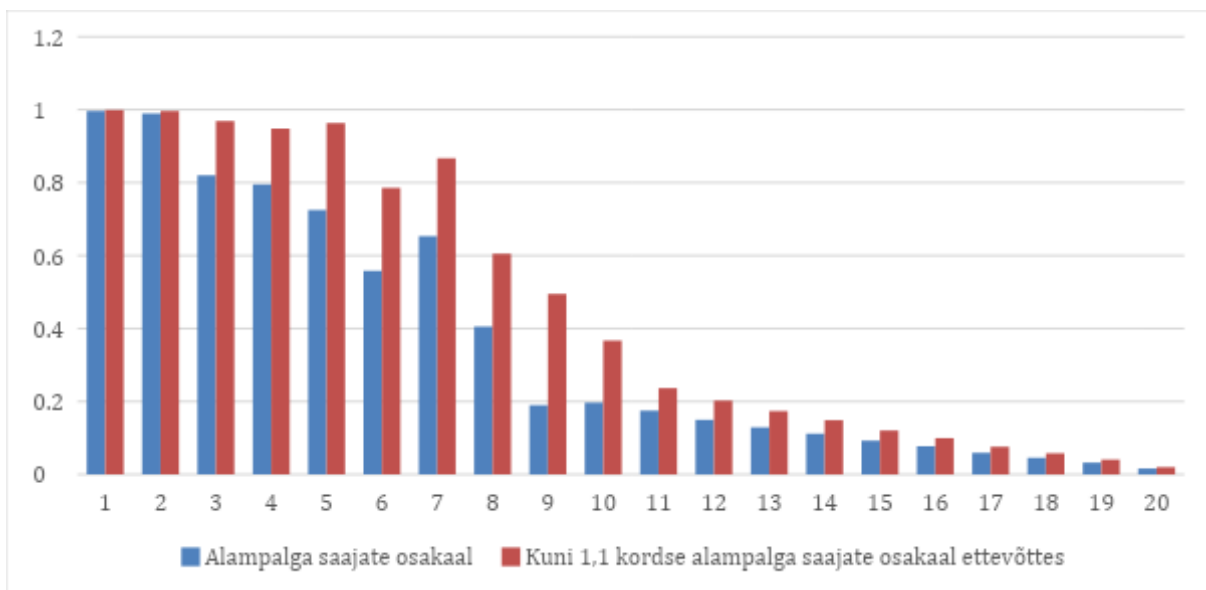


Figure 2. Proportion of employees in a firm receiving the Minimum Wage and up to 10% more than the Minimum Wage based on the companies' wage level.

Source: Joonis 32, (Tellinud Sotsiaalministeerium, 2021)

Figures 3 and 4 below show the Kernel Density Graphs for ROE change and ROA change respectively. The differences between the two groups of companies, i.e. those with low and high exposure to minimum wages are not that big. In Figure 3 on ROE change, we can see that there is relatively higher probability density at negative change in ROE for companies

with more than 50% of the employees below the median wage (the dashed line) compared to those that had less than 50% of the employees below the median wage. Similarly, Figure 4 on ROA also shows a higher probability density at the negative ROA change for companies with more than 50% of the employees below the median wage (the dashed line) compared to those that had less than 50% of the employees below the median wage.

