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How do firms adjust to rises in the minimum wage? Survey evidence from Central and Eastern Europe

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This paper contains research conducted within the Wage Dynamics Network (WDN). The WDN is a research network comprising economists from the European Central Bank (ECB) and the national central banks (NCBs) of the EU countries. It aims to study in depth the features and sources of wage and labour cost dynamics and their implications for monetary policy.

The WDN initially operated from 2006 to 2009 and resumed activities, in part, in 2013. At present, 25 NCBs participate in the WDN, which is chaired by Juan F. Jimeno (Banco de España), with Ana Lamo (ECB) acting as secretary. The WDN's current research focus is to assess labour market adjustments in the period 2010-13 and firms' reactions to the labour market reforms which took place over this period in EU Member States. For this purpose, in 2014 the network launched an ad hoc survey of firms called the "WDN3 survey".

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The paper is hereto released in order to make the results of WDN's research widely available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are those of the author and do not necessarily reflect those of the ESCB.

Abstract

We study the transmission channels for rises in the minimum wage using a unique firm-level dataset from eight Central and Eastern European countries. Representative samples of firms in each country were asked to evaluate the relevance of a wide range of adjustment channels following specific instances of rises in the minimum wage during the recent post-crisis period. The paper adds to the rest of literature by presenting the reactions of firms as a combination of strategies, and evaluates the relative importance of those strategies. Our findings suggest that the most popular adjustment channels are cuts in non-labour costs, rises in product prices, and improvements in productivity. Cuts in employment are less popular and occur mostly through reduced hiring rather than direct layoffs. Our study also provides evidence of potential spillover effects that rises in the minimum wage can have on firms without minimum wage workers.

JEL classifications: D22, E23, J31

Keywords: minimum wage, adjustment channels, firm survey.

Non-technical summary

Rises in the minimum wage determine not only the bottom part of the earnings distribution but also labour costs in general, and this could potentially cause headcount reductions. However, the exact channels through which minimum wages affect the economy are still the subject of debate in the literature. Used as a policy tool, changes in the minimum wage should take account of possible transmission effects on firms and households. While from a monetary policy point of view, the impact on product prices should also be considered. Given the nature of our data, the focus of this paper is on the adjustment strategies firms use following rises in the minimum wage.

We address this topic using a unique firm-level cross-country survey dataset compiled from a survey conducted within the scope of the third wave of the European Central Bank's (ECB) Wage Dynamics Network (WDN3). Firms in eight Central and Eastern European (CEE8) countries, namely Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia, were asked about the particular adjustment strategies they had chosen following a specific instance of a rise in the minimum wage during the recent post-crisis period. The adjustment channels in the survey were layoffs, cuts in hiring, price rises, cuts in non-labour costs, wage rises for employees earning above the minimum wage, and improvements in productivity. The survey collected responses from more than 7400 companies in the CEE8 countries operating in the non-agricultural private sector and employing at least five workers.

First, we provide some descriptive information about the CEE countries, focusing on economic conditions and institutional characteristics. Further, we find significant cross-country and sectoral differences in the average share of workers earning the minimum wage. However, there are some similarities in that smaller, domestically owned, non-exporting firms and firms employing a higher proportion of low-skilled blue collar workers tend to pay a higher share of their employees the minimum wage.

Almost half of the subsample of firms, which employ minimum wage workers responded that at least one of the specified six adjustment channels was relevant. The most popular adjustment channels are the increase in product prices, the reduction of non-labour costs and productivity improvement. Direct layoffs of employees were cited as relevant by the smallest number of respondents, while only a slightly larger share of firms indicated the relevance of reductions in hiring. We also show that rises in the minimum wage can have significant spillover effects on firms that do not employ workers at the minimum wage. About 20 percent of such firms reported that raising product prices and labour productivity and cutting non-labour costs were adjustment channels that they used for rises in the minimum wage.

This paper contributes to the literature by studying the reactions of firms to rises in the minimum wage as a combination of several strategies and by reporting a preference ranking of those strategies. Such information is not available in other studies due to their concentration on a single transmission channel, most frequently layoffs.

1. INTRODUCTION

The debate on the effects of rises in the minimum wage has run for several decades, and the evidence on the impact remains largely disputed. A variety of theoretical models have been developed to describe the possible effects of rises in the minimum wage, such as the competitive model, where there are negative effects on employment as firms substitute lower-skilled with higher-skilled workers; monopsony models, which identify positive effects on employment from the increased use of low-skilled workers; or efficiency wage models, which find efficiency gains as workers make more effort as they have a higher wage. Other transmission channels for adjusting to a rise in the minimum wage include wage spillovers and wage compressions, pass-through into prices, cuts in non-labour costs, improvements in productivity and production capacity, or changes in the quality of human capital and absorption into profits (see Neumark and Wascher (2008) and Belman and Wolfson (2015)).

Only a very small segment of the literature analyses different effects of a rise in the minimum wage simultaneously. Even fewer studies look directly at the answers employers give about their preferred strategies for adjustment. An example of research combining these two aspects is a study of the US restaurant sector by Hirsch et al. (2015), who use a qualitative survey of restaurant managers about the adjustment channels they use in response to a change in the minimum wage. The survey approach appears again in a paper by Harding and Harding (2004), who study how a rise in the minimum wage affects employment and wages in small and medium-sized businesses in Australia. A smaller survey is run each year in the US by Small Business Majority, which collects the views of small businesses on possible increases in the minimum wage (see e.g. Small Business Majority, 2015). To the best of our knowledge there are no studies using European firm-level data focusing on multiple possible adjustment channels, making our study a valuable addition to the literature on minimum wages in Europe.

The unique questionnaire has been prepared within the third wave of the ECB WDN3[1], and asks firms in eight of the participating countries (Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia) about their strategies for adjusting following the most recent rises in the minimum wage, or recent and envisaged rises in Romania. These countries, which joined the EU in or after 2004, have a higher share of low wage earners than other European Union members, and have seen significant rises in the minimum wage in recent years coupled with a growing ratio of the minimum wage to average earnings, and so they provide an excellent setting for analysis of transmission channels for minimum wage rises.

[1] In 2014, 25 European national central banks participated in the third wave of the ECB's WDN, conducting a firm-level survey about labour cost adjustment practices, and wage and price setting mechanisms in 2010-2013.

Unlike in other EU countries, low wages are typical in these nine member states not only for new entrants to the labour market but for all age cohorts, which may partly explain the relatively high incidence of in-work poverty and labour market segmentation (see Horemans et al., 2016). Thus rises in the minimum wage changes can be expected to impact the functioning of the labour market more in this particular group of countries than in the other EU economies.

The WDN3 questionnaire of the CEE8 countries included two questions on minimum wages, one asking about the proportion of employees earning the minimum wage[2], and the second, asking how firms adjusted following the most recent rise in the minimum wage or recent and envisaged rises for Romania.

Our results show that the rise in minimum wages is mostly transmitted into higher prices, cuts in non-labour costs and improvements in productivity. This result is in line with the findings of Hirsch et al. (2015) for the US. We also show that cutting employment is not a common reaction to a rise in the minimum wage, and when it happens it is mostly through reduced hiring rather than direct layoffs. Furthermore, we find evidence of an important spillover effect from rises in the minimum wage to firms with no workers earning the minimum wage. Finally, the analysis of the factors driving the choice of particular adjustment channels takes the possible simultaneous use of the channels into account. For this purpose, we estimate a multivariate probit model consisting of several probit equations that are correlated through their error terms.

The structure of the paper is as follows: we first review the theoretical and empirical literature; then, we explain the survey questions and database harmonisation and provide the main descriptive statistics; next we discuss the economic conditions and institutional characteristics of the countries; after that we discuss our empirical results. The last part concludes.

2. LITERATURE REVIEW

2.1. Theoretical models

The literature on the effect of changes in the minimum wage covers four main theoretical approaches – the competitive model, the dynamic monopsony model, the search and matching model, and the institutional model. These approaches are based on different assumptions about how the labour market functions and the mechanisms for adjusting to binding minimum wages (Schmitt, 2013; Wilson, 2012) and support the evidence that there are other channels for adjustment to rises in the minimum wage than

[2] The first question was asked in an additional country, Slovakia, in which case we will refer to CEE9 countries.

the employment channel. Different theoretical models feature the pass-through of labour costs to prices, cuts in non-labour costs, wage rises for employees not earning the minimum wage, efficiency improvements and changes in employment adjustments.

The basic competitive model is a baseline framework in this regard (see Lester, 1960; Hirsch et al., 2015; Wilson, 2012; Kaufman, 2010; Lee and Saez, 2012; Schmitt, 2013). In perfectly competitive labour markets, setting minimum wages above the market clearing level reduces the demand for labour. This results in lower employment if there is no other possible channel for adjustment. Extending the basic competitive model can introduce further adjustment channels, including cuts in working hours instead of in the number of employees, reduced investment in training and other worker benefits, and lower turnover. Prices can also rise in these models if all the firms experience the same cost increase in response to higher minimum wages. As firms under perfect competition operate at maximum productivity, there is no room left in this framework for any improvement in overall efficiency.

The monopsony model is also often used assessing the impact of minimum wages on firms' decision-making. The static monopsony framework is reviewed by Boal and Ransom (1997); the dynamic monopsony model is discussed in, among others, Manning (2003) and Ashenfelter et al. (2010); see also Kuhn, 2004; Lee and Saez, 2012, Card and Krueger, 1995; and Wilson, 2012. Labour market frictions are a key component of dynamic monopsony models. Market power and labour market frictions allow profit-targeting firms in monopsonic markets where there are no binding minimum wages to hire less labour than the socially efficient amount and to set wages below the competitive market rate. The upward-sloping labour supply curve, where employment is an increasing function of wages, determines that both employment and wages in such settings rise in response to the binding minimum wage up to a competitive market level. However, monopsonic market power allows firms to pass at least a part of the increase in their costs on to consumers by raising prices. There are also positive spillover effects on wages in this model, as monopsonic firms that already pay more than the minimum wage might decide to maintain the differential to the minimum wage in order to attract new employees.

Like the monopsony framework, the search and matching model accounts for labour market imperfections (see Cahuc, 2014; Flinn 2006, Rogerson et al., 2005). This model assumes search frictions, as there are both employed and unemployed workers in the labour market, and jobs are either filled or unfilled. Unemployed workers search for job openings, whereas firms, driven by the objective of profit maximisation, search for employees to fill their vacancies. In this framework, like in monopsonic markets, binding minimum wages could, in fact, reduce unemployment under certain conditions. A rise in minimum wages may lead to stronger job search efforts, an improved matching process, and thus a rise in employment and overall efficiency.

The institutional model (see Kaufman, 2010; Hirsch et al., 2015; Lester, 1960; Hall and Cooper, 2012; Schmitt, 2013; Wilson, 2012) uses concepts from behavioural economics. It assumes that employees are heterogeneous, and that labour markets are imperfectly competitive, integrated and exposed to an excess labour supply, and that they operate under certain labour market institutions. Firms in the model respond to a rise in the minimum wage by improving their overall efficiency by either reducing organisational inefficiencies or increasing the productivity of employees. In contrast to the competitive model, where there is no room left for productivity improvements, the institutional framework suggests that it is possible under normal circumstances for firms to improve their overall efficiency, even though it appears to be costly as it requires continuous identification of problems and solutions. Furthermore, the pass-through into higher prices appears in this framework to complement the increase in efficiency in offsetting the rise in labour costs. On the demand side, the increase in binding minimum wages is reflected in higher disposable income, which could boost demand for goods and services, spurring growth in firm revenues and then feeding back into demand for additional labour and higher wages, like in the monopsony model.

In total these theoretical models suggest that firms have a number of strategies for reacting to rises in the minimum wage. Moreover, rises in the minimum wage can result in both increases and decreases in specific cost components.

2.2. Empirical results for the effects of rises in the minimum wage

Estimates of the effects of rises in the minimum wage are based on several different methodological approaches. These approaches can be divided by the extent to which they account for the transmission mechanism of rises in the minimum wage to macroeconomic outcomes (whole economy vs. specific industries, direct vs. indirect effects; see Lemos, 2008). General equilibrium models are claimed to account for the whole transmission mechanism, while other methods such as input-output models, separate Philips curve equation estimations, difference-in-difference estimation, or regression analysis, account only for part of the transmission.

The following overview of the empirical findings focuses mainly on studies of partial equilibria. Empirical findings on the effects of rises in the minimum wage on employment predominate. Although existing studies indicate potential effects in both directions, negative employment effects dominate slightly. Neumark and Washer (2006) and Neumark et al. (2014) review a number of studies on how minimum wages affect employment, mostly in the United States but also in other countries, including some European countries. The authors provide support for the conventional view that minimum wages

reduce employment among low-skilled workers and that the low-wage labour market segment can be reasonably well approximated by the neoclassical competitive model. Similar results are obtained by Huang et al. (2014) for China, where the minimum wage is also found to affect employment negatively, particularly in firms with low wage earners. In contrast, Levin-Waldman and McCarthy (1998) use information from a qualitative survey of small businesses in the United States and find that jobs are not necessarily destroyed, but job creation may be hindered.

For the wage effects, rises in the minimum wage are found to compress the lower tail of the wage distribution and to have some positive spillover effects on wages up to about 20% above the minimum wage level (Neumark and Wascher, 2008) or up to the median wage (Manning, 2003). A similar effect is found by Hirsch et al. (2015) for the US restaurant sector. Kambayashi et al. (2010) reveal that the increase in the minimum wage in Japan from the 1990s until the early 2000s in a period of deflation compressed the lower tail of the wage distribution among women. Strong wage compression not only in the lower tail but also in the upper tail of the wage distribution is found during an economic downturn in the German construction sector, indicating a negative wage spillover effect for high-wage earners and increased bargaining power for firms over workers still in employment (Aretz et al., 2012 and 2013; Kraft et al., 2012; Gregory, 2014). Wage-setting institutions might play a role in determining the extent of the spillover effect (Rattenhuber, 2014). Draca et al. (2011) find that after the minimum wage was introduced in the UK in 1999, wages above the minimum level were raised significantly, while firm profitability declined considerably. Hirsch et al. (2015) find that the profitability growth of firms is particularly likely to be reduced if due to adverse economic conditions the effect cannot be transmitted into higher prices.

Most empirical studies find rises in the minimum wage have no significant effect on training and through that on productivity (e.g. Acemoglu and Pischke, 2003; Grossberg and Sicilian, 1999; Neumark and Wascher, 2001). In contrast, Hirsch et al. (2015) show that a rise in minimum wages creates pressure on managers to increase labour productivity from the workforce by cross-training, multi-tasking and tighter work schedules.

