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Did minimum wage increases reduce employment? Panel data evidence from Romania

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Abstract

Rising minimum wages is a popular policy used to increase the income of low wage workers, reduce inequalities and improve labour market participation. However, there are concerns among policy makers about its possible negative effects on employment. This paper examines the effect of minimum wage increases on regional employment, using a panel of 42 NUTS III regions from Romania over a recent period, 2008-2014, which includes the economic crisis and the recovery. The results show that, on average, increases in minimum wages had an insignificant effect on employment during the period studied. The results are robust to different specifications. They also highlight the importance of a strong manufacturing base for raising regional employment.

JEL classification: J23, J31, O25, R23.

Keywords: employment, minimum wage, industrial policy, manufacturing, regional labour markets.

¹ The views expressed are those of the author and may not in any circumstances be regarded as stating an official position of the Ministry of Public Finance, Romania. Email address: smaranda.pantea@mfinante.ro. Valuable comments and suggestions from Bernarda Zamora, Dan Matei and David Orțan and participants at Recent Advances in Economic and Social Research 2017 conference are gratefully acknowledged. The author remains responsible for all the errors and omissions.

1 Introduction

Minimum wage hikes aim to increase the income of low wage workers, reduce in work poverty and improve labour market participation. However, there are concerns among policy makers that large increases in minimum wage may reduce employment. Understanding the employment effects of the minimum wage is very relevant for many EU Member States, especially in Central and Eastern Europe (CEE) that have recently increased the level of their statutory minimum wage and are debating further increases.

Economic theory predicts that firms adjust to an increase in minimum wage by reducing employment, rising prices or reducing profitability. Among these possible effects, the most controversial one is the effect on employment. There is a large empirical literature on this effect, recently reviewed by Neumark & Wascher (2006), Metcalf (2007), Schmitt (2013), Neumark et al. (2014) and Manning (2016). Most studies find insignificant or very limited effects for the overall employment (OECD, 1998, Lemos, 2008; Andreica et. al, 2010; Harasztosi and Lindner, 2015, European Commission, 2016), yet negative effects are observed for specific socio-economic groups.

Despite the large number of studies, there are some questions that remain unanswered. First, most studies focus on USA and UK, where minimum wages increases were mostly moderate, minimum wages were low relative to average wage and the proportion of employees affected was limited. The results of these studies cannot be directly generalised for CEECs, where increases in minimum wages tend to be large and to affect a large share of employees (IMF, 2016). The empirical literature on CEECs is more limited and heterogeneous and their results are mixed. For Romania, in particular, there is a lack of studies for the period following the economic crisis in 2008. Second, most studies estimate an average effect. To establish a sustainable dynamic of minimum wages it is useful to examine the employment effects at different levels of the minimum wage and whether there is a threshold above which its impact becomes negative. IMF (2016) advises a threshold of 40% of the average wage, but without providing empirical evidence. There is also little evidence about how this effect varies across different regional characteristics which are relevant for policy making such as the level of development or the labour market conditions.

This study examines employment effects of the minimum wage increases in Romania during the period 2008-2014 using a panel data methods and regional level data (NUTS III). Romania is an interesting case. On one hand, it has the largest share of people in work at risk of poverty in the EU (almost 19%) and the second lowest minimum wages in the EU and, thus, there is a strong social justification for this policy. On the other hand, Romania experienced steep

increases in the minimum wages during the period studied, cumulated growth amounting to almost 50%, and additional increases were adopted in 2015, 2016 and 2017, which led to concerns about their employment effects. In this context, it is essential to examine empirically the effects of minimum wage. These estimates are informative also for other EU countries, where there are discussions about increasing minimum wages or concerns about their possible negative effects, in particular for other CEECs that also experienced large increases in minimum wages.

The use of disaggregated regional level data allows to focus on local labour markets and differences in their characteristics. The use of panel data allows controlling for region unobserved, time invariant specific characteristics. Therefore, in addition to estimating an average effect, the paper also examines how the effects vary across regions and whether the effects are more pronounced above a certain threshold of the minimum wage. These questions were not addressed before and they are very policy relevant. The study also provides novel evidence on the effects of the industrial structure on employment.