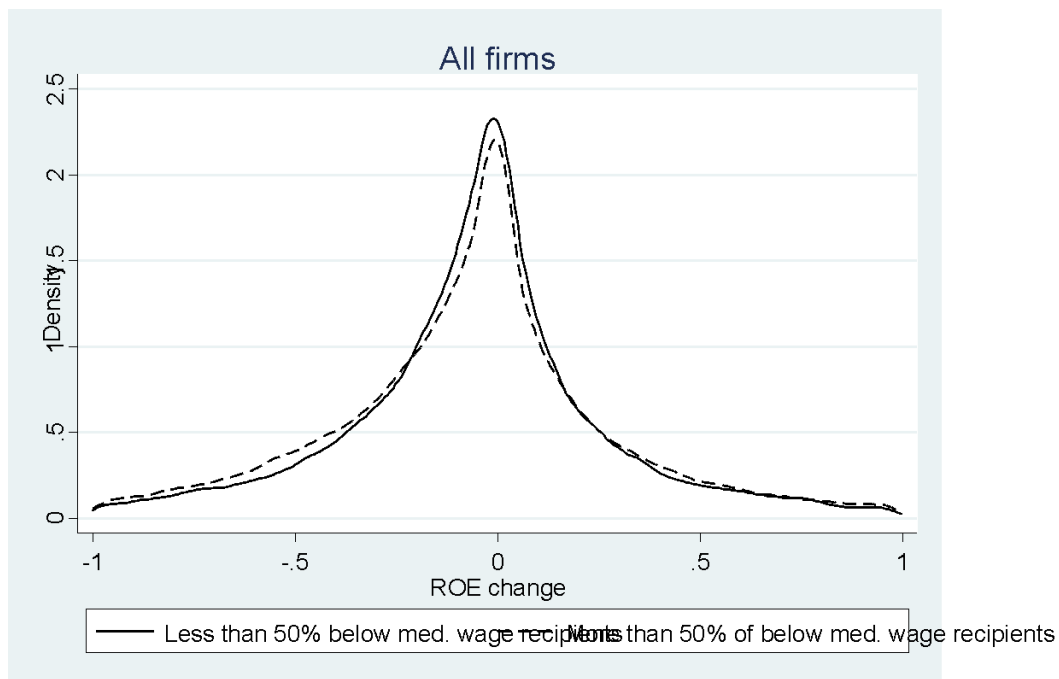


Figure 3. Change in ROE Kernel Density

Source: Statistics Estonia

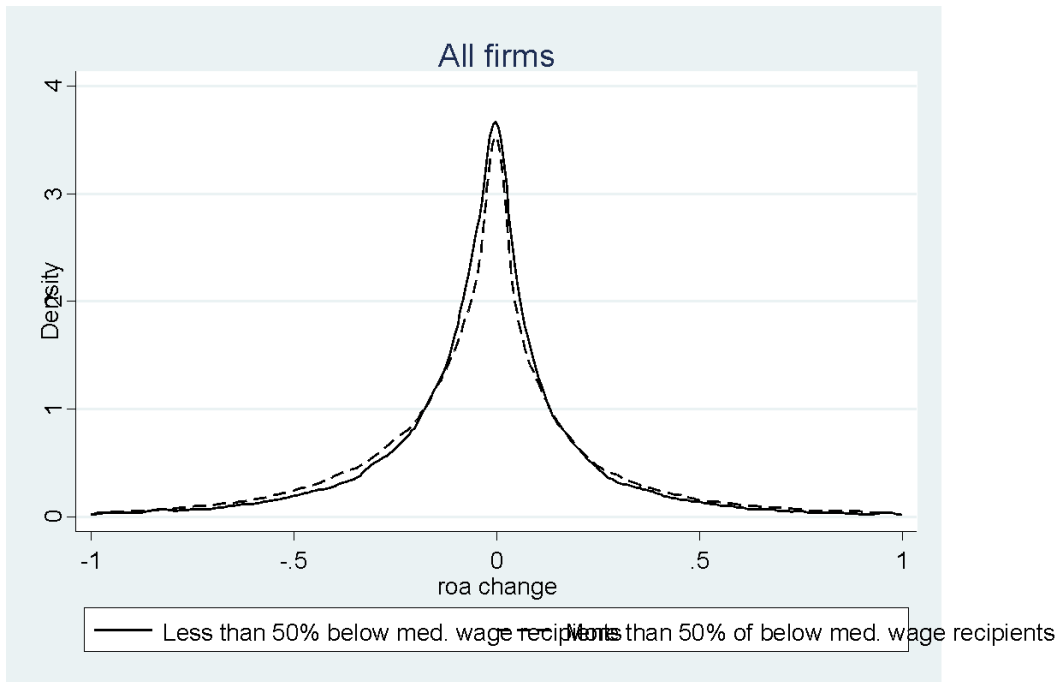


Figure 4. Change in ROA Kernel Density
 Source: Statistics Estonia

Figure 5 below shows the mean changes in ROE and ROA over time. It shows the changes in ROE and ROA relative to the 2012 level, but as the difference between the companies with high exposure and low exposure. The difference is always negative, thus indicating that the change in profitability was more negative in companies with high exposure to the minimum wage compared to the companies with low exposure to the minimum wages. The difference is greater in case of ROE in comparison to ROA and in case of ROE, it is up to 1.5 percentage points. The two groups of companies are created by a dummy variable measuring whether the share of minimum wage recipients is more than 30%.