For the transmission into prices, Card and Krueger (1995), Macdonald and Aaronson (2000), and Hirsch et al. (2015) find that rises in the minimum wage affect inflation significantly, but Katz and Krueger (1992) do not concur. Lemos (2008) compares over twenty studies on the price effects in the US and concludes that rise in the minimum wage is associated with a stronger increase in food prices and a weaker increase in overall prices. Similarly, Wadsworth (2010) finds that within four years of the introduction of the minimum wage in the UK, prices appear to have risen significantly faster in several minimum wage-intensive sectors than in other sectors.

2.3. Empirical studies from Central and Eastern Europe

Empirical findings from Central and Eastern Europe (CEE) show that rises in the minimum wage have a negative effect on employment and hiring, particularly in small enterprises and for younger, unskilled and minimum wage workers, in Hungary (Kertesi and Köllő, 2002; Kertesi and Köllő, 2004; Halpern et al., 2004), the Czech Republic and Slovakia (Eriksson and Pytlikova, 2004, Fialova and Mysikova, 2009), Estonia (Hinnosaar and Rõõm, 2003), Latvia (Zepa, 2006) and Slovenia (Laporšek et al., 2015, Brezigar Masten et al., 2010). Adverse effects on employment are also reported for rises in the minimum wage in Poland, in particular for the workers with the weakest bargaining position, like young workers and temporary workers (Majchrowska and Żółkiewski, 2012; Kamińska and Lewandowski, 2015).

Evidence of higher consumer prices being caused by a rise in the minimum wage is found in Hungary (Harasztosi and Lindner, 2015) and Latvia (Zepa, 2006).

A positive wage effect for workers at and above the minimum wage is found for Hungary (Kézdi and Kónya, 2012, Harasztosi and Lindner, 2015), the Czech Republic and Slovakia (Gottvald et al., 2002; Eriksson and Pytlikova, 2004 in 1999-2003), Slovenia (Brezigar-Masten et al., 2010 and Laporšek et al., 2015), Latvia (Zepa, 2006) and Estonia (Ferraro et al., 2016). Banerjee et al. (2013) find that the rise in the minimum wage in Slovenia prevented wage cuts being made and thus contributed to downward wage rigidity.

Finally, non-compliance with the minimum wage (the incidence of paying wages below the minimum wage) in Central and Eastern European countries was studied by Goraus and Lewandowski (2016), who found that higher ratios of the minimum wage to the average wage were associated with higher non-compliance, which may significantly weaken the final effects of minimum wage policies in CEE countries.

Following the designated literature and given the specifics of our data (direct firm responses from the WDN3 survey), the analysis in this study is based on a multivariate probit model, and is therefore likely to cover only a part of the transmission mechanism, and thus possibly not take account of second-round effects. The adjustment channels considered in the WDN3 survey were chosen to reflect the main theoretical models presented above.

3. DATA

The empirical part of the paper uses firm-level data obtained from a survey conducted within the WDN3. The survey was run in 2014 by 25 national central banks[3] using a harmonised questionnaire that covered the period 2010-2013. This paper concentrates specifically on a block of questions about firms reaction to a rise in the minimum wage, which was included in the questionnaires of the nine countries (Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). A question about the share of minimum wage earners was included in all nine countries (see Table A1) and firms in all of them except Slovakia were asked about adjustment strategies they followed after the most recent rise in the minimum wage (see Table A2).

An advantage of this survey is that firms were asked directly about their chosen course of action following a rise in the minimum wage. This information is not available in administrative datasets. One of the main caveats of the survey approach is that the answers from firms do not necessarily reflect what they actually did but rather their subjective perception of it, and so they may be influenced by circumstances at the time the survey was carried out, even though the reference period in most cases is explicitly stipulated.

The total sample size of this dataset is 8079 firms. The composition of the sample by countries, sectors and firm size categories can be seen in Table 1. This sample is designed to be representative across firm-size categories within each country and its sectoral distribution closely follows the distribution of firms in each country.[4,5] The size of the sample, however, varies across countries both in absolute terms and relative to the population of firms in the country, so individual weights have been used to make the sample representative of the population of firms in each country (firm weights) and to account for the number of workers that the firm represents in the population (employment weights).

[3] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, France, Greece, Germany, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the United Kingdom.
[4] The survey covered non-agricultural private-sector firms with five or more employees (sectors C-N in the NACE 2. rev. classification).
[5] Please note that the WDN aggregate does not necessarily refer to 2013. See Table A1 for the exact reference period.

Table 1 Number of respondents by countries, sectors and firm size (conditional on answers being given to the block of questions on the minimum wage)

countries:	BG	EE*	HU	LT	LV	PL*	RO	SI	SK	Total
sample size:	456	498	2031	515	557	899	2029	493	601	8079
Sectors										
Manufacturing	47	134	798	76	100	295	1094	193	185	2922
Electricity, gas, water	-	17	-	-	-	23	-	18	16	74
Construction	21	84	145	60	69	96	216	63	51	805
Trade	205	92	439	169	173	225	291	61	126	1781
Business services	89	157	596	153	203	232	428	150	199	2207
Financial services	-	5	53	57	12	4	-	8	24	163
Public sector services	-	-	-	-	-	9	-	-	-	9
Arts & entertainment	94	1	-	-	-	3	-	-	-	98
Number of employees										
<20	312	186	235	297	264	307	-	177	155	1933
20-49	94	177	604	98	144	189	173	93	167	1739
50-199	41	108	807	93	118	259	307	144	196	2073
>199	9	27	385	27	31	144	1549	79	83	2334

Notes: *The sector of operation is missing for 8 firms in the Estonian sample and for 12 in the Polish sample.
Sources: WDN3 survey, authors' estimations.

4. DESCRIPTIVE RESULTS

4.1. Share of employees earning the minimum wage

There is in general great uncertainty about the actual number of workers employed at the minimum wage, as estimates by various sources may differ significantly. Overall, the WDN estimates are comparable with the official estimates by national statistical offices or ministries for 2013 (see Table 2), though the WDN estimates other than those for Latvia, Estonia and Poland are a little higher than the national statistics.[6]

[6] The estimate for Hungary is in line with the 22% or 30% share of minimum wage workers estimated by Elek et al. (2008) and Krekó and Kiss (2007).

Table 2 Average share of employees of firms earning the minimum wage (%)

countries:	BG	EE	HU	LT	LV	PL	RO	SI	SK	CEE9
WDN aggregate‡	20.3	4.8	31.5	15.3	15.5	11.8	24.3	8.0	11.8	17.8
National statistics (2013)†	8.6	5.8	17.8	10.5	16.7	13.8	5.0	7.1	7.0	
Sectors										
Manufacturing	27.8	4.2	34.5	16.2	16.0	10.7	24.0	4.7	10.0	19.0
Electr., gas, water	.	2.6	.	.	.	1.4	.	2.4	3.7	1.9
Construction	18.4	5.9	28.5	15.3	10.6	18.6	34.7	15.3	10.5	20.5
Trade	18.9	3.5	30.9	16.6	14.6	12.0	22.4	4.6	13.1	17.7
Business services	18.3	5.8	28.6	14.2	19.1	14.4	21.4	15.6	16.8	18.2
Financial services	.	.	23.7	4.5	2.0	.	.	1.1	1.4	7.8
Arts & entertain.	12.5	-	.	.	.	.	.	.	.	12.5
Number of employees										
<20	23.9	8.8	29.6	29.7	24.7	30.6	.	12.0	14.9	25.4
20-49	25.2	5.7	30.4	17.9	23.1	16.7	36.5	7.9	11.8	23.8
50-199	12.5	3.2	32.7	11.9	13.2	9.3	32.7	8.9	9.6	17.2
>199	23.8	1.5	32.2	5.0	9.7	5.8	15.2	5.5	10.7	13.1
Workforce type										
LS BC ††	23.6	5.4	41.3	21.1	31.9	13.4	43.6	20.4	19.0	23.0
HS BC	16.2	4.6	27.4	14.7	14.1	10.9	24.1	4.8	13.5	17.7
LS WC	25.7	3.1	29.8	11.4	16.5	15.9	24.5	8.2	10.8	17.8
HS WC	13.0	2.5	18.4	12.2	4.7	5.1	7.8	2.3	3.2	8.0
Ownership										
Mainly domestic	20.3	6.0	32.7	18.0	16.2	14.9	30.1	9.2	10.7	20.2
Mainly foreign	55.6*	1.9	26.1	3.8	9.6	3.9	12.9	4.1	14.8	10.7
Exporting status										
Exporting	29.6	4.0	31.6	13.7	13.4	9.3	21.3	-	13.4	16.4
Non-exporting	18.7	6.8	31.4	18.7	19.0	14.8	28.3	-	10.0	19.9

Notes:

‡ WDN aggregate refers to the time before the corresponding rise in the minimum wage rate. See Table A1 for the exact reference period.

†Source of national statistics on the share earning the minimum wage in 2013: BG - National statistical institute; EE – LFS, Statistics Estonia; SK – Finance Ministry; LT – Statistics Lithuania (only full-time employees); LV – LFS, Central Statistical Bureau of Latvia; HU – LFS, Hungarian Central Statistical Office; RO – National Institute for Statistics, estimates for October 2012; SI – Statistical Office of the Republic of Slovenia for the number of all employees and Agency of the Republic of Slovenia for Public Legal Records and Related Services for the number receiving the minimum wage.

†† High/low-skilled white/blue-collar workers, based on the ISCO-08 classification of the ILO.

* This result is driven by one large manufacturing firm with foreign ownership. If it is excluded, the average share is 7.70.

Sources: WDN3 survey, authors' estimations, employment adjusted estimates.

The average share of employees earning the minimum wage in our sample varies quite significantly across countries, sectors and occupations, but only partially across firm-size groups (see Table 2). There are several points to note from this. First, the WDN survey results show that fewer than 5% of the

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. Second, the sector with the highest share of minimum wage earners differs across countries, as manufacturing has the largest share in Bulgaria, Lithuania and Hungary, business services does in Latvia, Slovenia and Slovakia, while construction has the largest proportion of workers employed at the minimum wage in Estonia, Poland and Romania. At the opposite end of the spectrum, energy and financial services have the smallest shares of their workers earning the minimum wage. Third, minimum-wage workers are more frequently employed by firms where low-skilled blue collar workers are a dominant part of the workforce. Fourth, although the differences across firm-size categories are not very large, small firms with fewer than 50 employees are more likely to pay the minimum wage than larger firms are. In Bulgaria and Hungary, however, the share of workers in large firms earning the minimum wage is more significant, reflecting the higher share of workers on the minimum wage in manufacturing. Finally, minimum wage workers are slightly more frequently employed in domestic and non-exporting firms.

4.2. The adjustment strategies used following rises in the minimum wage

When answering the questions about their strategies for adjusting to rises in the minimum wage, firms evaluated relevance of several different adjustment channels for a specified moment of minimum wage increase. In most countries, all firms could answer the question, irrespective of whether they actually had any workers on the minimum wage or not. The exception was Slovenia, where only firms with workers employed at the minimum wage answered. The adjustment channels were: we had to lay people off, fewer people were hired, we had to increase prices, we had to reduce other costs, we had to increase wages that were above the minimum wage as well, and we raised productivity.[7] By design, the questions in the WDN3 questionnaire on rises in the minimum wage only consider one side of the effects of the channels explored, with the exception of the Bulgarian survey (see Section 3 for details). Specifically, interviewees could not cite any of the positive effects on employment or hiring that are possible under monopsony, matching or institutional model assumptions.

The answer choices were different in different countries (see Table A2). Most countries offered the choice of 'not relevant', 'of little relevance', 'relevant' and 'very relevant'. The Slovenian questionnaire gave two options, 'relevant' and 'not relevant'. In Bulgaria, as already mentioned, the choices cover both positive and negative effects. Many countries had a binary yes/no choice for the answer to the question about wage spillover from the higher minimum wage to the wages of other workers.

[7] For the list of adjustment channels offered in each country's questionnaire and for the slight differences in wording, see Table A2.

To evaluate how relevant the different adjustment channels were, the answers from the second block were harmonised across countries (see Table A3) using a binary measure of relevance. The answer "Relevant" is assigned if the firm answered that the channel is of little relevance, relevant or very relevant, or if the answer "yes" is given. The answer "Not relevant" is assigned for all other cases. For Bulgaria, the answer "Relevant" is assigned for a decrease in the employment or non-labour costs channels if a firm answered that the decrease in the corresponding measure was strong or moderate; similarly, "Relevant" is assigned for increases in the measures of prices or labour productivity if the firm showed a moderate or strong increase.

Table 3 Timing and size of rise in the minimum wage, % (period analysed in bold)

Country	2010 Q1-2	2010 Q3-4	2011 Q1-2	2011 Q3-4	2012 Q1-2	2012 Q3-4	2013 Q1-2	2013 Q3-4	2014 Q1-2	2014 Q3-4	2015 Q1-2	2015 Q3-4
BG	-	-	-	-	**13**	**7**	**7**	-	10	-	6	6
EE	-	-	-	-	4	-	10	-	**11**	-	10	-
HU	-	-	6	-	**19**	-	5	-	4	-	4	-
LT	-	-	-	-	-	-	**18‡**	-	-	-	4	8
LV	-	-	11	-	-	-	-	-	**12**	-	13	-
PL	-	-	5	-	8	-	**7**	-	**5**	-	**4**	-
RO	-	-	12	-	4	-	7	7	**6**	**6**	**8**	**8**
SI	**23**	-	2	-	2	-	3	-	1	-	-	-
SK	-	-	3	-	3	-	**3**	-	4	-	8	-

Notes:
‡ In Lithuania there were two rises in the minimum wage between 2012 Q3-4 and 2013 Q1-2, of 6% from 231.7EUR to 246.18 EUR in July 2012 and of 18% from 246.18 EUR to 289.62 EUR in Jan 2013. In the questionnaire firms were asked specifically about the 18% increase in the minimum wage.
Source: Eurostat, Monthly minimum wages (bi-annual data).

The timing and the size of the analysed rises in the minimum wage differ notably across countries (see Table 3). Several countries referred to a specific date when the minimum wage rose, with the Estonian and Latvian questionnaires asking about firms' reaction to the rise in the minimum wage in January 2014, the Slovenian questionnaire referring to the rise in February 2010, and the Lithuania questionnaire to the rise in January 2013. Other countries referred to longer periods of changes in the minimum wage, with the Bulgarian questionnaire covering the period 2010-2013 for example. The Polish questionnaire focused on changes in the minimum wage after 2013, and since the survey was conducted in 2015, its answers reflect how firms reacted to rises in the minimum wage between 2013 and 2015. No period was specified in the Romanian questionnaire for rises in the minimum wage, and, since at the moment of the survey the future path of such rises in 2015 was known to firms, the answers may also reflect the expected change in the minimum wage rather than solely the historical changes before 2013.