The results suggest that minimum wage increases had an insignificant effect on employment and this lack of effect is a robust finding across regions and across different empirical specifications. However, the estimates refer to the overall employment and it is possible that specific socio-demographic groups or types of firms were adversely affected. The findings also suggest that regional policies that aim to strengthen the manufacturing base and the development of market service sectors are key to raising regional employment.

The paper is organised as follows. Section 2 reviews related literature. Section 3 reviews the evolution of minimum wage in Romania. Section 4 explains the empirical strategy. Section 5 describes the data used. Section 6 presents the main estimation results and robustness checks and Section 7 provides a discussion of the results and the conclusions.

2 Related literature

Theoretically, a firm that operates in a competitive environment, would respond to an increase in labor costs by reducing employment. However, most empirical studies that tested this hypothesis found inconclusive results, with many finding insignificant or very limited effects (Metcalf, 2007; Schmitt, 2013; Manning, 2016)². Possible explanations for these results include characteristics of monopsony or oligopsony for some labour markets, the use of other channels of adjustment to minimum wage increases, such as, increasing prices, decreasing

² Neumark & Wascher (2006), Metcalf (2007), Schmitt (2013) Neumark et al. (2014) and Manning (2016) provide very detailed reviews of this literature

profitability, decreasing non-wage labour costs, wage compression, adopting efficiency increasing technologies (Metcalf, 2007; Hirsch et al., 2011, Schmitt, 2013), but the empirical evidence on these explanations is limited.

The related relevant empirical studies for this paper are those that examine the employment effects using regional or cross country data, such as, (OECD, 1998; Neumark & Wascher, 1992; Neumark & Wascher, 2004; Majchorowska & Zoliewski, 2012, European Commission, 2016). Among the studies that report estimates for the overall employment rate of prime age adults, OECD (1998), European Commission (2016), and IMF (2016) found insignificant effects for OECD countries, the 28 EU member states and CEECs, respectively, while Majchorowska & Zoliewski (2012) found negative effects on employment for Poland. Also, some studies that examined the effect on young workers only (Neumark & Wascher, 1992; Baker et al., 1999; Neumark & Wascher, 2004) found negative effects.

The evidence from other CEECs is more relevant for this paper than evidence from more advanced economies due to similarity in the evolution of minimum wage (large increases that affect a large share of employees) and in the institutional environment. The literature on CEECs is more limited and more heterogeneous, with studies differing in coverage, level of aggregation and methods used and even the effect studied³. Ericsson and Pytlikova (2004) used firm level data from Czech and Slovak Republics and studied the effects of increases in minimum wages of 40% and 30%, respectively, and found mixed effects for different types of firms. Andreica et al. (2010) using macroeconomic data for Romania for the period 1999-2009 found that a 10% increase in minimum wages was associated with a 0,9% decrease in employment. Majchorowska & Zoliewski (2012) using regional data from Poland for the period 1999-2010 found that a 10% increase in the minimum wage decreased the employment rate by around 1%. Harasztosi & Lindner (2015) studied the effect of a 60% increase in minimum wage in Hungary using firm level data and found that a 10% increase in the minimum wage decreased employment by 0,1%⁴. IMF (2016) used firm level data from 11 CEECs during the period 2009-2013 and found that a 10% increase in the minimum wage was associated with a 0,4% decrease in employment. INCSMPS (2016) found very different effects on different socio-economic groups defined based on gender and age group, with the largest effects concentrated among older workers. Taken together, these studies show that the evidence on the employment effects

³ Related, although not providing direct estimates to the employment effects, NBR (2015) used firm level data from Romania for the period 2010-2013 and found that increases in minimum wages limited recruitment.

⁴ They also found that 80% of the labour cost increases were paid by consumers through higher prices and 20% by the firm owners through lower profitability.

of an increase in the minimum wage in CEECs is mixed, with estimated effect of a 10% increase in the minimum wage varying between 0,1% to 1%.

Most studies estimate an average effect of the minimum wage increases, but it may have different effects depending on its level. At a low level, an increase in the minimum wage could have an insignificant effect, as it affects a low share of employment and of labour costs. As the minimum wage increases and it affects a larger share employment and labour costs and its effects could become more negative. IMF (2016) suggests the effect of the minimum wage could depend on the ratio of the minimum wage to average wage, and that its effect is likely to be more negative when this ratio is above 0.4, but without providing empirical evidence.