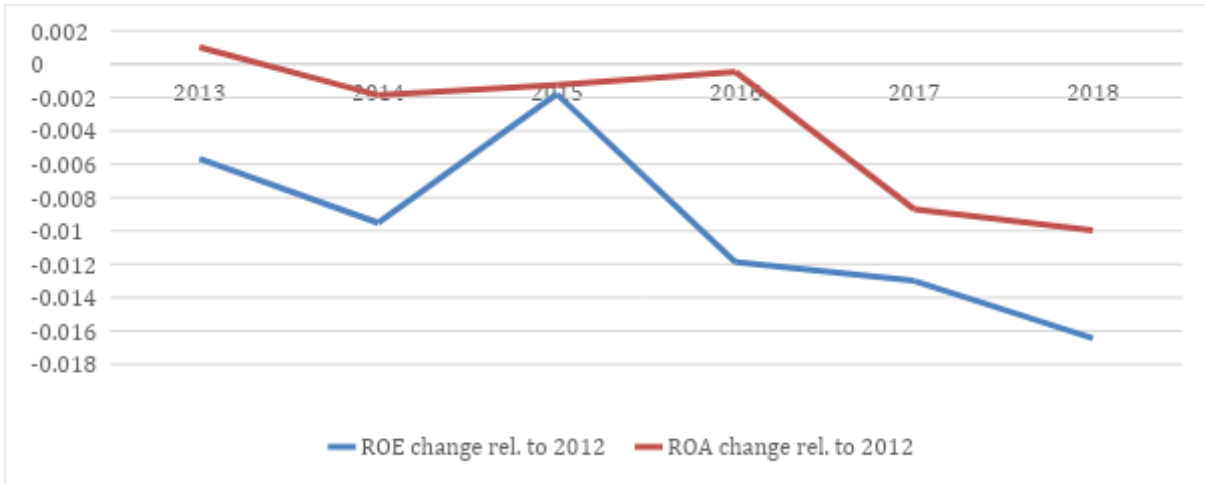


Figure 5. Difference in mean changes in ROE and ROA over time between companies with high exposure and low exposure to Minimum Wage

Source: Statistics Estonia

6: Results

Table 3 presents the complete regression specification including control variables and presents the impact of the Share of Minimum Wage Recipients on the ROE change. Firm age in 2012 is positively correlated with ROE change and statistically significant.

Table 3. The effects of the share of minimum wage earners on the change in return on equity (ROE)

Year	2011	2013	2014	2015	2016	2017	2018
Firm age in 2012	-0.103	0.098	0.182	0.134	0.208	0.213	0.196
	(0.074)	(0.052)*	(0.056)***	(0.056)**	(0.052)***	(0.048)***	(0.047)***
Firm age in 2012 squared	0.007	-0.034	-0.050	-0.035	-0.053	-0.051	-0.048
	(0.017)	(0.012)***	(0.013)***	(0.013)***	(0.012)***	(0.011)***	(0.011)***
Labour share in turnover 2010-2012	0.104	0.086	0.117	0.140	0.099	0.146	0.126
	(0.065)	(0.052)*	(0.050)**	(0.051)***	(0.050)**	(0.045)***	(0.046)***
Log capital intensity average 2010-2012	0.004	0.014	0.002	0.010	-0.001	-0.001	-0.004
	(0.006)	(0.005)***	(0.005)	(0.005)*	(0.005)	(0.004)	(0.004)
Return on equity average 2010-2012	-0.089	-0.552	-0.554	-0.570	-0.550	-0.536	-0.564
	(0.043)**	(0.032)***	(0.031)***	(0.032)***	(0.032)***	(0.029)***	(0.029)***
Foreign firm in 2012 (dummy)	-0.043	0.007	0.045	0.030	0.039	0.039	0.025
	(0.032)	(0.031)	(0.031)	(0.031)	(0.029)	(0.025)	(0.024)
Log depreciation to turnover 2010-2012	-0.016	-0.020	-0.003	-0.014	-0.005	-0.002	0.000
	(0.008)**	(0.007)***	(0.007)	(0.007)**	(0.006)	(0.006)	(0.006)
Profits to turnover 2010-2012	0.006	0.009	0.002	0.007	0.000	0.002	0.001
	(0.006)	(0.006)*	(0.004)	(0.004)*	(0.005)	(0.004)	(0.005)