The highest single rise in the minimum wage among those analysed was of 23% in Slovenia in 2010, followed by rises of 19% in Hungary in 2012 and of 18% in Lithuania in 2013. The Estonian and Latvian questionnaires focus on relatively small rises of 11% and 12% respectively that occurred more recently in 2014. The Bulgarian, Romanian and Polish questionnaires refer to extended periods of time with cumulative minimum wage increases of 29% in 2010-2013, 31% in 2014-2015 and 18% in 2013-2015 correspondingly. However, there is no correlation between the size of the rise in the minimum wage and the relevance of the adjustment channels. This suggests that cross-country differences in the relevance of the adjustment channels are more likely to come from differences in institutional characteristics, the sectoral composition of the economies and the economic shocks that were experienced, rather than the extent of minimum wage increases.

Overall, almost half of all firms in the sample answered that at least one of the six adjustment channels offered was relevant as a response to an increase in the minimum wage (see Table 4). The most frequently chosen channels for adjustment to rises in the minimum wage are increases in productivity, reduction of non-labour costs, and rises in product prices. Cutting employment is relatively less popular, and employment effects are realised mostly through reduced hiring, rather than direct layoffs.

Although around 40% of the firms in the sample do not have any employees on the minimum wage (the share is smaller in Bulgaria and Hungary and larger in Estonia) our results indicate potential spillovers from a rise in minimum wages to these firms (see the lower part of Table 4). The overall importance of the adjustment channels is lower, with the exception of the wage, price and productivity adjustment channels for Bulgaria[8]. Around one quarter of firms without any employees on the minimum wage at the moment the minimum wage was raised view rises in prices and productivity and cuts in non-labour costs as relevant measures.

[8] One possible explanation for the stronger spillover effects of minimum wage increases on the wages of employees earning above the minimum wage in Bulgaria may be that the minimum wage system is linked to the practice of determining minimum social security thresholds by economic activity and occupation in that country. The stronger wage spillover effect may therefore indirectly lead to a stronger relevance of other adjustment channels in companies without employees on the minimum wage in Bulgaria. It should also be remembered for Bulgaria that the question about adjustment to the minimum wage rise was related to the strategies of companies over a longer period of time, 2010-2013, and not only to the most recent change as in other countries. The reference of the question to a longer period of time makes it more likely that second round spillover effects related to the wage distribution will also materialise at firms without any workers earning the minimum wage.

Table 4 Share of firms answering that the minimum wage adjustment channel was "Relevant", % (Relevant + Not Relevant=100%)

MW rise:	BG	EE	HU	LT	LV	PL	RO	SI‡	CEE8
	Firms with minimum wage employees (before the MW rise)								
We had to lay people off	25.2	9.7	19.2	9.1	22.7	38.5	35.7	7.1	29.6
We could hire fewer people	-	12.2	47.3	28.2	29.5	46.4	54.7	20.7	45.8
We had to raise product prices	35.0	39.2	57.0	36.6	52.5	52.3	67.8	15.0	52.7
We had to reduce non-labour costs	8.1	27.8	56.1	49.7	55.6	66.6	77.9	63.2	59.1
We had to raise the wages of other employees	29.2	32.9	-	30.0	49.9	43.3	29.8	18.8	40.5
We increased productivity	21.5	25.0	59.4	55.7	45.6	68.7	-	-	61.6
Total	23.8	24.5	47.8	34.9	42.6	52.6	53.2	24.9	48.2
Number of observations	317	169	1540	264	283	444	1223	493	4650
	Firms without minimum wage employees (before the MW rise)								
We had to lay people off	13.9	3.3	11.7	0.0	6.4	7.2	14.2	-	7.8
We could hire fewer people	-	3.2	20.6	3.6	12.0	14.2	29.7	-	14.5
We had to raise product prices	41.3	15.3	30.4	10.8	20.3	21.0	36.0	-	22.9
We had to reduce non-labour costs	5.6	13.6	23.9	13.9	24.0	26.1	45.7	-	23.8
We had to raise the wages of other employees	50.6	10.9	-	22.3	25.8	27.5	12.3	-	27.2
We increased productivity	35.8	12.4	28.5	28.7	26.3	28.1	-	-	28.1
Total	29.5	9.8	23.0	13.2	19.1	20.7	27.6	-	20.7
Number of observations	211	329	479	248	241	453	815	-	2776

Notes:
The option "Relevant" is assigned if the firm answered that the corresponding adjustment channel is of little relevance, relevant or very relevant; when only a yes or no option was available, "Relevant" refers to the 'yes' answer. "Total" shows the average share of firms claiming any of the six adjustment channels as "Relevant".
‡ Slovenian firms without minimum wage employees were not asked the corresponding question.
Sources: WDN3 survey, authors' estimations, firm number adjusted estimates.

5. COUNTRY OVERVIEW

The next section of the paper discusses the institutional characteristics of the CEE9 and summarises the macroeconomic developments before and during 2010-2013. This helps put the results in the context of the economic and institutional background of the CEE9 countries, and shows that background in comparison with the EU.

5.1. Macroeconomic background

The years before the global financial crisis saw economic activity in the CEE9 grow at considerably higher rates than the EU average, and saw both real and nominal convergence accompanied by large capital inflows, large current account deficits and rapidly increasing unit labour costs (ULC). Fuelled by large capital inflows that supported a credit boom, and coupled with an expansionary fiscal policy, domestic demand grew strongly in most of the CEE9 in 2005-2007 (Lane and Milesi-Ferretti, 2015).

The sudden halt in capital flows and demand at the beginning of the global crisis had a strong negative impact on economic activity, especially in the Baltic States, where GDP fell by more than 15% in 2008-2009 (see Figure A1 in Appendix 3). Only Poland in the whole group of countries did not experience a real recession at any point in the period 2008-2013, mainly because its reliance on internal consumption served as a cushion for external shocks, while favourable changes in the currency exchange rate supported Polish exports.

The crisis triggered a strong labour market adjustment as employment dropped cumulatively by 5-8% in most countries apart from Poland[9], and by more than 10% in Bulgaria and the Baltics. As a consequence, the unemployment rate, which had been at relatively low levels of around 5-7% in most countries in 2007, rose substantially, exceeding 10% in 2010 except in Poland, Romania and Slovenia, and even reaching more than 15% in 2010 in the Baltic States (see Figure A1). Starting from 2010, the economies recovered gradually except for those in Hungary and Slovenia where the recovery started only after a second dip, so that by 2015 most of the CEE9 had recovered all the loss of output since the crisis. Following the recovery, the unemployment rate came down slowly, although in many countries the demand for low-skilled labour appeared to remain subdued.

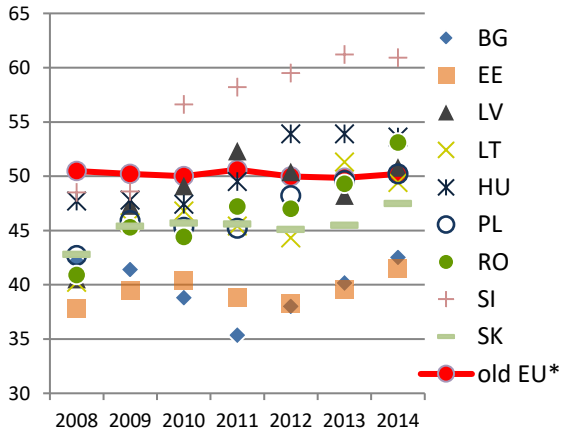
[9] The relatively mild response of the Polish economy to the global financial crisis, especially during its first wave, meant an extensive adjustment observed in the labour market in Poland appeared to be quite minor. An almost immediate and significant adjustment in wage dynamics together with a decline in the intensity of labour utilisation as working hours were reduced also helped keep the drop in employment quite modest in 2009, when it did not exceed 1% of total employment.

During the crisis, both real and nominal gross wages remained on an upward trajectory. The exceptions were the Baltic countries, where large-scale internal devaluations were used to restore economic growth. While the increase in average wages could be partially attributed to the changes in the employment structure, since job destruction mostly affected low and medium-skilled workers, institutional factors may also have played a role. In this regard, the degree of the centralisation and the coverage of wage bargaining and especially the minimum wage policy affected aggregate wage developments.

While nominal average wages have been rising since 2008, minimum wages appear to have risen more, and this has resulted in a growing Kaitz index, which is the ratio of the minimum wage to the average or median wage (see Figure 1). In 2008 and 2009 the Kaitz index in all the CEE9 countries was below the average of selected EU countries. After that it rose, reflecting that in recent years the growth of minimum wage (relative to both average and medium wages) was higher in the CEE9 than in other EU countries.

Figure 1 The Kaitz index

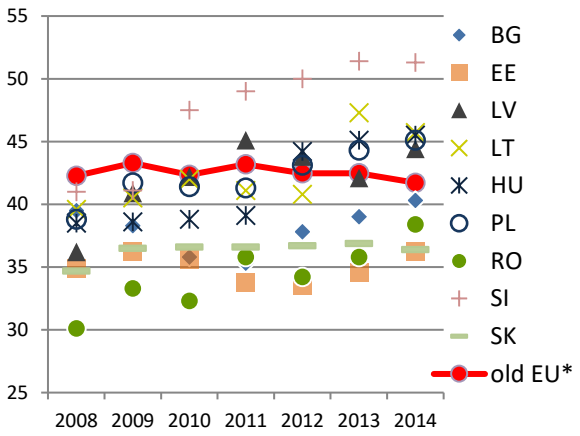
Nominal minimum wage as a proportion (%) of **median** earnings



Note: old EU* is a simple average composed of data for Belgium, Ireland, Greece, Spain, France, Luxembourg, Netherlands, Portugal and the UK.

Source: OECD and authors' calculations for Bulgaria.

Nominal minimum wage as a proportion (%) of **average** earnings



Note: old EU* is a simple average composed of data for Belgium, Ireland, Greece, Spain, France, Luxembourg, Netherlands, Portugal and the UK.

Source: Eurostat.

According to Eurostat data, the share of low wage earners in most CEE9 countries in 2010 was significantly above the EU15 average[10], with the lowest share being recorded in Slovenia at 17.1% and

[10] Low wage earners are defined as those employees excluding apprentices earning two-thirds or less of the national median gross hourly earnings in that particular country.

the highest in Latvia at 27.8% (see Figure A2). Although low wage earners are generally heavily concentrated among young workers or new entrants to the labour market, it seems that low wage earners in the countries analysed are more equally dispersed across all age cohorts than they are in most advanced European economies (see Figure A2). This has important implications since it indicates that the effects of rises in the minimum wage in the CEE9 may be more widely distributed in the economy. The sharp rise in the Kaitz index in the CEE9 together with the high shares of workers earning the minimum wage implies further wage compression at the bottom and pressure on the labour cost competitiveness of firms, especially since the rise in minimum wages since 2008 was not accompanied by similar gains in productivity (see Figure A3).

5.2 Institutional characteristics

It is generally considered that centralisation of wage bargaining and higher values for other wage rigidity indicators like trade union density or high minimum wages are evidence of lower labour market flexibility (Deutsche Bundesbank, 2009). There are differences among the CEE9 when we compare individual institutional aspects[11]; however, institutions are more flexible in the majority of the CEE9 countries than in the EU15 countries, which suggests it is easier to adjust to rises in the minimum wage through direct changes in labour cost components.

Trade union density, defined as the proportion of employees who are union members, is on average 17% in the CEE9, which is lower than the EU15 average of 35% (see Table 5). The density is below the EU15 average in all the CEE9 countries. In general, union density in the CEE9 has declined strongly in the past because of industrial restructuring and a fundamental change in the role of unions (Worker participation, 2015).

Collective bargaining coverage, measured as the proportion of employees that it affects, is again much lower in the CEE9 on average at 37% than in the EU15, where it is 72% (see Table 5). The coverage is higher only in Slovenia, at around 90%, which is well above union density and reflects the legal framework in which collective bargaining takes place.[12] In Slovenia, negotiations are held at industry and company levels, and at the national level in the public sector. In the other CEE9 countries, bargaining at firm level predominates, since industry bargaining has largely disappeared, at least in the

[11] See Appendix 2 for a comparison of minimum wage adjustment models in the CEE9.
[12] Almost all employees are covered by collective bargaining in Slovenia, partly as a result of the historical position where the employers' side included chambers of commerce and industry, to which all employers had to belong (Worker participation, 2015).

private sector.[13] This leaves employers free to set their own terms and conditions. The economic crisis sped up the trend of decentralisation, and the national level agreement was abolished in Romania for example, while the coverage decreased in Hungary and Slovakia.[14] This is one reason why a national minimum wage has now become more typical as it absorbs those workers who do not have adequate minimum wage protection under a collective agreement (Worker participation, 2015, Schulten, 2014). Additionally, the minimum wage serves as an important anchor for the wage structure as a whole in countries with low collective agreement coverage. As a rule, developments in the minimum wage are a key benchmark for wage developments in general (Schulten, 2014).

Table 5 Institutional characteristics

Country	Union density (%), 2012*	Collective bargaining coverage (%), 2012*	Implicit tax rate on labour (%), 2012	Strictness of employment protection legislation – individual and collective dismissals (regular contracts), 2013
BG	20	30	24.5	NA
EE	10	33	35.0	2.1
HU	12	33	39.8	2.1
LT	10	15	31.9	2.4
LV	13	34	33.0	2.9
PL	12	25	34.0	2.4
RO	33	36	30.4	NA
SI	27	90	35.6	2.7
SK	17	35	32.3	2.3
EU15	35**	71.5**	36	2.5**

Notes: *2012 or latest available data, **simple average.

Source: Worker participation (2015), European Commission (2012, 2014), OECD Employment Protection Database.

In most of the CEE9 countries, however, the collectively bargained wages are not linked to the minimum wage and the direct links between rises in the minimum wage and in the wages of other employees are limited to specific types of companies, such as mostly big companies in Poland or sectors, such as public servants in Lithuania. In some of the countries, the minimum wage is a benchmark for lump-sum allowances or other social payments and also, for example, for severance payment. The minimum wage in Bulgaria is usually a lower benchmark for collectively bargained wages and for the system of minimum social security thresholds, which implies that the wage distribution is adjusted more regularly in response to the minimum wage. In Poland, the minimum wage level gives a reference for night-shift

[13] See: European Central Bank (2016).
[14] At the same time the percentage of firms in Poland covered by collective agreements increased slightly from 19.3% in 2006 (WDN1) to 20.9% in 2013 (WDN3), which is still clearly below the EU average of over 60%.

pay and severance pay, and is also the minimum base for social security contributions, which is the same as in Hungary.