The study is also related to literature on determinants of regional employment and unemployment, reviewed by Elhorst (2003). This literature shows that industrial structure of the region is a key determinant of the employment and unemployment. Economic sectors are affected by different economic and technological trends, which can have important employment effects (Elhorst, 2003; Marelli et al., 2012; European Commission, 2016).

This study contributes to all these different strands of literature integrating them in one framework to study the effects of the minimum wage, industrial structure and other labour market characteristics on regional employment rate in Romania.

3 Evolution of minimum wage in Romania

The statutory minimum wage in Romania is determined at national level by the government after consultations with the main social partners, trade unions and employers. The growth of the minimum wage is linked to the evolution of the economy, but also to social and economic objectives, such as reducing poverty in work and increasing labour participation. The statutory minimum wage is only one and there are no special rates or exceptions.

At the end of 2008 the minimum wage was 540 RON or 137 Euro. After an increase to 600 RON at the beginning of 2009, it remained frozen during the crisis. In 2011, it was raised to 670 RON. Since then it was raised every year, reaching of 900 RON, or 205 Euro in 2014. Further increases took place after the period studied: two increases of 8,3% and 7,7% in 2015, an increase of 19% in 2016 and an increase of 16% in 2017.

Table 1 shows the minimum wage levels at the beginning and at the end of the period studied in Romania and several other CEECs. In nominal terms, in euros, Romania had the second lowest, minimum wage, except Bulgaria, both in 2008 and in 2014. During the period studied all countries increased the level of the statutory minimum wages. However, the growth rate varied considerably from 3,1% in Czech Republic to more than 50% in Bulgaria. The countries

with lowest levels of minimum wages tended to have the highest growth and Romania had the steepest growth (49,5%) after Bulgaria (54,5%). Overall, the evolution of the minimum wage in Romania was similar to other CEECs, but with lower initial minimum wage and faster growth. To a certain extent, this evolution reflects convergence. Taking into account differences in purchasing power does not affect these patterns.

Not only the absolute level of the minimum wage is important, but also its position in the wage distribution. The most used indicator for these purposes is the Kaitz index, which is defined as the ratio of the statutory minimum wage to the average gross wage in the economy. Table 1 shows that this index in Romania increased from 30,1% to 38,5% between 2008 and 2014, an increase of more than 8 percentage points, indicating that the minimum wage grew much faster than the average wage. While this increase was steep, the ratio of minimum wage to average wage remained one of lowest in the CEE.

Another important aspect is the share of employees affected by the minimum wage. As the ratio of the minimum wage to average wage grows, the minimum wage affects an increasing share of workers and its impact becomes larger. In Romania, in 2014, minimum wage affected 22% of employees, a larger proportion than in comparable countries like Poland and Lithuania (9%, in both) and Latvia (15%) IMF (2016).

Overall, these statistics show that minimum wage in Romania increased fast both in absolute and in relative terms and by the end of the period studied it affected a large share of workers.

4 Empirical strategy

The paper applies the standard model used to examine the employment effect of the minimum wages in a cross-country setting (OECD, 1998; Neumark & Wascher, 2004; European Commission, 2016; IMF, 2016), or at regional level (Neumark & Wascher, 1992; Baker et al., 1999; Majchrowska & Zołkiewski, 2012). This model assumes that employment rate is determined by the minimum wages, expressed relative to average wage, economic cycle, social protection and other characteristics of the regions. The model assumes that in regions where the ratio of minimum to average wage is higher a larger share of population is affected by the minimum wage and an increase in the minimum wage has a larger impact. In regions where this ratio is low, minimum wage affects a small share of labour force and labour costs and it is likely to have limited effects. Thus, if minimum wage has a negative effect on employment, the coefficient of the Kaitz index should be negative. The model can be written as it follows:

$$ER_{rt} = \alpha_0 + \alpha_1 KaitzIndex_{rt} + \alpha_x X_{rt} + e_{rt} \quad (1)$$