Labour share in valued added 2010-2012	-0.091 (0.035)***	-0.026 (0.027)	-0.033 (0.025)	-0.070 (0.028)**	-0.012 (0.024)	-0.036 (0.025)	-0.027 (0.026)
Share of minimum wage earners in 2010-2012	-0.005 (0.025)	-0.022 (0.023)	-0.036 (0.022)	-0.022 (0.022)	-0.029 (0.021)	-0.029 (0.020)	-0.025 (0.019)
Number of observations	23148	21737	20909	19768	19026	18569	18296
R-squared	0.005	0.099	0.106	0.102	0.113	0.118	0.125
R-squared adjusted	0.004	0.098	0.105	0.101	0.112	0.117	0.124

Standard errors in parenthesis. * - significant at 10%; ** - significant at 5%; *** - significant at 1%.

Source: Statistics Estonia

In Table 4 below, we report the impact of Share of Minimum Wage Recipients in 2010-2012. The table shows the coefficients and standard errors on different firm profitability variables regressed on the Share of Minimum Wage Recipients in 2010-2012 and other control variables shown in Table 3. The effect on all the variables is mostly negative though it is not significant for all variables in all years.

All variables are expressed as the change or difference relative to 2012. The ROA change was greatest in the years 2017 and 2018 with ROA declining by 1.7 percentage points (pp) in 2017 and declining by 1.8 pp in 2018. The results were statistically significant at 10% and 5 % respectively. The Operating profit to turnover change declined by 3.1 pp in 2014 significant at 5%.

Table 4. Coefficients estimated from the regression analysis on the Share of Minimum Wage Recipients in 2010-2012

	2013	2014	2015	2016	2017	2018
Dependent Variables						
ROA change rel. to 2012	-0.008	-0.001	0.007	-0.013	-0.017	-0.018
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)*	(0.009)**
Operating profit per employee growth rel. to 2012	-0.068	0.205	-0.007	0.027	0.067	-0.359
	(0.135)	(0.171)	(0.187)	(0.229)	(0.251)	(0.264)
ROE change rel. to 2012	-0.022	-0.036	-0.022	-0.029	-0.029	-0.025
	(0.023)	(0.022)	(0.022)	(0.021)	(0.020)	(0.019)
Operating profit to turnover change rel. to 2012	-0.017	-0.031	-0.021	-0.011	-0.021	-0.024
	(0.012)	(0.015)**	(0.018)	(0.016)	(0.017)	(0.016)
Net income per employee growth rel. to 2012	0.001	0.308	-0.090	-0.032	-0.014	-0.337
	(0.144)	(0.178)*	(0.206)	(0.249)	(0.269)	(0.271)

Standard errors in parenthesis. * - significant at 10%; ** - significant at 5%; *** - significant at 1%.

Source: Statistics Estonia

Table 5 below presents the effects of the minimum wage on firm profitability by using another exposure variable, the Share of Below-Median Wage Recipients in a firm in 2010-2012.

The ROA change is negative and significant in all the years except 2014. The greatest decline in ROA is in 2013, 2017 and 2018 at -2.1 pp, -2.1 pp and -2.5 pp respectively. The ROE change is negative in all the years the Minimum Wage increased at significance level 1%. The decline is more pronounced over time with a -5.8 pp change in 2013 and a -7 pp change in 2018.