In most of the countries there is a uniform minimum wage for all workers. An exception is Slovakia, where the minimum wage is adjusted annually by coefficients based on the level of job qualifications or difficulties for six subgroups, which were set by law well before 2010 and have remained unchanged since then. Poland and Slovenia allow a starting wage lower than the minimum threshold for graduates or students, while in Hungary there is a higher minimum wage for positions that require secondary education, but wages of the workers in public employment programmes are set below the minimum wage.

The implicit tax rate in the CEE9 with the exception of Hungary, where labour taxation is relatively high, stood close to or even below the EU15 average, ranging from 24.5% in Bulgaria to 39.8% in Hungary. About a half of the overall implicit tax rate on labour, or around one-third in Slovenia, consisted of non-wage labour costs paid by employers (Taxation trends in the European Union, 2014).

The most common quantitative measure for evaluating the strictness of labour laws is the Employment Protection for Regular Contracts (EPRC) index[15] developed and derived by the OECD[16]. The general idea of the index is to evaluate whether an employer is facing additional hiring and firing costs because of labour protection laws. These costs might be associated with longer hiring processes or an additional financial burden if employment contracts are terminated. Therefore, a higher EPRC value might indicate that it is difficult to cut employment after the minimum wage rises.

The employment protection indicators are available for all the CEE9 countries except Bulgaria and Romania and are listed in Table 5. The data show employment protection to be stricter for regular contracts in Latvia and Slovenia than it is on average in the EU15, while it is weaker in Estonia, Hungary, Lithuania, Poland and Slovakia. However, when comparing EPRC indexes among countries, it is important to remember that the EPRC index presents the legal position on employment protection, but this may not accurately reflect how these legal norms are applied in practice, especially in countries with low unionisation, low collective bargaining power and a large shadow economy.

To explore how the institutional characteristics interact with the preferred channels for adjusting to rises in the minimum wage, we plot them against the relevance of adjustment channels normalised by the

[15] The EPRC index is aggregated from two sub-indexes: the first covers regulations of individual dismissals, and the second assesses additional provisions that apply to dismissals of groups of workers but not to individual dismissals (weights are applied of 5/7 for the regular contracts and 2/7 for collective dismissals). The time series of these indexes for OECD countries for 1985–2013 (for some countries for 2014–2015) are calculated by the OECD and can be found at www.oecd.org/els/emp/EPL-timeseries.xlsx. Methodological issues and the scores for the separate elements of the indexes are also reported in the same file.
[16] These indicators are expressed on a scale from 0 to 6; the higher the value, the stricter the labour protection laws.

average share of employees earning the minimum wage in the country (see Figure A4). We find that firms in countries with higher implicit tax on labour and a higher share of collective bargaining coverage tend to report higher relevance for the adjustment channels. The association with the strictness of employment protection or union density is less evident.

Adding to the economic and institutional differences in the CEE9 is strong cross-country variation in the institutional changes in the survey period and afterwards, which may have affected the transmission of rises in the minimum wage. Some countries did not see any significant reforms to the minimum wage in this period, while others made such labour market reforms. The reduction in hiring costs in Romania may have mitigated the effects of the rise in the minimum wage to a certain extent. In Slovenia, the minimum wage was indexed to inflation after a substantial rise in it in 2010.[17] In Bulgaria, four collective bargaining contracts were extended to all employees in the industries they covered, which may have increased the transmission of the minimum wage. There was also an extension of the minimum wage coverage in Slovakia. In Hungary, the minimum wage was raised substantially in 2012, and the government defined a compulsory pay rise in order to compensate workers for their loss from the abolition of the tax credit. They encouraged the implementation of this wage rise in the private sector by paying wage compensation, which impacted how the rise in the minimum wage affected the wage distribution.

To sum up, given the significantly higher share of workers earning the minimum wage and their distribution across all age cohorts, as well as the lower level of employment protection, it might be expected that a rise in the minimum wage would have more of an impact in the CEE9 countries than in the EU on average.

6. EMPIRICAL RESULTS

The degree of correlation between the adjustment channels for the minimum wage is high[18] (see Table A4), suggesting that different adjustment strategies seem to be used jointly. Descriptive evidence suggests that the choice of the preferred adjustment channel depends on firm-specific characteristics, such as the share of workers earning the minimum wage, size, sector, use of collective agreements, and the changes in macroeconomic conditions. In this section, we apply a multivariate probit framework to

[17] The Law on the Minimum Wage requires the minimum wage to be increased by at least the rate of inflation each year. It also allows other benchmarks to be used for the adjustment, such as wage trends, economic growth and employment trends.
[18] With the exception of Bulgaria, where the specific questionnaire design allowed for both positive and negative effects of the rise in the minimum wage in all adjustment channels.

study the factors that determine the choice of the adjustment channels, controlling for correlation between the channels.

The dependent variable takes the value 1 if the firm answered that the particular adjustment channel is "Relevant" and 0 otherwise (see Section 3, Table A2 and Table A3 for details). Explanatory variables include dummy variables for country, sector, size, ownership and collective bargaining coverage[19] (see Table A5 for the full list of explanatory variables). Firm-specific economic conditions are controlled for by including ordered variables for changes in the demand for the firm's products and services and changes in external financing conditions. In addition, we control for the presence of minimum wage employees at the firm. Therefore, the average marginal effects of the categorical explanatory variables presented in Table 6a and Table 6b refer to discrete changes from the base level.

As not all the adjustment channels were included in the questionnaires of all the countries[20] (see Table A2 and Table 4), we run two versions of the multivariate probit models. The first is for a subset of countries containing Poland, Latvia, Lithuania and Estonia, where all the channels are observed, and the second is for a subset of adjustment channels, consisting of lay-offs, price rises and cuts in non-labour costs, that are observed for all countries.

As expected, estimates from the two versions of the model for all channels and for all countries imply that after the abovementioned characteristics are controlled for, the transmission of rises in the minimum wage is stronger, or more relevant, for firms employing workers at the minimum wage than it is for firms where nobody on the payroll earns the minimum wage. Further, an improvement in demand conditions reduces the probability that the firm will consider cutting employment and non-labour costs or improving productivity. The effect of a change in external financing conditions is weaker but still statistically significant with the short country sample.

[19] In order to control for potential endogeneity between an increase in the minimum wage share and the presence of a firm-level collective bargaining agreement, we tried two different versions of the variable – presence of any collective agreement and presence of an outside-firm collective agreement. The effect of change in the variable is very small, which was expected due to the relatively low level of collective agreement coverage in the CEE9 countries. Therefore we keep the broader version of the variable in our estimations.

[20] All countries asked about the relevance of three adjustment channels – lay-offs of workers, price rises and cuts in non-labour costs, while only four countries – Latvia, Lithuania, Estonia and Poland – asked about all six of the adjustment channels in the questionnaire.

Table 6a Multivariate probit model of the relevance of adjustment channels, average marginal effects (all channels; sample restricted to the Baltic countries and Poland)

	(1) lay off	(2) hire less	(3) increase prices	(4) cut non-lab. costs	(5) increase wages	(6) increase prod.
Presence of MW employees	0.124***	0.175***	0.241***	0.248***	0.175***	0.222***
at the firm	(0.013)	(0.014)	(0.017)	(0.017)	(0.019)	(0.018)
Foreign ownership, dummy	-0.065***	-0.091***	-0.149***	-0.153***	-0.133***	-0.126***
	(0.019)	(0.023)	(0.026)	(0.026)	(0.026)	(0.027)
Presence of collective agreement	0.007	-0.006	-0.015	-0.027	0.002	0.030
	(0.022)	(0.027)	(0.034)	(0.034)	(0.035)	(0.036)
Demand level (Base: Strong decrease)						
- Moderate decrease	0.008	-0.005	-0.007	-0.033	0.023	-0.031
	(0.021)	(0.027)	(0.036)	(0.035)	(0.037)	(0.038)
- Unchanged	-0.038*	-0.017	0.004	-0.047	0.008	-0.044
	(0.022)	(0.028)	(0.037)	(0.036)	(0.039)	(0.039)
- Moderate increase	-0.043**	-0.036	-0.010	-0.061*	0.010	-0.046
	(0.021)	(0.027)	(0.035)	(0.035)	(0.037)	(0.038)
- Strong increase	-0.106***	-0.054	-0.016	-0.082*	0.000	-0.083*
	(0.033)	(0.039)	(0.046)	(0.047)	(0.049)	(0.049)
Access to external finance (Base: Strong decrease)						
- Moderate decrease	-0.005	0.010	0.083*	0.095**	0.039	0.092*
	(0.027)	(0.036)	(0.049)	(0.048)	(0.049)	(0.053)
- Unchanged	-0.018	-0.023	-0.001	-0.012	-0.055	0.025
	(0.024)	(0.030)	(0.042)	(0.041)	(0.042)	(0.045)
- Moderate increase	-0.009	-0.011	0.009	-0.003	-0.036	0.073
	(0.029)	(0.036)	(0.047)	(0.047)	(0.049)	(0.052)
- Strong increase	0.001	0.023	-0.022	-0.119	-0.092	0.010
	(0.046)	(0.054)	(0.077)	(0.077)	(0.078)	(0.085)
Sectoral dummies (Base: Manufacturing)						
Electricity, gas, water	-0.022	-0.079	-0.211***	-0.200**	-0.165*	-0.221***
	(0.044)	(0.062)	(0.079)	(0.082)	(0.087)	(0.077)
Construction	0.010	0.012	-0.033	-0.031	-0.026	-0.023
	(0.020)	(0.024)	(0.030)	(0.031)	(0.033)	(0.033)
Trade	-0.010	-0.019	-0.067***	-0.056**	-0.043	-0.116***
	(0.017)	(0.021)	(0.026)	(0.027)	(0.028)	(0.028)
Business services	-0.021	-0.038*	-0.075***	-0.049*	-0.038	-0.102***
	(0.017)	(0.021)	(0.025)	(0.026)	(0.027)	(0.027)
Financial intermediation	0.015	-0.062	-0.211***	-0.055	-0.125**	-0.129**
	(0.043)	(0.046)	(0.064)	(0.057)	(0.062)	(0.060)
Arts		-0.022	-0.136	-0.176		0.118
		(0.160)	(0.218)	(0.227)		(0.327)
Firm size dummies (Base: <20 employees)						
20-49 employees	-0.033**	-0.045**	-0.043*	-0.043*	-0.001	-0.031
	(0.016)	(0.019)	(0.023)	(0.024)	(0.025)	(0.025)
50-199 employees	-0.004	-0.016	-0.026	-0.013	-0.007	-0.005
	(0.015)	(0.019)	(0.025)	(0.025)	(0.026)	(0.027)
200+ employees	-0.041*	-0.066**	-0.034	-0.016	0.053	-0.007
	(0.024)	(0.031)	(0.037)	(0.036)	(0.037)	(0.039)
Country dummies (Base: Poland)						
Latvia	-0.020	-0.088***	-0.022	-0.066**	-0.049*	-0.093***
	(0.016)	(0.022)	(0.027)	(0.028)	(0.028)	(0.030)
Lithuania	-0.113***	-0.089***	-0.120***	-0.123***	-0.129***	-0.054**
	(0.018)	(0.019)	(0.024)	(0.023)	(0.026)	(0.025)
Estonia	-0.078***	-0.182***	-0.077***	-0.177***	-0.170***	-0.230***
	(0.018)	(0.022)	(0.026)	(0.026)	(0.026)	(0.028)
Observations	2,083	2,083	2,083	2,083	2,083	2,083

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable – binary measure of relevance used for all countries (1 – Relevant, 0 – Not relevant).
For a detailed description of the explanatory variable see Table A5.
Source: WDN3 survey, authors' estimation.

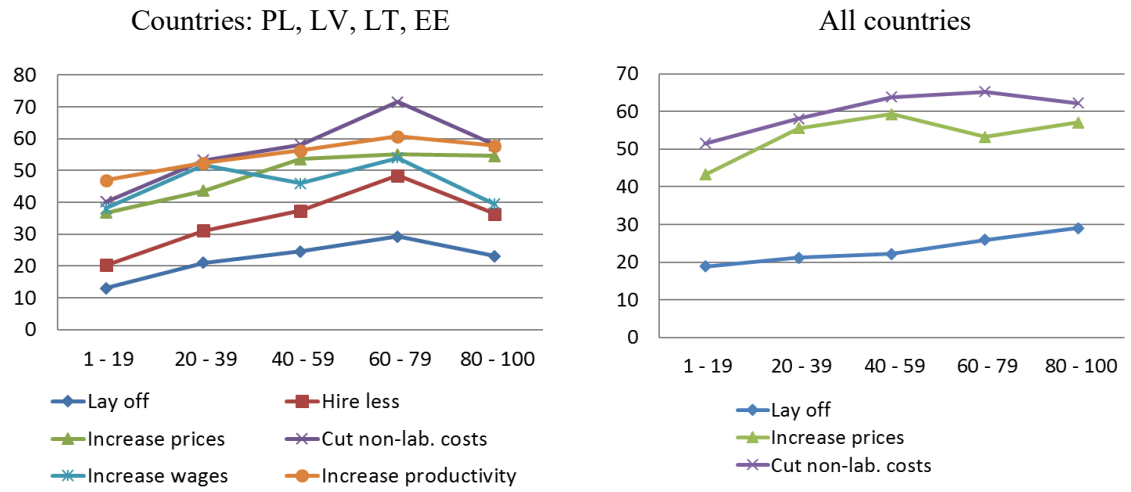
Table 6b Multivariate probit model of the relevance of adjustment channels, average marginal effects (all countries; 3 adjustment channels)