ER_{rt} is defined as the ratio between the number of employees and the population of working age in the region r and year t . While this is the standard variable used in most empirical studies on this topic (OECD, 1998; Neumark & Wascher, 1992, 2004; Majchrowska & Zołkiewski, 2012; European Commission, 2016; IMF, 2016), the mechanism through which minimum wage affects employment is relevant mainly for the business sector. Therefore, a version of Eq. (1) is estimated with employment in business sector (sectors B-N rev. 2) as dependent variable. $KaitzIndex_{rt}$ is the ratio between the minimum wage and average wage in the region r and year t . X_{rt} represent other characteristics of the regions. The equation includes *time fixed effects* that control for macroeconomic shocks common to all regions, such as the business cycle. The regional variables X_{rt} considered in our model are: (1) *Regional GDP per capita* - captures the effects of region specific business cycle fluctuations⁵, (2) *The shares of manufacturing and market services in total regional employment* - capture the effects of a specialisation in these sectors, (3) *The ratio between average unemployment allowance and minimum wage* -controls for the generosity of social protection, which can influence negatively the incentives to work⁶. Detailed definitions of all variables used are given in Table 2.

OLS estimation of equation (1) could pose several problems. First, the effect of the minimum wage on employment rate cannot be identified directly from their variation across regions because the Kaitz index is expected to be endogenous. That is, it could be correlated with unobserved, time invariant characteristics, such as geographical location or historic heritage affecting both the wage and employment levels. For instance, a geographical location close to EU markets could be associated with higher wages and higher employment. Not taking into account these characteristics could lead to omitted variable bias. As these characteristics are time invariant, regional fixed effects are included in equation (1) to avoid this potential problem. Therefore, equation (1) is estimated using OLS with Fixed Effects for regions. Second, if policy makers increase the minimum wage when employment grows and freeze it when it declines, the estimated effect of minimum wage could be biased due to reverse causation (Neumark & Wascher, 2004, Neumark & Wascher, 2006; IMF, 2016). To avoid this, the Kaitz index is

⁵ Output gap would be a more appropriate measure, but data on output gap at regional level is not available. Another commonly used measure to control for region specific business cycle fluctuations, especially in papers that focus on youth employment, is unemployment of prime age males. Given the focus in this paper on overall employment and the possible correlation between this measure and employment rate, it was decided to use GDP per capita.

⁶ The rules regarding the level for the allowance are common for the whole country, but they depend on socio-economic characteristics of the recipients that vary across regions.

lagged one period. Finally, the errors in equation (1) could be affected by heteroskedasticity and serial correlation. To account for these possible problems, the errors are clustered by region.

5 Data description

The data used for this analysis covers all 42 NUTS III level regions (județe) for the period 2008-2014. The period studied was limited by the availability of data for all variables in the model.

All data come from National Statistical Institute of Romania, in particular, from the survey *Ancheta privind costul forței de muncă*, a survey on labour force costs designed to be representative at NUTS III level and conducted by the National Statistical Institute, and *Conturi Naționale*. These datasets are widely regarded high quality and are frequently used by the Ministry of Public Finance and by the Ministry of Labour and Social Justice for policy analysis. They are also used by academic researchers, such as Aparaschivei et al. (2011).

Ancheta privind costul forței de muncă is the source of the data for the average number of employees and the average wages by region and economic sector, defined based on NACE rev.2, as well as the source for the calculation of the share of manufacturing and the share of market services in the economy at regional level. *Conturi Naționale* (National Accounts) is the source for the regional GDP per capita. This variable is deflated using national level GDP deflator also taken from National Accounts. The unemployment allowance is taken from the National Statistical Institute and it is based on administrative sources.