Table 5. Coefficients estimated from the regression analysis on the Share of Below-Median Wage Recipients in 2010-2012

	2013	2014	2015	2016	2017	2018
Dependent Variables						
ROA change rel. to 2012	-0.021	-0.009	-0.015	-0.016	-0.021	-0.025
	(0.008)***	(0.008)	(0.008)*	(0.008)**	(0.008)***	(0.008)***
Operating profit per employee growth rel. to 2012	-0.156	0.069	-0.121	-0.007	-0.061	-0.193
	(0.118)	(0.136)	(0.157)	(0.186)	(0.204)	(0.217)
ROE change rel. to 2012	-0.058	-0.064	-0.060	-0.065	-0.072	-0.070
	(0.021)***	(0.020)***	(0.020)***	(0.019)***	(0.018)***	(0.018)***
Operating profit to turnover change rel. to 2012	-0.011	-0.012	-0.012	-0.002	-0.013	-0.016
	(0.011)	(0.013)	(0.016)	(0.015)	(0.015)	(0.014)
Net income per employee growth rel. to 2012	-0.054	-0.039	-0.105	0.129	0.016	-0.237
	(0.126)	(0.149)	(0.179)	(0.205)	(0.228)	(0.240)

Standard errors in parenthesis. * - significant at 10%; ** - significant at 5%; *** - significant at 1%.

Source: Statistics Estonia

Figure 5 depicts the point estimate and confidence intervals for the ROE change when the exposure variable (EV) is the Share of below media wage recipients. The effect is negative and statistically significant in most of the years, similar to the results in Table 4.

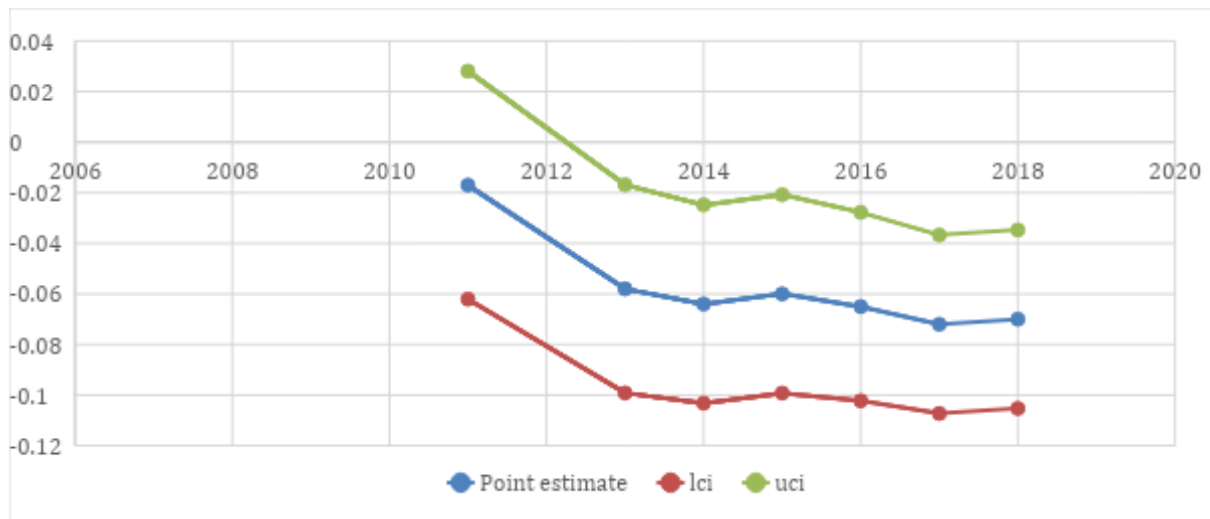


Figure 5. ROE Change Point Estimate, EV: Share of Below-Median Wage Earners

Source: Statistics Estonia

Figure 6 depicts the point estimate and confidence intervals for the ROA change when the exposure variable is the Share of below media wage recipients. The effect is negative and statistically significant in several of the years when the MW increased, similar to the results in Table 4.