	(1) lay off	(2) increase prices	(3) cut non-lab. costs
Presence of MW employees	0.137***	0.237***	0.263***
at the firm	(0.010)	(0.011)	(0.011)
Foreign ownership	-0.034***	-0.077***	-0.071***
	(0.011)	(0.014)	(0.014)
Presence of collective agreement	0.025**	0.045***	0.057***
	(0.011)	(0.015)	(0.014)
Demand level (Base: Strong decrease)			
- Moderate decrease	-0.021	0.028	-0.014
	(0.015)	(0.022)	(0.021)
- Unchanged	-0.075***	-0.033	-0.114***
	(0.016)	(0.022)	(0.022)
- Moderate increase	-0.095***	0.004	-0.088***
	(0.017)	(0.023)	(0.023)
- Strong increase	-0.172***	-0.027	-0.149***
	(0.029)	(0.033)	(0.034)
Access to external finance (Base: Strong decrease)			
- Moderate decrease	-0.027	0.066**	0.029
	(0.019)	(0.028)	(0.027)
- Unchanged	-0.088***	-0.025	-0.070***
	(0.018)	(0.026)	(0.025)
- Moderate increase	-0.065***	0.028	-0.040
	(0.022)	(0.030)	(0.029)
- Strong increase	0.010	0.002	-0.038
	(0.038)	(0.050)	(0.051)
Sectoral dummies (Base: Manufacturing)			
Electricity, gas, water	-0.080	-0.240***	-0.210***
	(0.060)	(0.081)	(0.071)
Construction	0.005	-0.026	-0.013
	(0.014)	(0.019)	(0.019)
Trade	-0.027**	-0.049***	-0.010
	(0.012)	(0.015)	(0.015)
Business services	-0.033***	-0.054***	-0.040***
	(0.011)	(0.014)	(0.014)
Financial intermediation	-0.015	-0.208***	-0.055
	(0.038)	(0.047)	(0.041)
Arts	-0.068*	0.044	-0.022
	(0.036)	(0.052)	(0.072)
Firm size dummies (Base: <20 employees)			
20-49 employees,	-0.000	-0.030*	-0.022
	(0.014)	(0.018)	(0.017)
50-199 employees,	-0.005	-0.043**	-0.021
	(0.014)	(0.018)	(0.017)
200+ employees,	-0.002	-0.055***	-0.019
	(0.016)	(0.021)	(0.020)
Country dummies (Base: Poland)			
Latvia	-0.017	0.010	-0.050*
	(0.022)	(0.029)	(0.029)
Lithuania	-0.174***	-0.151***	-0.153***
	(0.026)	(0.028)	(0.026)
Estonia	-0.105***	-0.100***	-0.208***
	(0.025)	(0.029)	(0.029)
Hungary	-0.044***	0.078***	-0.053***
	(0.015)	(0.020)	(0.020)
Bulgaria	0.066***	-0.041	-0.403***
	(0.020)	(0.029)	(0.033)
Slovenia	-0.185***	-0.328***	-0.045
	(0.024)	(0.031)	(0.028)
Romania	0.043**	0.133***	0.102***
	(0.017)	(0.023)	(0.023)
Observations	7,011	7,011	7,011

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. The variable "Presence of MW employees at the firm" is equal to 1 if the share of minimum wage employees in a firm is greater than 0%, zero otherwise. For detailed variable description see Table A5.
Source: WDN3 survey, authors' estimation.

Next, in line with the descriptive results shown in Table 2, foreign-owned firms seem to be affected less by rises in the minimum wage, and are less likely to find any of the adjustment channels relevant, especially prices, non-labour costs and productivity channels. Institutional features of the labour market, such as the use of a collective pay agreement, tend to increase the relevance of certain adjustment channels, but only in the full country sample (Table 6b). The significance is mainly driven by the strong effect in Hungary and Romania. Binding terms in collective agreements can pose additional restrictions on activity and force firms to compensate for rises in the minimum wage by raising prices and cutting non-labour costs and employment in these countries. However, if all the channels are included in the estimation, and so the sample is restricted to the Baltic countries and Poland (Table 6a), the marginal effect of collective agreements becomes statistically insignificant.

Figure 2 Predicted probabilities to find the adjustment channel "Relevant" for a given range of the share of employees earning the minimum wage at the firm

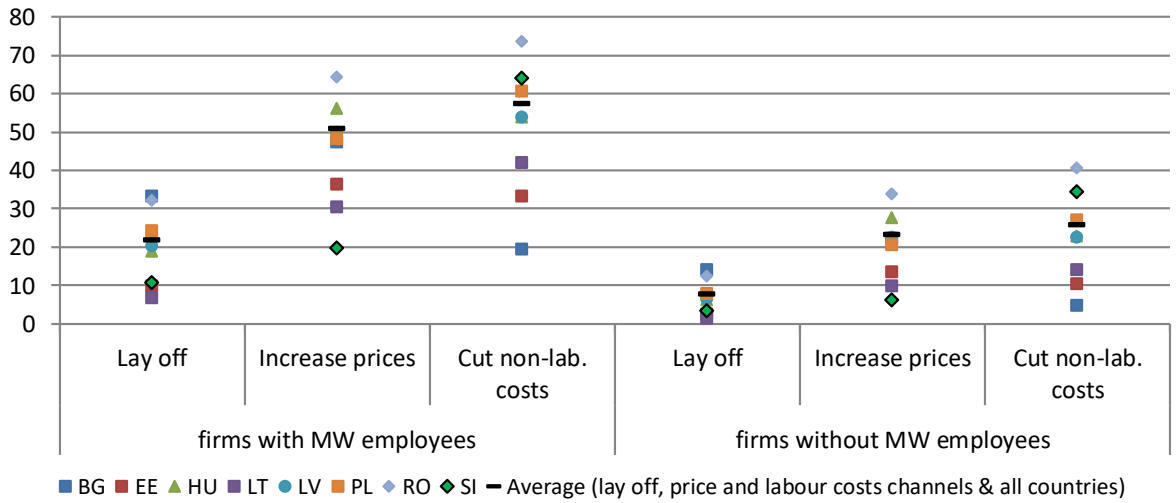


Note: Calculated using a multivariate probit model presented in Table A7 and Table A8 in Appendix 1.

Looking into the predicted probabilities for the adjustment channels for firms with different shares of employees at the minimum wage adds additional insights (see Figure 2). In the subsample of four countries the predicted probability of the channels being favoured increases with the share of employees earning the minimum wage at the firm and peaks when that share is between 60% and 79% (Figure 2, left-hand graph). For the full sample of countries (see Figure 2, right-hand graph), the picture is broadly similar, except that the probability of layoffs being relevant increases monotonically with the share of employees on the minimum wage.

The ranking of the adjustment channels changes slightly with the share of minimum wage employees[21]. The productivity adjustment channel has the highest predicted probability for firms where a small share of employees get the minimum wage. In the firms with larger shares though, cutting non-labour costs is the most popular channel. The importance of the price rise channel is constantly lower than the channels for productivity improvement or cuts in non-labour costs. The wage increase channel is used to roughly the same extent whatever share of employees earn the minimum wage, and it has a higher probability than the channel of cuts in employment.

Figure 3 Predicted probabilities of the adjustment channels being "Relevant" by country (all countries, a subset of channels)



Note: For Slovenia the effect for firms without MW employees is rather hypothetical, assuming that Slovenian firms (with their characteristics taken into account) would react as firms without MW employees in other countries without actually having the actual responses of Slovenian firms without MW employees included in the sample.

Source: Authors' calculations using the multivariate probit model presented in Table 6b.

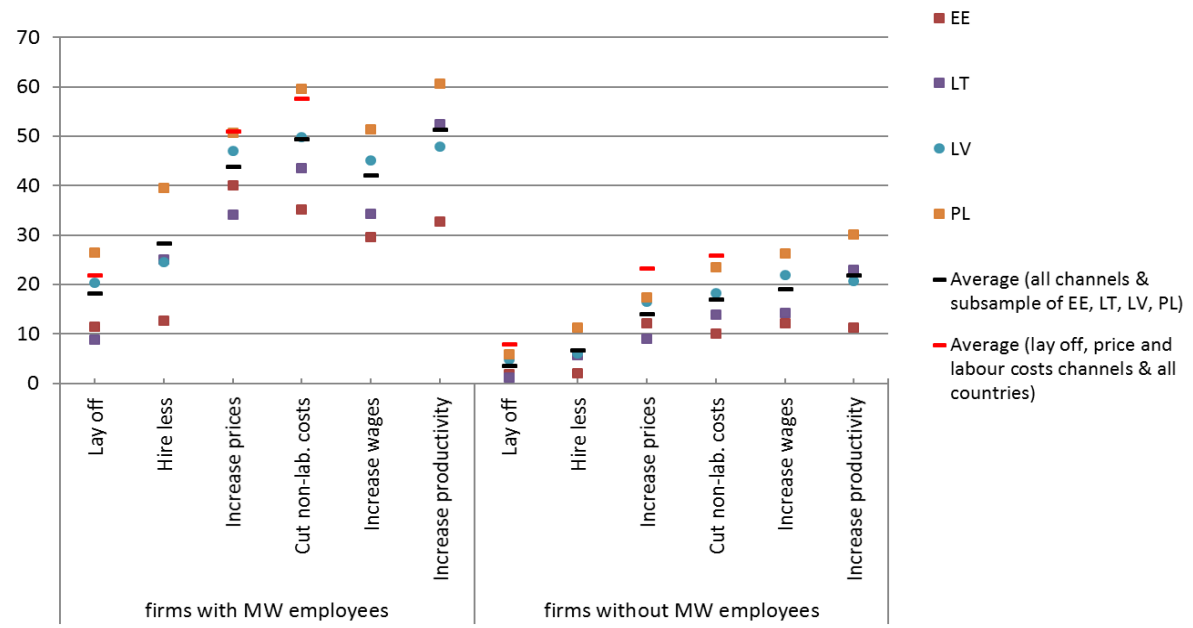
The predicted probabilities for the relevance of adjustment channels for firms with and without employees on the minimum wage show that the most popular channels for adjustment for both groups are cuts in non-labour costs, price rises, and the increases in wages and productivity (Figure 3 and Figure 4). The channels that affect employment levels through laying off workers and reducing hiring are less popular, which is in line with the descriptive results in Table 2. As would be expected, the average predicted probability of either adjustment channel being found relevant is smaller for firms

[21] The structure of firms in different groups by the share of minimum wage employees is not the same. This affects the predicted probability of the adjustment channel being used in each group. Therefore differences in probabilities between groups should be treated with caution.

without employees earning the minimum wage, where it is half as much as at firms paying some employees the minimum wage.

The predicted probabilities for the relevance of the adjustment channels vary significantly by country. At the same time, only some of these cross-country differences are due to the aggregate factors represented by the country dummies. The rest of the differences are explained by sample composition effects related to the distribution of sectors, firm-size categories and other firm-specific characteristics in the sample of each country. Estimates based on the full sample of countries and the three adjustment channels included in the questionnaires of all the countries (Figure 3) suggest, for example, that Romanian firms are slightly more likely to report each channel as relevant than firms in other countries are. Equally, the probability of Bulgarian firms expressing a preference for lay-offs is above the average, but they are the least likely to consider the non-labour costs channel relevant. Further, Slovenian firms are predicted to be least likely to prefer the price channel, and to be less likely than the average to choose the lay-off channel. In contrast, an above average share of Slovenian firms are predicted to favour the non-labour costs channel. Lithuanian and Estonian firms have a consistently lower probabilities of considering all three adjustment channels relevant than do firms in other countries.

Figure 4 Predicted probabilities for the relevance of adjustment channels by country
(all channels, a subset of countries)



Source: Authors' calculations using the multivariate probit model presented in Table 6a and Table 6b.

Figure 4 presents the results for a subsample of the four countries (PL, LV, LT, EE) where the full set of adjustment channels was available. The predicted probability of the adjustment channels being found relevant is consistently higher in Poland than in the Baltic countries. Interestingly, the wage channel has a higher relative importance than the other channels among firms without employees earning the minimum wage. It ranks second after the productivity channel and overtakes the price and non-labour cost channels for predicted relevance.

7. CONCLUSIONS

This paper uses a unique firm-level cross-country survey dataset on the adjustment channels preferred by firms following a rise in the minimum wage. The data were obtained within the third wave of the WDN survey and come from eight CEE countries, namely Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia.

Our paper contributes to the literature on the firm-level impacts of rises in the minimum wage in several ways. First, we provide detailed cross-country information about the shares of minimum wage workers in the CEE8 and Slovakia, which is rarely available in statistical reports. We show that the average share of workers earning the minimum wage varies significantly across countries, sectors, occupations, ownership and exporting status, but only partially across firm-size groups.

Second, we look at firms' reaction to rises in the minimum wage as a combination of strategies and report a preference ranking for the adjustment channels in the CEE8. Such information is not available in other studies due to their concentration on a single transmission channel, most frequently layoffs. Almost half of the subsample of firms which employ workers at the minimum wage responded that at least one of the six adjustment channels proposed was relevant. The most popular adjustment channels are raising product prices, cutting non-labour costs, and improving productivity, which more resembles the theoretical outcome predicted by the institutional model. The ranking of the channels remains robust to a range of different estimation procedures.

Third, our results indicate important spillovers from a rise in minimum wages to firms employing no minimum wage earners. Almost one quarter of the firms without any employees on their payrolls at the minimum wage reported that an increase in prices, wages or productivity, or a reduction in non-labour costs are relevant reactions to rises in the minimum wage.

Controlling for firm-specific conditions and correlations between the channels, we show that favourable demand conditions and the availability of external financing are associated with lower relevance for the adjustment channels. Foreign-owned firms seem to be affected less by rises in the minimum wage.

It should further be noted that we expect minimum wages to play a greater role in CEE than in the other EU countries. This can be explained by the significantly higher share of low wage earners in the CEE and the more equal distribution of them across all age cohorts, and also by the sharp growth in the minimum wage level in these countries during the period analysed. Finally, the power of trade unions and collective bargaining coverage have decreased significantly in these transition economies over recent decades because of industrial restructuring. The shrinking role of collective bargaining may be one reason why a national minimum wage has now become more typical in the CEE, as the minimum wage provides some protection for workers not covered by collective bargaining.

References

Acemoglu, D., J. S. Pischke (2003), Minimum wages and on-the-job training. Research in Labor Economics 22, 2003, 159-202

Aidt, T., Z. Tzannatos (2002), Unions and Collective Bargaining: Economic Effects in a Global Environment. The World Bank, Washington, D.C.

Aretz, B., M. Arntz, T. Gregory (2013), The minimum wage affects them all: Evidence on employment spillovers in the roofing sector. German Economic Review, 14(3):282-315.

Aretz, B., M. Arntz, T. Gregory, C. Rammer (2012), Der Mindestlohn im Dachdeckerhandwerk: Auswirkungen auf Beschäftigung, Arbeitnehmerschutz und Wettbewerb. Journal for Labour Market Research, 45(3-4):233-256.

Ashenfelter O., Farber H., Ransom M. (2010), Modern Models of Monopsony in Labor Markets: A Brief Survey, IZA Discussion Paper No. 4915, April 2010.

Banerjee, B., M. Vodopivec, U. Sila (2013), Wage setting in Slovenia: interpretation of the wage dynamics network (WDN) survey findings in an institutional and macroeconomic context. IZA Journal of European Labor Studies 2013, 2:9

Belman, Dale, and Paul J. Wolfson. 2015. What Does the Minimum Wage Do? Journal of Labor Research, 12/2015, Vol.36(4), pp.462-464.