The summary statistics for all the variables at the beginning of the period studied (2008) and at the end (2014) are given in Table 3. In the average region, employees represented 33% in 2008 and 32% in 2014 of the working age population. While these values may seem low, it is important to mention that this ratio includes only employees, excluding the self-employed, which in more rural regions represent a considerable share of working age population. PIAROM (2017) reported similar patterns and indicated the proportion of population working in agriculture as the main explanation. During the period studied this ratio decreased during the economic crisis reaching a minimum in 2011 and then it recovered, but without reaching the level recorded in 2008. It also varied considerably across regions, ranging from 20% to more than 70%, in the capital. The Kaitz index for the average region rose by 10 percentage points from 35% to 45%. This index also varied considerably across regions ranging from below 30% in Bucharest to close to 60% in low wage regions, such as Vaslui and Neamț. The evolution of GDP per capita reflected an incomplete economic recovery during the period studied, while the changes in the evolution of the share of manufacturing and market services reflected the

different impact of the crisis on the two sectors and historic trend towards tertialisation (Pashev et al., 2015).

6 Estimation results

6.1 Baseline results

Table 4 presents the results of the estimation of equation (1) for the overall employment rate in columns (1) and (2) and for the business sector in columns (3) and (4). The result for all regions are reported in column (1) and (3) and the results for the sample that excludes Bucharest and Ilfov, which in many respects are outliers, in columns (2) and (4).

The estimation results indicate an insignificant effect of Kaitz index on the employment, which imply that minimum wage hikes did not reduce employment during the period studied. This result holds for the sample that excludes Bucharest and Ilfov and for the specifications that use employment in the business sector as a dependent variable. The results are broadly in line with previous studies (OECD, 1998; European Commission, 2016; IMF, 2016).

The coefficients of time fixed effects are statistically significant, but GDP per capita is not statistically significant, as most of the effects of the business cycle are captured by the time fixed effects and regional fixed effects capture unobserved time invariant characteristics of the regions. The share of manufacturing has a positive effect on employment and employment in business sector, while the share of service sectors has a positive effect only on employment in business sector, suggesting that specialisation in these sectors is conducive to job creation. The ratio of unemployment allowance to minimum wage has a significant negative effect, suggesting that a reduced difference between the two decreases the motivation to work.

In conclusion, the results show an insignificant effect of minimum wage increases on employment, the latter being determined mainly by the business cycle, industrial structure and social protection policies.

Even if on average minimum wage has an insignificant effect on employment, it is possible that some regions were negatively affected.

IMF (2016) suggests that the effect of the minimum wage could depend on the ratio of the minimum wage to average wage, and that its effect is likely to be more negative when this ratio is above 0.4. To test this hypothesis, equation (1) is estimated separately for regions where the ratio of the minimum wage to average wage is equal or above 0.4 and for those where this ratio is below. The results of these estimations are presented in Table 5⁷ in columns (1) and (2) and

⁷ For expositional reasons, only the results for the overall employment rate are reported, but the results for business sector employment are very similar.

show that the effect is insignificant both for regions where the Kaitz index is below 0.4 or above 0.4. These results suggest that the threshold for negative effects is higher. A threshold of 0.5 could not be examined because few regions reached this level for more than one year.

An increase in the minimum wage could have a more negative effect on the employment of poorer, less productive regions, where a high minimum wage would decrease the probability of employment for a larger share of employees. Majchrowska & Zołkiewski (2012) document such an effect for Poland. To test this hypothesis, equation (1) is estimated separately for poor regions (with GDP per capita below the median) and rich (with GDP per capita above the median) regions. The results reported in columns (3) and (4) show that the effect is insignificant for both poor and rich regions.

Policy makers are concerned that an increase in the minimum wage could have a particularly negative effect on regions with high unemployment. Columns (5) and (6) report the results of the estimation of the equation (1) on high unemployment regions and on low unemployment regions, defined as regions with unemployment above or below 10%. The results show insignificant effects for both types of regions.

Overall, the results suggest insignificant impact of minimum wage hikes on high and low wage regions, poor or rich regions and also on regions with high or low levels of unemployment.

6.2 Robustness tests

Several robustness tests are reported in Table 6. According to IMF (2016) the ratio of minimum wage to labour productivity is a more direct measure of the distortionary effects of minimum wage than the indicator based on average wage. The first two columns report the results of the estimation of equation (1) using this measure. The effect remains statistically insignificant. There is a debate whether a linear or a logarithmic model is more appropriate and many studies report the results of both models (Baker *et al.*, 1999; OECD, 1998). The columns (3) and (4) report the results of equation (1) in logarithmic form and show that they are similar to the baseline results. Several studies (Baker *et al.*, 1999; Neumark & Wascher, 2006; Metcalf, 2007) argue that estimations that use the variation over longer time periods are more informative because firms may not be able to adjust the labour and non-labour inputs in the short term. Columns (5) and (6) present the results in first differences using 2 year differences and columns (7) and (8) present the same estimations for 3 year differences. The results confirm the baseline results for the Kaitz index and the other variables. In summary, the robustness tests confirm the insignificant effect of the minimum wages.