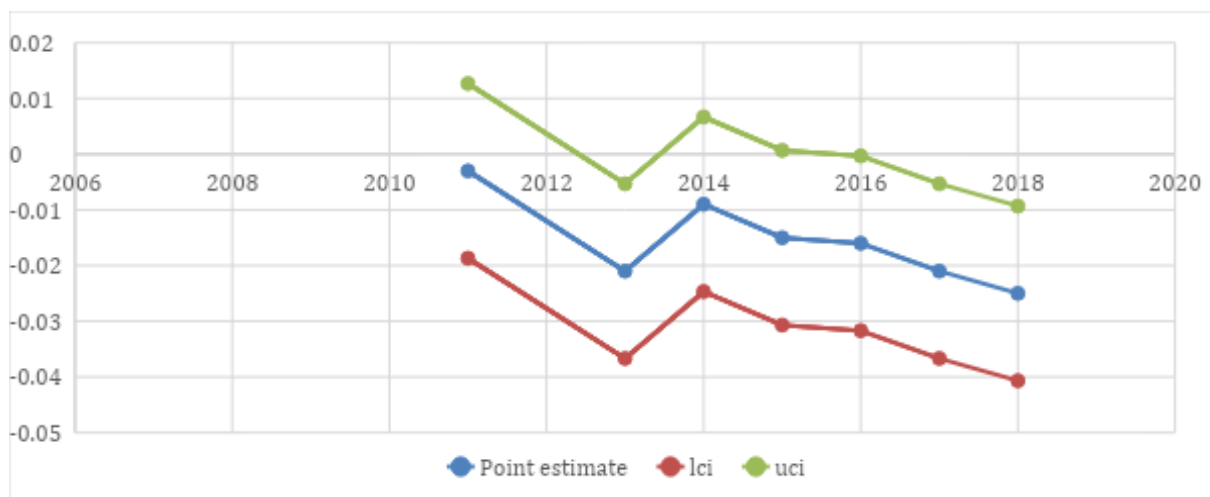


Figure 6. ROA Change Point Estimate, EV: Share of Below-Median Wage Earners

Source: Statistics Estonia

In Figure 7, the point estimate for ROE change is shown when the exposure variable is average wages. The effect is positive and statistically significant. The positive coefficient makes sense as the higher the wage level of a company, the less exposure it has to the effect of MW increase and thus the effects on profitability variable, here ROE, is positive. Thus, the negative results before when exposure is measured through share of minimum wage and below median wage earners and the positive results now are in accordance with one another.