Boal W., Ransom M. (1997), Monopsony in the Labor Market, Journal of Economic Literature Vol.35(1), pp.86-112.

Brezigar Masten, A., S. Kovačič, U. Lušina, A. T. Selan (2010), Impact of Minimum Wage Rise in Slovenia. IMAD Working Paper Series No. 3, Vol. XIX, Institute of Macroeconomic Analysis and Development. Only in Slovenian.

Cahuc, P. (2014), Seach, flows, job creations and destructions, Labour Economics, No.30 (2014), pp. 22-29.

Card, D., A. B. Krueger (1995), Myth and measurement: the new economics of the minimum wage. Princeton University Press Princeton.

Deutsche Bundesbank (2009), Wage setting in Germany — new empirical findings. Monthly Report. April, 17–29.

Draca, M., S. Machin, J. Van Reenen (2011), Minimum Wages and Firm Profitability. American Economic Journal: Applied Economics, American Economic Association, vol. 3(1), pages 129-51, January.

Elek, P., Á. Scharle, B. Szabó, P. A. Szabó (2009), A bérekhez kapcsolódó adóeltitkolás Magyarországon. (Wage-related tax evasion in Hungary.) Közpénzügyi füzetek (Working Papers in Public Finance) 23., April 2009.

Eriksson, T., M. Pytlikova (2004), Firm-level Consequences of Large Minimum-wage Increases in the Czech and Slovak Republics. Labour: review of labour economics and industrial relations, Vol. 18: pp. 75–103.

European Central Bank (2016), ECB Economic Bulletin, Issue 5 / 2016 – Article 2: New evidence on wage adjustment in Europe during the period 2010-13. https://www.ecb.europa.eu/pub/pdf/other/eb201605_article02.en.pdf

European Commission (2012), Tax reforms in EU Member States 2012 - Tax policy challenges for economic growth and fiscal sustainability, October 2012 http://ec.europa.eu/economy_finance/publications/european_economy/2012/ee-2012-6_en.htm

European Commission (2014) Taxation trends in the European Union — Data for the EU Member States, Iceland and Norway, Luxembourg: Publications Office of the European Union http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_structures/2014/report.pdf

Ferraro, S., J. Meriküll, K. Staehr (2016), Minimum Wages and the Wage Distribution in Estonia, Eesti Pank Working Paper Series, 6/2016.

Fialova K., M. Mysikova (2009), The Minimum Wage: Labor Market Consequences in the Czech Republic. Czech Journal of Economics and Finance (Finance a uver), Charles University Prague, Faculty of Social Sciences, vol. 59(3), pages 255-274, August.

Flinn, C. (2006), Minimum wage effects on labor market outcomes under seach, maching, and endogenous contract rates, Econometrica, Vol. 74, No.4 (July, 2006), pp. 1013-1062.

Goraus K., P. Lewandowski (2016), Minimum wage violation in Central and Eastern Europe, IBS Working Paper 03/2016.

Gottvald, J., Hančlová, J., Pytlikova, M., Stanek, V. (2002), Minimum Wage in the Wage Structures of the Czech and Slovak Republics. – Determinants of Individual Pay and Firm's Pay Structures in the Czech and Slovak Republic. Ed. by Jaromir Gottvald, Ostrava: Vysoká Škola Báňská – Technická Univerzita Ostrava, Ekonomická Fakulta.

Gregory, T. (2014), When the minimum wage bites back: Quantile treatment effects of a sectoral minimum wage in Germany. ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research Discussion Paper, (14-133).

Grossberg, A.J., P. Sicilian (1999), Minimum wages, on-the-job training, and wage growth. Southern Economic Journal, pages 539-556.

Hall D., Cooper D. (2012), How raising the federal Minimum Wage Would Help Working Families and Give the Economy a Boost, Issue Brief no. 341, Washington, DC: Economic Policy Institute.

Halpern, L., M. Koren, G. Kőrösi, J. Vincze (2004), A minimálbér költségvetési hatásai [The budgetary effects of the minimum wage]. Közgazdasági Szemle (Economic Review - monthly of the Hungarian Academy of Sciences), Közgazdasági Szemle Alapítvány (Economic Review Foundation), vol. 0(4), pages 325-345.

Harasztosi, P., A. Lindner (2015), Who Pays for the Minimum Wage? Job Market Paper, October.

Harding, D., G. Harding (2004), Minimum wages in Australia: an analysis of the impact on small and medium sized businesses. MPRA Paper No.25, University Library of Munich, Germany.

Hinnosaar, M., T. Room (2003), Labour market impact of the minimum wage in Estonia: an empirical analysis. In Labour market research in Estonia. Papers of the Research Seminar. Talinn, pages 61-92.

Hirsch, B., T. Kaufman, E.Bruce, T. Zelenska (2015), Minimum wage channels of adjustment, Industrial Relations, Vol.54, No.2, p.199-239.

Horemans J., I. Marx, B. Nolan (2016), Hanging in, but only just. Part-time employment and in-work poverty throughout the crises, IZA Journal of European Labor Studies, 2016, Vol.5(1), pp.1-19

Huang, Y., P. Loungani, G. Wang (2014), Minimum wages and firm employment: evidence from China. IMF Working Papers, 2014/184, October 2014

Kambayashi, R., D. Kawaguchi, K. Yamada (2010), The minimum wage in a deflationary economy: The Japanese experience, 1994-2003, Labour Economics, October 2013, Vol.24, pp.264-276

Kamińska, A., P. Lewandowski (2015), The effects of minimum wage on a labour market with high temporary employment, IBS Working Paper 07/2015.

Katz, L. F., A. B. Krueger (1992), The effect of the minimum wage on fast food industry. Industrial and Labor Relations Review, 1 October 1992, Vol.46(1), pp.6-21

Kaufman B. (2010), Institutional economics and the minimum wage: broadening the theoretical and policy debate, Industrial and Labor Relation Review, Vol. 63, No. 3 (April 2010)., pp.427-453

Kertesi, G., J. Köllő (2004), A 2001. évi minimálbér-emelés foglalkoztatási következményei [The employment consequences of the 2001 rise in the minimum wage]. Közgazdasági Szemle (Economic Review - monthly of the Hungarian Academy of Sciences), Közgazdasági Szemle Alapítvány (Economic Review Foundation), Vol. 0(4), pp. 293-324.

Kertesi, G., J. Köllő (2002), Economic transformation and the revaluation of human capital-Hungary, 1986-1999. Research in Labor Economics, 21:235-273.

G. Kézdi, Kónya, I.(2012), Wage setting in Hungary: Evidence from a firm survey. 2011. Working Paper Series 1378, European Central Bank.

Kraft, K., C. Rammer, S. Gottschalk (2012), Minimum wages and competition: The case of the German roofing sector. ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research Discussion Paper, 12-083.

Krekó, J., G. P. Kiss (2007), Adóelkerülés és a magyar adórendszer. Occasional Paper 65, Magyar Nemzeti Bank, only in Hungarian.

Kuhn P. (2004), Is monopsony the right way to model labor markets? A review of Alan Manning's monopsony in motion, International Journal of the Economics of Business, Volume 11, Issue 3, 2004., pp. 369-378.

Lane, P.R., G. M. Milesi-Ferretti (2015), Global Imbalances and External Adjustment After the Crisis," Central Banking, Analysis, and Economic Policies Book Series, in: Claudio Raddatz & Diego Saravia & Jaume Ventura (ed.), Global Liquidity, Spillovers to Emerging Markets and Policy Responses, edition 1, volume 20, chapter 4, pages 105-142, Central Bank of Chile.

Laporšek, S., M. Vodopivec, M. Vodopivec (2015), The Employment and Wage Spillover Effects of Slovenia's 2010 Minimum Wage Increase. http://www.parthen-impact.com/parthen-uploads/78/2015/add_1_258669_qSUgcPc03M.pdf.

Lechthaler, W., D. J. Snower (2008), Minimum wages and training. Labour Economics, 15(6):1223-1237.

Lee D., Saez E. (2012), Optimal Minimum Wage Policy in Competitive Labour Markets, Journal of Public Economics, October 2012, Vol.96(9-10), pp.739-749

Lemos, S. (2008), A Survey Of The Effects Of The Minimum Wage On Prices. Journal of Economic Surveys, Wiley Blackwell, Vol. 22(1), pp. 187-212.

Lester, R. (1960), Employment effects of minimum wages, Industrial and Labor Relations Review, Vol. 13, No.2 (Jan 1960), pp. 254-264.

Levin-Waldman, O. M., G. W McCarthy (1998), Small business and the minimum wage. Economics Policy Note Archive, Levy Economics Institute.

Macdonald, J. M., D. Aaronson (2000), How Do Retail Prices React to Minimum Wage Increases?, Working Paper 2000-20, Federal Reserve Bank of Chicago.

Majchrowska, A., Z. Żółkiewski (2012), The impact of minimum wage on employment in Poland, Investigaciones Regionales, 01 January 2012(24), pp. 211-239

Manning, A. (2003), Monopsony in motion: Imperfect competition in labor markets. Princeton University Press, 2003.

Neumark, D., I. Salas J. M., W. Wascher (2014), Revisiting the minimum wage–employment debate: Throwing out the baby with the bathwater? Industrial & Labor Relations Review, 2014, Vol.67(3_suppl), pp. 608-648

Neumark, D., W. L Wascher (2008), Minimum wages. MIT Press.

Neumark, D., W. Wascher (2006), Minimum wages and employment: A review of evidence from the new minimum wage research. Working Paper 12663, National Bureau of Economic Research.

Neumark, D., W. Wascher (2001), Minimum wages and training revisited. Journal of Labor Economics July 2001, Vol.19(3), pp.563-595

Rattenhuber, P. (2014), Building the minimum wage: The distributional impact of Germany's first sectoral minimum wage on wages and hours across different wage bargaining regimes, Empirical Economics, Vol.46(4), pp. 1429-1446

Rogerson R., R. Shimer, R. Wright (2005), Search-Theoretical Models of the Labor Market: A Survey, Journal of Economic Literature, Vol. XLIII (December 2005), pp. 959-988.

Small Business Majority (2015), Opinion poll: small businesses support increasing minimum wage, July 29. http://www.smallbusinessmajority.org/small-business-research/minimum-wage/support-for-12-dollar-min-wage.php

Schmitt, J. (2013), Why Does the Minimum Wage Have No Discernible Effect on Employment? CEPR Reports and Issue Briefs, CEPR, No.2013-4.

Schulten, T. (2014), Minimum Wage Regimes in Europe … and What Germany Can Learn from Them. Friedrich-Ebert-Stiftung, Department for Central and Eastern Europe, Berlin.

Zepa, B. (2006), Wages and impacting factors. Project of the European Structural Fund National Programme "Labour market studies of the Ministry of Welfare" No. VPD1/ESF/NVA/04/NP/3.1.5.1./0001/0003, Riga.

Wadsworth, J. (2010), Did the National Minimum Wage Affect UK Prices?, Fiscal Studies, March 2010, Vol.31(1), pp.81-120

Wilson M. (2012), The Negative effect of Minimum Wage Laws. Policy Analysis N. 701. Cato Institute http://object.cato.org/sites/cato.org/files/pubs/pdf/PA701.pdf

Worker participation webpage (2015), http://www.worker-participation.eu/National-Industrial-Relations/Across-Europe/

Appendix 1: Tables

Table A1 Country specific questions: share of employees earning the minimum wage

Country	Question	Measurement	Period
BG	What was the percentage of employees receiving the minimum wage and secured at the minimum insurance threshold in your company at the end of 2013?		
	% of employees receiving the minimum wage	%	At the end of 2013
	% of secured at the minimum insurance threshold	%	At the end of 2013
EE	What was the percentage of employees receiving the minimum wage in your company before the increase in the minimum wage on 1 January 2014 and what was the percentage after?	%	Before 01/01/2014
		%	After 01/01/2014
HU	What was the percentage of employees receiving the minimum wage in your company before the increase in the minimum wage (Jan 2012) and what was the percentage after?		
	% of employees receiving the minimum wage before the change in the minimum wage	%	Before 01/01/2012
	% of employees receiving the minimum wage after the change in the minimum wage	%	After 01/01/2012
LT	What was the percentage of employees receiving the minimum wage in your company before the increase in the minimum wage in January 2013 and what was the percentage after?	%	Before 01/01/2013
		%	After 01/01/2013
LV	What was the percentage of employees receiving the minimum wage in your company before the increase in the minimum wage on 1 January 2014 and what was the percentage after?	%	Before 01/01/2014
		%	After 01/01/2014
PL	What was the percentage of employees receiving the minimum wage and secured at the minimum insurance threshold in your company at the end of 2013?	%	At the end of 2013
RO	What was the percentage of your employees earning the minimum wage in 2013?	%	In 2013
SI	What percentage of the employees received minimum wage:		
	Before the adoption of the new minimum wage legislation	%	Before 23/02/2010
	After the adoption of the new minimum wage legislation	%	After 23/02/2010
SK	What was the percentage of your employees earning the minimum wage in 2013?	%	In 2013

Source: WDN3 survey.

Table A2 Country specific questionnaires: adjustment channels and answer options

Country	Adjustment channel	Country specific formulation of adjustment channel or question used to derive relevance of adjustment channel	Answer type
LV, LT, HU	Number of employees	We had to lay people off	1
EE, RO, PL			2
SI			3
BG		Number of employees	4
LV, LT, HU	Hiring	We were able to hire fewer people	1
RO, PL			2
SI			3
EE		We could not replace empty positions We were not able to open new job positions	2
BG		n.a.	
LV, LT, HU	Prices	We had to increase product prices	1
EE, RO, PL			2
SI			3
BG		Price of main product/service	4
LV, LT, HU	Non-labour costs	We had to reduce non-labour costs	1
EE, RO, PL			2
RO		We had to reduce other costs	2
SI			3
BG		Non-labour costs	4
LV, LT, HU, PL	Productivity	We increased productivity	1
EE		We had to seek to improve the quality and scope of products through process innovation	2
		We had to seek to increase productivity through organisational innovation	2
		We had to seek to increase productivity through process innovation	2
BG		Labour productivity	4
RO, SI		n.a.	
EE, PL	Hours	We had to reduce working hours	2
LV, LT, HU, RO, SI, SK, BG		n.a.	

Notes: answer types

1) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant, 5 = Don't know
2) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant
3) 1 = Relevant, 0 = Not relevant
4) 1 = Strong decrease, 2 = Moderate decrease, 3 = Unchanged, 4 = Moderate increase, 5 = Strong increase
5) 1 = Yes, 0 = No

Source: WDN3 survey.