7 Discussion and conclusions

Increasing minimum wage has the potential to decrease work poverty and increase the earnings of low wage workers, but there are concerns that it may reduce employment. There is no consensus in the literature on the effect of the minimum wage on employment. There is also a lack of studies on this topic for Romania for the period following the economic crisis.

This study examines the effect of minimum wage on employment in Romania, between 2008 and 2014, using panel data at regional level. The use of very recent data assures the relevance of the results for policy. The use of panel data allows controlling for region specific unobserved characteristics. In addition, the study examines how this effect varies across characteristics of the regions and the level of the minimum wage, aspects which have not been studied before.

The results indicate an insignificant effect of the minimum wage on employment, which is determined mainly by regional industrial structure, the business cycle and social protection policies. The results are very robust to the use of different specifications and across different types of regions.

Despite the robustness of the results and the consistency with previous studies, such as OECD (1998), European Commission (2016), IMF (2016), Harasztosi & Lindner (2015) they may appear surprising. There are several possible explanations.

First, firms could adjust to minimum wage increases through the hours worked, prices, profitability, wage compression and adoption of efficiency increasing methods (Hirsch et al., 2011; Schmitt, 2013). Adjustment through hours was limited, as only a small share of employees worked part time during the period studied, but this share rose fast (INS, 2016a). Adjustments through prices and profitability played an important role in Hungary (Harasztosi & Lindner, 2015), so they could be important channels also in Romania.

Second, it is possible that some labour markets had characteristics of monopsonic/ oligopsonic markets, where employers have significant market power in wage determination due to frictions in labour market, limited mobility of workers or workers' preferences. In this case, an increase in the minimum wage may increase employment by increasing the incentives to work. The empirical evidence consistent with monopsonic/oligopsonic labour markets found by Eriksson and Putlikova (2004) for Czech and Slovak Republics and the very low level of wages in Romania suggest that this explanation could be relevant for certain labour markets in Romania.

Third, the practice of receiving part of the wage as envelope wage could also be part of the explanation. If workers receive part of the wage as envelope wages, the most likely effects of an increase in minimum wage are an increase in the formal wage, a decrease in the envelope wage, and no effect on employment. Williams (2009) found that 23% of all employees in

Romania received a large part of their wages (close to 70%) as envelope wages. Given how widespread this practice is, it may explain, at least partly, the insignificant effect.

Finally, increases in minimum wages could affect negatively only specific skill groups, sectors or types of firms as shown by previous studies (OECD, 1998, Eriksson & Pytlikova, 2004; Harasztosi & Lindner, 2015; European Commission, 2016).

The paper has several limitations. It studies the effect on overall employment, but different workers and firms could be affected differently. Future research should study the effect on young and low-skill workers, specific sectors, such as labour intensive manufacturing, and different types of firms, such as, SMEs or exporters. Another limitation of the study is that it uses aggregate data. Ideally this question should be studied using micro data, which allows identifying more precisely the effects. Finally, the study examined only the adjustment of firms to this increase through employment. Future work should examine the adjustments through prices, profitability and other channels.

From a policy perspective, the result that increases in minimum wage between 2008 and 2014 had no major effects on employment lends support to the use of this policy to increase earnings of low wage workers, reduce in-work poverty and increase labour force participation. However, the estimates refer to the overall employment rate and possible negative effects on specific socio-demographic groups or specific types of firms should be taken into account. The results also highlight the importance of regional development policies that aim to strengthen the regional manufacturing base.