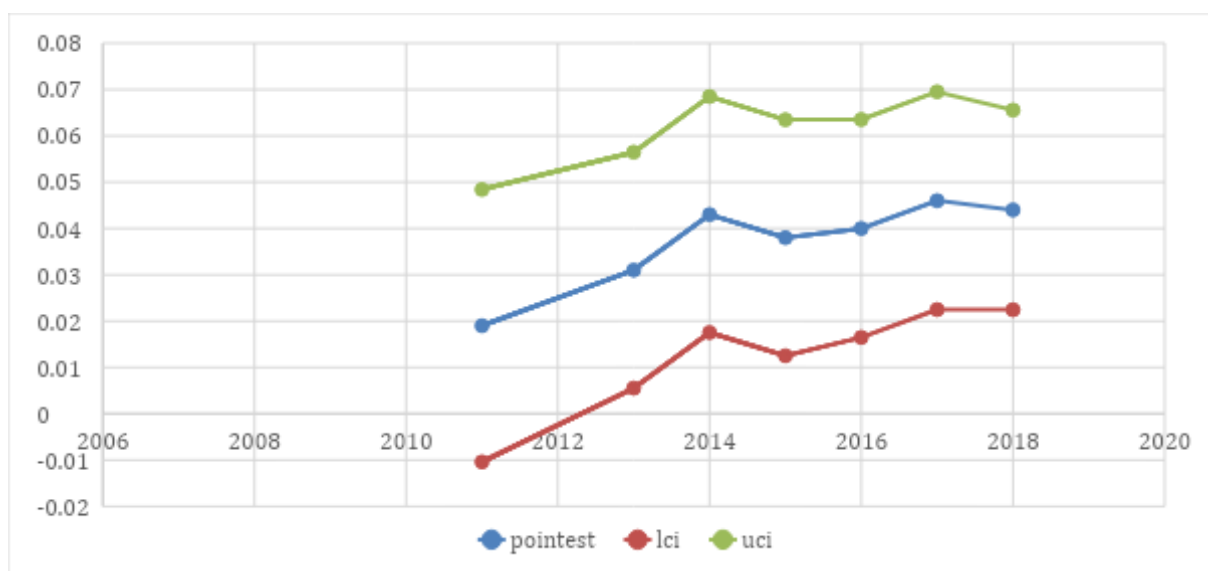


Figure 7. ROE Change Point Estimate, EV: Average Wages

Source: Statistics Estonia

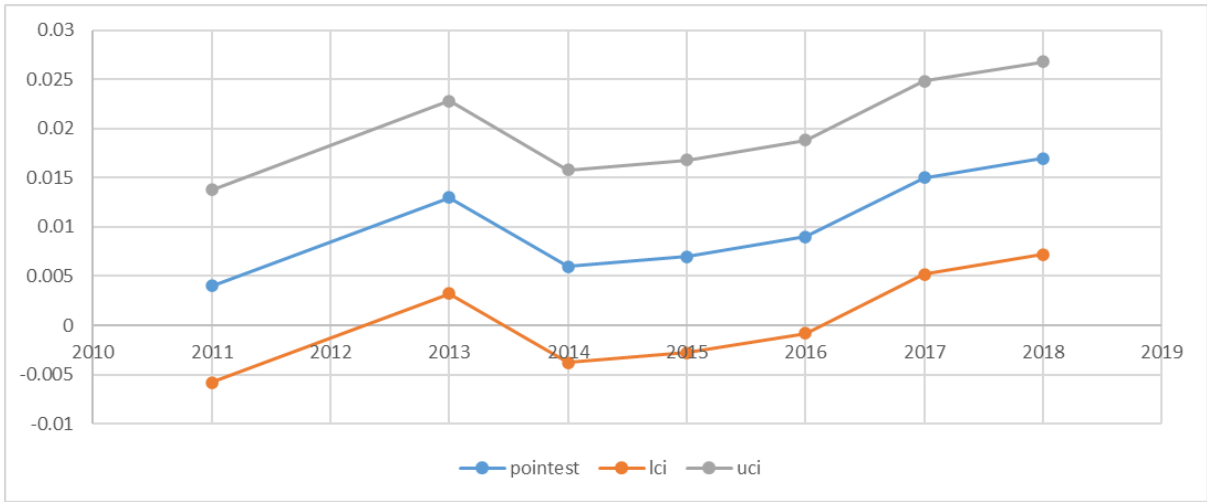


Figure 8. ROA Change Point Estimate, EV: Average Wages

Source: Statistics Estonia

7: Conclusion

In this paper we use the Minimum Wage increase to explore its impact on firm profitability.

We use several different measures of exposure in order to test the robustness of our analysis.

The exposure measures we use include, the Share of Minimum Wage Recipients, the Share of Below-Median Wage Recipients and the Firm Average Wage.

Similar to the work of Draca, Machin and Van Reenen (2011) in the UK, we find a negative and statistically significant effect of the increase in minimum wage on firm profitability. This paper contributes to the strand of minimum wage research at the firm level. For further research, more analysis can be done on the revenue effects and the passing of wage cost on to consumers as done by Harasztosi and Lindner (2019).

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9: Estonian Summary

Miinumupalga mõju ettevõtte kasumlikkusele Eestis

Kokkuvõte

Miinumupalk on laialdaselt uuritud teema, kuid miinumupalga mõju ettevõtte tegevusele, täpsemalt ettevõtte kasumlikkusele on teema, mis vajab edasist uurimist. Käesolevas artiklis kasutatakse Eesti töötajate ja tööandjate lingitud andmeid aastate 2010-2018 kohta, et uurida miinumupalga tõusu mõju ettevõtte kasumlikkuse näitajatele. Töös kasutatakse erinevuste ja erinevuste mudelit, et hinnata miinumupalga mõju ettevõtte kasumlikkusele. Varade tasuvuse (ROA) muutus ja omakapitali tasuvuse (ROE) muutus võrreldes poliitikaelse aastaga 2012 on negatiivne ja oluline. kõik aastad alampalga tõusis. Suurim ROA langus on 2018. aastal $-2,5$ protsendipunktiga ning ROE langus on ajas tugevam – 2013. aastal muutus $-5,8$ protsendipunkti ja 2018. aastal muutus -7 protsendipunkti.

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