Table A2 (continued) Country specific questionnaires: adjustment channels and answer options

Country	Adjustment channel	Country specific formulation of adjustment channel or question used to derive relevance of adjustment channel	Answer type
LV	Wages above the minimum wage	We had to increase the wages of employees earning above the minimum wage level	1
PL		We had to increase the wages of employees earning above the minimum wage level in order to keep the wage relations in the firm	2
EE		Did the increase in the minimum wage on 1 January 2014 make it necessary to raise wages or any other type of compensation for those employees in your company ?	5
		Please indicate the percentage of employees whose wages or other type of compensation increased in response to the rise in the minimum wage (including those who earned minimum wages and who earned higher wages before 1 January 2014)	%
RO		In the event of a rise in the minimum wage, do you raise the wages of your employees earning more than the minimum wage?	5
		Please specify the percentage of employees affected	%
LT		Did the increase in the minimum wage on 1 January 2013 make it necessary to raise wages or any other type of compensation for those employees in your company who earned more than the minimum wage (who earn more than 1000Lt)?	5
		Please indicate the percentage of employees whose wages or other type of compensation increased in response to the rise in the minimum wage (including those who earned minimum wages and who earned higher wages before 1 January 2013	%
SI		We also had to increase wages above the minimum wage	3
BG		Base wages of above minimum wage earners	4
		Flexible wage components (bonuses, benefits etc.)	4

Notes: answer types

1) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant, 5 = Don't know
2) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant
3) 1 = Relevant, 0 = Not relevant
4) 1 = Strong decrease, 2 = Moderate decrease, 3 = Unchanged, 4 = Moderate increase, 5 = Strong increase
5) 1 = Yes, 0 = No

Source: WDN3 survey.

Table A3 Scheme of answer harmonisation for adjustment channel questions

Answer type	Relevant (1)	Not relevant (-)
1 & 2	2, 3, 4	1
3	1	0
4	BG: Number of employees < 3 BG: Non-labour costs	>= 3
	BG: Prices > 3 BG: Labour productivity	<= 3
5	1	2

Note: answer types

1) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant, 5 = Don't know
2) 1 = Not relevant, 2 = Of little relevance, 3 = Relevant, 4 = Very relevant
3) 1 = Relevant, 0 = Not relevant
4) 1 = Strong decrease, 2 = Moderate decrease, 3 = Unchanged, 4 = Moderate increase, 5 = Strong increase
5) 1 = Yes, 0 = No

Source: WDN3 survey.

Table A4 Tetrachoric correlations between minimum wage adjustment channels

Latvia
(obs=474)

	A	B	C	D	E	F
A	1					
B	0.944	1				
C	0.874	0.895	1			
D	0.894	0.885	0.941	1		
E	0.831	0.858	0.876	0.894	1	
F	0.797	0.834	0.852	0.859	0.896	1

Estonia
(obs=500)

	A	B	C	D	E	F
A	1					
B	0.972	1				
C	0.801	1	1			
D	0.833	0.919	0.945	1		
E	0.215	0.417	0.61	0.556	1	
F	0.78	0.867	0.886	0.916	0.486	1

Lithuania
(obs=489)

	A	B	C	D	E	F
A	1					
B	0.795	1				
C	0.49	0.71	1			
D	0.617	0.73	0.657	1		
E	0.203	0.095	0.341	0.34	1	
F	0.68	0.7	0.626	0.794	0.448	1

Hungary
(obs=1955)

	A	B	C	D	F
A	1				
B	0.762	1			
C	0.518	0.719	1		
D	0.606	0.777	0.691	1	
F	0.572	0.707	0.782	0.754	1

Romania
(obs=2030)

	A	B	C	D	E
A	1				
B	0.91	1			
C	0.802	0.81	1		
D	0.795	0.85	0.912	1	
E	0.107	0.165	0.252	0.326	1

Bulgaria
(obs=528)

	A	C	D	E	F
A	1				
C	0.013	1			
D	0.291	-0.49	1		
E	-0.2	0.638	-0.56	1	
F	-0.27	0.669	-0.37	0.722	1

Slovenia
(obs=493)

	A	B	C	D	E
A	1				
B	0.947	1			
C	0.869	0.892	1		
D	0.869	0.871	0.946	1	
E	0.795	0.833	0.857	0.873	1

Poland
(obs=879)

	A	B	C	D	E	F
A	1					
B	0.917	1				
C	0.613	0.729	1			
D	0.797	0.845	0.874	1		
E	0.551	0.624	0.645	0.765	1	
F	0.765	0.837	0.819	0.926	0.744	1

Notes: Binary measure of relevance used for all countries (1 – Relevant, 0 – Not relevant). Slovenian sample does not include firms without minimum wage employees.
A - We had to lay people off
B - We were able to hire fewer people
C - We had to increase product prices
D - We had to reduce non-labour costs
E - We had to increase the wages of other employees
F – We increased productivity
Sources: WDN3 survey, authors' estimations.

Table A5 Explanatory variable definition

Name	Description	Values
Sector	Sector breakdown constructed from NACE sectors	1 "Manufacturing" 2 "Electricity, gas, water" 3 "Construction" 4 "Trade" 5 "Business services" 6 "Financial intermediation" 8 "Arts"
Size	Agreed size distribution	1 "5-19" 2 "20-49" 3 "50-199" 4 "200+"
Ownership	Ownership status	= 0 "Mainly domestic" = 1 "Mainly foreign"
Demand	Change in level of demand for main products/ services in 2010 - 2013	1 = Strong decrease 2 = Moderate decrease 3 = Unchanged 4 = Moderate increase 5 = Strong increase
Access to external finance	Change in level of access to external finance in 2010 - 2013	1 = Strong decrease 2 = Moderate decrease 3 = Unchanged 4 = Moderate increase 5 = Strong increase
Collective agreement	Collective pay agreement outside or inside firm	= 1 if there is such agreement, = 0 otherwise
Share of minimum wage employees	Share of employees receiving the minimum wage in total number of employees before the increase in the minimum wage	= 1 if share of employees earning minimum wage is bigger than 0%; = 0 otherwise

Sources: WDN3 survey, authors' estimations.

Table A6 Multivariate probit of adjustment channel relevance, average marginal effects (all channels; sample restricted to Baltic countries and Poland)

	(1) lay off	(2) hiring	(3) increase prices	(4) reduce non-lab costs	(5) increase wages	(6) increase prod.
Share of MW employees at the firm, dummies (Base: No MW employees)						
1 – 19 %	0.093***	0.133***	0.188***	0.184***	0.153***	0.200***
	(0.016)	(0.018)	(0.021)	(0.022)	(0.023)	(0.023)
20 – 39 %	0.145***	0.196***	0.244***	0.275***	0.257***	0.238***
	(0.021)	(0.025)	(0.033)	(0.034)	(0.037)	(0.038)
40 – 59 %	0.158***	0.220***	0.301***	0.308***	0.196***	0.260***
	(0.023)	(0.029)	(0.038)	(0.038)	(0.042)	(0.043)
60 – 79 %	0.164***	0.267***	0.302***	0.394***	0.247***	0.276***
	(0.024)	(0.027)	(0.039)	(0.039)	(0.043)	(0.042)
80 – 100 %	0.146***	0.199***	0.313***	0.294***	0.137***	0.249***
	(0.019)	(0.023)	(0.029)	(0.029)	(0.035)	(0.032)
Foreign ownership	-0.061***	-0.086***	-0.144***	-0.150***	-0.136***	-0.125***
	(0.019)	(0.023)	(0.026)	(0.026)	(0.026)	(0.027)
Presence of collective agreement	0.010	-0.002	-0.015	-0.021	0.006	0.027
	(0.022)	(0.027)	(0.033)	(0.033)	(0.034)	(0.035)
Demand level (Base: Strong decrease)						
- Moderate decrease	0.006	-0.002	-0.009	-0.030	0.027	-0.029
	(0.020)	(0.027)	(0.036)	(0.035)	(0.037)	(0.038)
- Unchanged	-0.039*	-0.013	0.003	-0.047	0.012	-0.041
	(0.022)	(0.028)	(0.037)	(0.036)	(0.039)	(0.039)
- Moderate increase	-0.042**	-0.029	-0.010	-0.057*	0.014	-0.043
	(0.021)	(0.027)	(0.035)	(0.034)	(0.037)	(0.038)
- Strong increase	-0.104***	-0.048	-0.015	-0.075	0.004	-0.080
	(0.032)	(0.038)	(0.046)	(0.047)	(0.049)	(0.049)
Access to external finance (Base: Strong decrease)						
- Moderate decrease	-0.006	0.009	0.083*	0.096**	0.039	0.089*
	(0.026)	(0.035)	(0.048)	(0.047)	(0.049)	(0.053)
- Unchanged	-0.014	-0.016	0.006	-0.001	-0.051	0.026
	(0.023)	(0.030)	(0.041)	(0.041)	(0.042)	(0.045)
- Moderate increase	-0.005	-0.005	0.019	0.010	-0.032	0.076
	(0.028)	(0.035)	(0.047)	(0.047)	(0.049)	(0.052)
- Strong increase	0.004	0.023	-0.018	-0.118	-0.089	0.013
	(0.044)	(0.052)	(0.076)	(0.073)	(0.078)	(0.084)
Sectoral dummies (Base: Manufacturing)						
Electricity, gas, water	-0.018	-0.072	-0.201***	-0.191**	-0.166*	-0.214***
	(0.045)	(0.063)	(0.078)	(0.077)	(0.085)	(0.074)
Construction	0.014	0.016	-0.025	-0.023	-0.026	-0.019
	(0.019)	(0.023)	(0.030)	(0.031)	(0.033)	(0.033)
Trade	-0.006	-0.013	-0.060**	-0.050*	-0.043	-0.111***
	(0.017)	(0.021)	(0.025)	(0.027)	(0.028)	(0.028)
Business services	-0.019	-0.035*	-0.069***	-0.045*	-0.040	-0.099***
	(0.017)	(0.020)	(0.025)	(0.025)	(0.027)	(0.027)
Financial intermediation	0.022	-0.048	-0.189***	-0.037	-0.134**	-0.120**
	(0.042)	(0.046)	(0.065)	(0.055)	(0.063)	(0.060)
Arts		-0.026	-0.163	-0.185		0.106
		(0.152)	(0.211)	(0.217)		(0.327)
Firm size dummies (Base: <20 employees)						
20-49 employees	-0.026*	-0.038**	-0.027	-0.028	-0.001	-0.025
	(0.016)	(0.019)	(0.023)	(0.024)	(0.025)	(0.025)
50-199 employees	0.011	0.003	0.004	0.017	-0.003	0.008
	(0.016)	(0.019)	(0.025)	(0.025)	(0.027)	(0.027)
200+ employees	-0.020	-0.039	0.008	0.025	0.063*	0.016
	(0.025)	(0.031)	(0.037)	(0.036)	(0.038)	(0.039)
Country dummies (Base: Poland)						
Latvia	-0.020	-0.088***	-0.019	-0.068**	-0.055*	-0.093***
	(0.016)	(0.021)	(0.027)	(0.028)	(0.028)	(0.030)
Lithuania	-0.116***	-0.092***	-0.123***	-0.127***	-0.130***	-0.058**
	(0.018)	(0.019)	(0.024)	(0.023)	(0.026)	(0.025)
Estonia	-0.069***	-0.169***	-0.064**	-0.164***	-0.170***	-0.227***
	(0.018)	(0.022)	(0.026)	(0.026)	(0.027)	(0.028)
Observations	2,083	2,083	2,083	2,083	2,083	2,083

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable – binary measure of relevance used for all countries (1 – Relevant, 0 – Not relevant). For detailed

description of the explanatory variables see Table A5. The model is used for the calculation of the predicted probabilities in Figure 4.
Sources: WDN3 survey, authors' estimations.

Table A7 Multivariate probit model of the relevance of adjustment channels, average marginal effects

	(1)	(2)	(3)
VARIABLES	lay off	increase prices	reduce non-lab costs
Share of MW employees at the firm, dummies (Base: No MW employees)			
1 – 19 %	0.110***	0.182***	0.198***
	(0.012)	(0.014)	(0.014)
20 – 39 %	0.142***	0.269***	0.289***
	(0.014)	(0.017)	(0.017)
40 – 59 %	0.137***	0.286***	0.338***
	(0.016)	(0.020)	(0.020)
60 – 79 %	0.169***	0.246***	0.342***
	(0.016)	(0.020)	(0.021)
80 – 100 %	0.181***	0.284***	0.300***
	(0.014)	(0.018)	(0.018)
Foreign ownership	-0.031***	-0.076***	-0.069***
	(0.011)	(0.014)	(0.014)
Presence of collective agreement	0.026**	0.045***	0.058***
	(0.011)	(0.015)	(0.014)
Demand level (Base: Strong decrease)			
- Moderate decrease	-0.021	0.027	-0.014
	(0.015)	(0.022)	(0.021)
- Unchanged	-0.074***	-0.033	-0.116***
	(0.016)	(0.022)	(0.022)
- Moderate increase	-0.095***	0.002	-0.090***
	(0.016)	(0.023)	(0.022)
- Strong increase	-0.170***	-0.030	-0.151***
	(0.029)	(0.033)	(0.034)
Access to external finance (Base: Strong decrease)			
- Moderate decrease	-0.032*	0.059**	0.022
	(0.019)	(0.028)	(0.027)
- Unchanged	-0.090***	-0.026	-0.071***
	(0.018)	(0.026)	(0.025)
- Moderate increase	-0.066***	0.026	-0.041
	(0.022)	(0.030)	(0.029)
- Strong increase	0.008	-0.003	-0.047
	(0.037)	(0.050)	(0.051)
Sectoral dummies (Base: Manufacturing)			
Electricity, gas, water	-0.073	-0.233***	-0.198***
	(0.060)	(0.080)	(0.067)
Construction	0.008	-0.023	-0.009
	(0.014)	(0.019)	(0.019)
Trade	-0.024**	-0.045***	-0.004
	(0.012)	(0.015)	(0.015)
Business services	-0.031***	-0.052***	-0.037***
	(0.011)	(0.014)	(0.014)
Financial intermediation	-0.009	-0.197***	-0.045
	(0.038)	(0.048)	(0.041)
Arts	-0.061*	0.050	-0.014
	(0.036)	(0.052)	(0.073)
Firm size dummies (Base: <20 employees)			
20-49 employees	0.009	-0.016	-0.005
	(0.014)	(0.018)	(0.017)
50-199 employees	0.007	-0.024	0.001
	(0.014)	(0.018)	(0.018)
200+ employees	0.018	-0.025	0.014
	(0.016)	(0.021)	(0.021)
Country dummies (Base: Poland)			
Latvia	-0.016	0.011	-0.050*
	(0.022)	(0.029)	(0.028)
Lithuania	-0.177***	-0.155***	-0.155***
	(0.026)	(0.027)	(0.026)
Estonia	-0.097***	-0.093***	-0.197***
	(0.025)	(0.029)	(0.029)
Hungary	-0.055***	0.053**	-0.087***

	(0.015)	(0.021)	(0.020)
Bulgaria	0.064***	-0.046	-0.411***
	(0.020)	(0.029)	(0.033)
Slovenia	-0.182***	-0.319***	-0.036
	(0.024)	(0.031)	(0.027)
Romania	0.032*	0.121***	0.087***
	(0.017)	(0.023)	(0.022)
Observations	7,010	7,010	7,010

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01
Dependent variable – binary measure of relevance used for all countries (1 – Relevant, 0 – Not relevant).
For detailed variable description see Table A5
The model is used for the calculation of the predicted probabilities in Figure 4.
Sources: WDN3 survey, authors' estimations.

Appendix 2: Minimum wage adjustment models

Four different minimum wage adjustment models are distinguished: (i) the indexation model, (ii) the negotiation model, (iii) the consultation model and (iv) the unilateral decision-making model.

TableA8 Models for adjusting national minimum wages in the CEE9

1. Indexation	2. Negotiation	3. Consultation	4. Unilateral decision-making
Automatic adjustment to price and/or wage development	Bi- or tripartite negotiations between employers, trade unions and the state	Institutionalised consultations between employers and trade unions	Unilateral decision-making by the state
Slovenia	Bulgaria, Estonia, Lithuania and Poland	Latvia, Hungary and Slovenia – supplementing indexation	Romania and Slovakia

Source: Schulten (2014) and adjustments for Lithuania.

The first model automatically adjusts the national minimum wage by taking account of the evolution of certain economic indicators, with the movement in consumer prices used most commonly. Indexation of this type with consumer price inflation is currently used in Slovenia. Moreover, the initial increase can be further supplemented by political adjustments, such as a rise in the minimum wage when inflation is considered to be too low.

Under the negotiation model, employers and trade unions regularly negotiate the adjustment of the national minimum wage and the state transposes the result of these negotiations into a statutory minimum wage. Such a model can be found in Bulgaria, Estonia, Lithuania and Poland. In reality however, genuine wage negotiations often do not take place, and trade unions lack the ability to exert the political pressure needed to get employers to make adequate minimum wage adjustments. Since such negotiations are usually unsuccessful in practice, the states that use them usually provide fall-back solutions and decide the minimum wage level if the negotiations fail (Schulten, 2014).

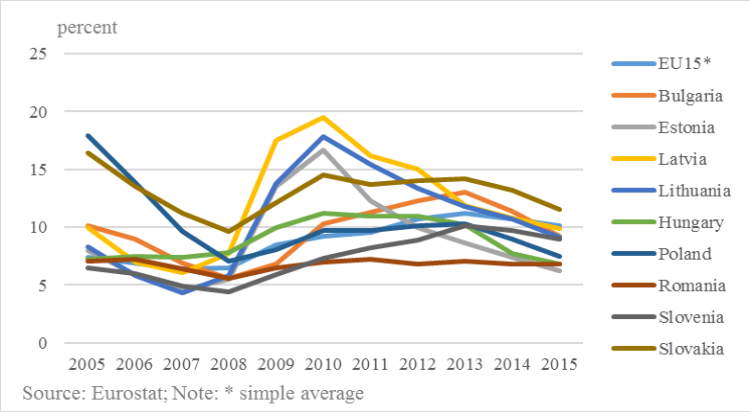
The third type of model involves consultations in more or less institutional form between employers, trade unions and sometimes other groups such as academics. The ultimate decision on adjusting the minimum wage, however, lies with the state. Latvia, Hungary and Slovenia use this model, with Slovenia using it to supplement indexation.

Under the fourth model there are no negotiations or institutionalised consultations with employers and trade unions, and the state itself determines the minimum wage. This model is fairly untypical for Europe and has emerged only in recent years in the wake of the financial crisis in countries that used to have a negotiation or a consultation model. Such countries among the CEE9 are Romania and Slovakia, with the unilateral decision in Slovakia being based on recommendations from social partners (Schulten, 2014).

Appendix 3: Figures

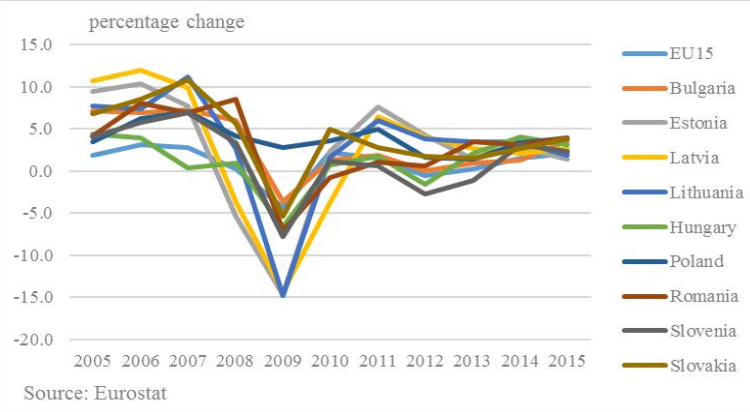
Figure A1 Macroeconomic background

Unemployment rate



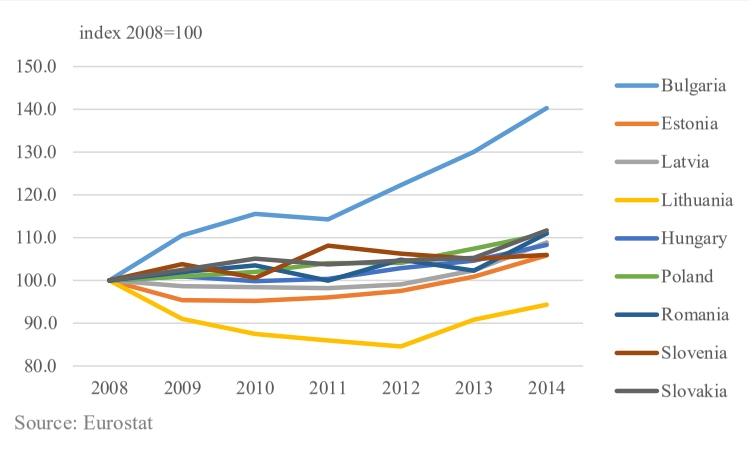
Source: Eurostat; Note: * simple average

Gross domestic product at market prices



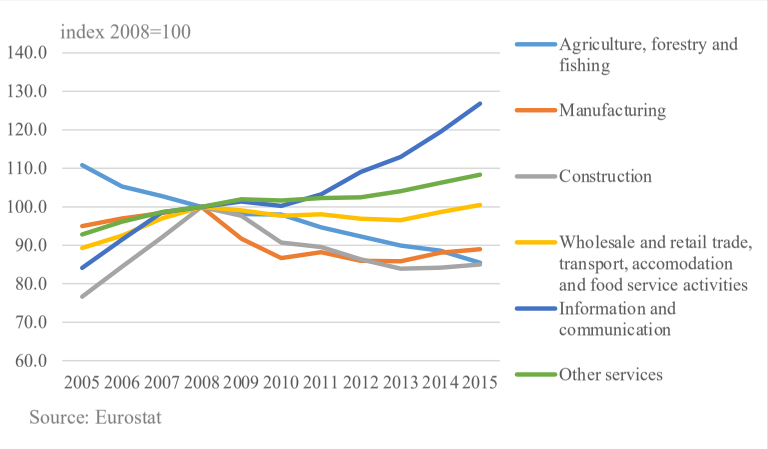
Source: Eurostat

Average monthly real gross wages (national currency)



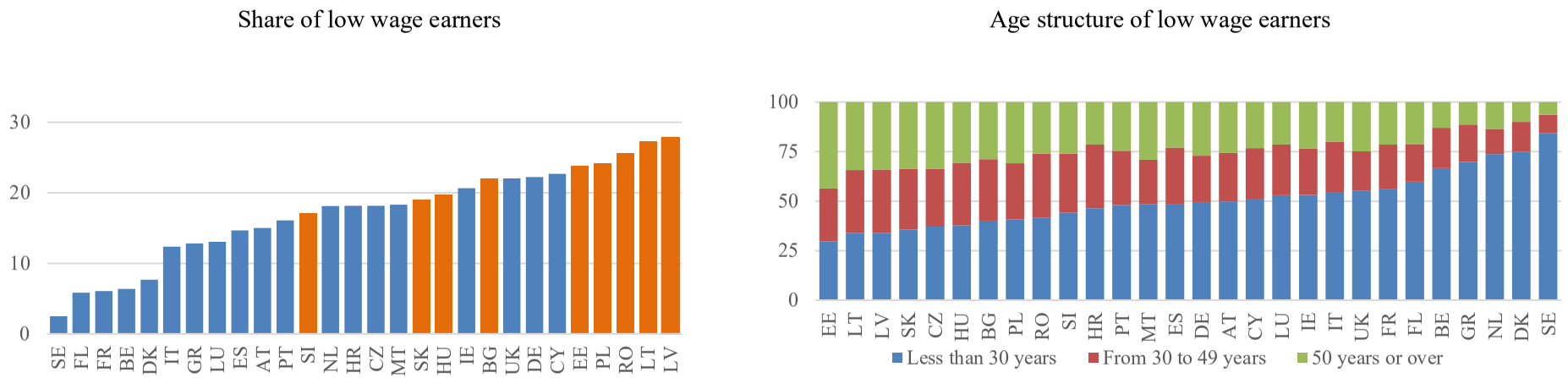
Source: Eurostat

Employment in CEE9 by economic activity



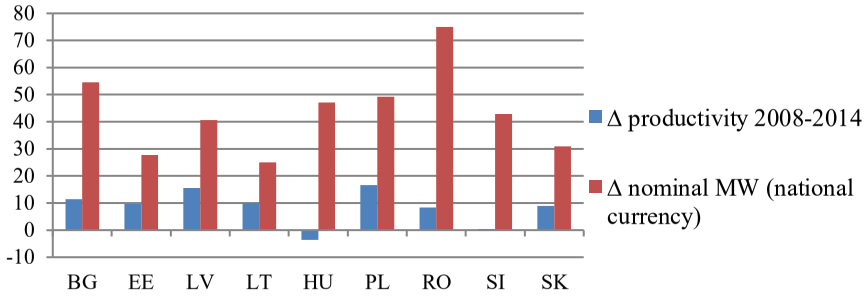
Source: Eurostat

Figure A2 Low wage earners as a proportion of all employees (excluding apprentices) and their distribution by age group in firms with more than 10 employees in 2010



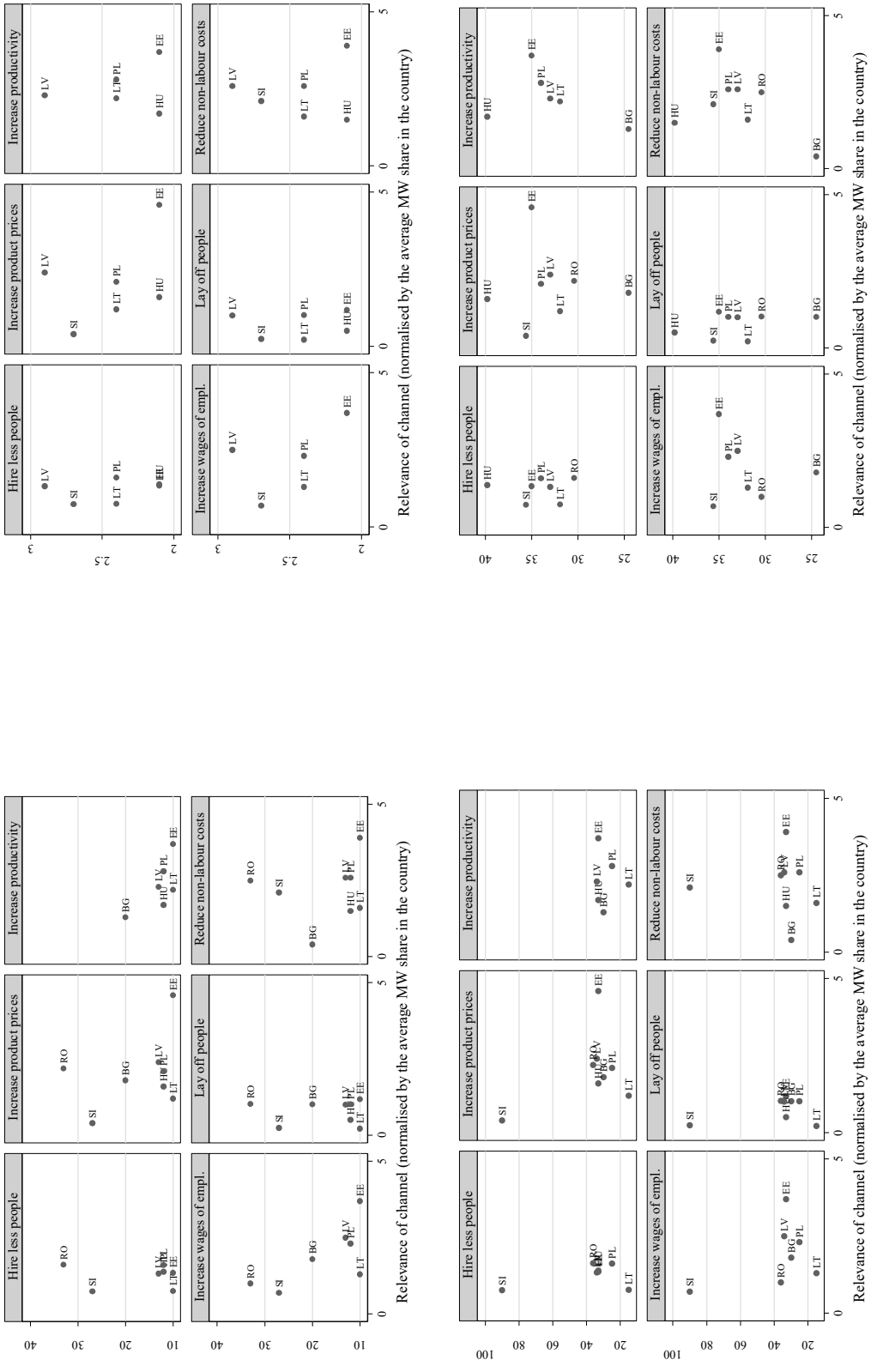
Source: Eurostat

Figure A3 Real Minimum wages and real labour productivity per person 2014 versus 2008



Source: Eurostat

Figure A4 Average relevance of adjustment channels (normalised by the average share of minimum wage workers) and institutional characteristics



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