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Annexes

Table 1 Minimum wages in Romania and in comparable countries

| Country | Minimum wage in EURO | | | Minimum wages in PPS | | | Minimum Wage/Average Wage | | |
|-----------|----------------------|-------|-------|----------------------|-------|-------|---------------------------|------|------|
| | 2008 | 2014 | Δ (%) | 2008 | 2014 | Δ (%) | 2008 | 2014 | Δ |
| BG | 112.5 | 173.8 | 54.5 | 227.6 | 363.2 | 59.6 | 39.5 | 40.3 | 0.8 |
| CZ | 300.4 | 309.6 | 3.1 | 414.8 | 484.6 | 16.8 | 35.2 | 32.8 | -2.4 |
| EE | 278.0 | 355.0 | 27.7 | 362.4 | 469.5 | 29.5 | 34.9 | 36.2 | 1.3 |
| LV | 22.,8 | 320.0 | 39.3 | 303.2 | 456.3 | 50.5 | 36.2 | 44.4 | 8.2 |
| LT | 231.7 | 289.6 | 25.0 | 351.0 | 461.3 | 31.4 | 39.6 | 45.7 | 6.1 |
| HU | 271.9 | 328.2 | 20.7 | 394.9 | 571.5 | 44.7 | 38.5 | 45.5 | 7.0 |
| PL | 313.3 | 404.2 | 29.0 | 462.6 | 719.1 | 55.5 | 38.8 | 45.1 | 6.3 |
| RO | 138.6 | 205.3 | 48.2 | 215.0 | 381.2 | 77.3 | 30.1 | 38.4 | 8.3 |
| SI | 538.5 | 789.2 | 46.5 | 649.9 | 966.5 | 48.7 | 41.0 | 51.3 | 10.3 |
| SK | 241.2 | 352.0 | 45.9 | 370.6 | 519.1 | 40.1 | 34.7 | 36.4 | 1.7 |

Source: Eurostat, Minimum wages.

Table 2 Variable definition

| Variable | Definition |
|-----------------------------------|--|
| Employment rate (all sectors) | Number of employees/working age population |
| Employment rate (business sector) | Number of employees in the business sector (B-N based on NACE rev. 2)/working age population |
| Kaitz index | Ratio of minimum wage to average wage |
| GDP per capita | Real regional GDP per capita |
| Manufacturing | Share of manufacturing in total employment in the region |
| Market services | Share of market services (G- N) in total employment in the region |
| Unemployment allowance | Ratio of unemployment allowance to minimum wage |

Table 3 Summary statistics

| Variable | 2008 | | 2014 | |
|-----------------------------------|-------|-----------|-------|-----------|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Employment rate (all sectors) | 0.33 | 0.10 | 0.32 | 0.09 |
| Employment rate (business sector) | 0.25 | 0.09 | 0.24 | 0.09 |
| Minimum wage/average wage | 0.35 | 0.09 | 0.48 | 0.06 |
| GDP per capita (thousands RON) | 22.08 | 9.77 | 21.85 | 9.93 |
| Manufacturing | 0.29 | 0.07 | 0.26 | 0.08 |
| Market services | 0.31 | 0.07 | 0.34 | 0.07 |
| Unemployment allowance | 0.72 | 0.37 | 0.54 | 0.09 |

Source: Own calculations based on INS data.

Table 4 Employment effects of minimum wages

| | All sectors | All sectors | Business | Business |
|------------------------|--------------------|-------------|--------------------|-------------|
| | Excluding B and IF | All regions | Excluding B and IF | All regions |
| Kaitz Index | 0.02 | 0.17 | -0.04 | 0.11 |
| | [0.08] | [0.14] | [0.07] | [0.12] |
| GDP per capita | 0.00 | 0.03 | 0.01 | 0.02 |
| | [0.01] | [0.02] | [0.01] | [0.02] |
| Manufacturing | 0.33 | 0.43 | 0.41 | 0.50 |
| | [0.11]*** | [0.15]*** | [0.09]*** | [0.12]*** |
| Market services | 0.12 | 0.13 | 0.21 | 0.21 |
| | [0.11] | [0.11] | [0.10]** | [0.10]** |
| Unemployment allowance | -0.02 | -0.03 | -0.02 | -0.02 |
| | [0.01]* | [0.01]*** | [0.01]** | [0.01]*** |
| Obs | 238 | 250 | 238 | 250 |
| Regions | 40 | 42 | 40 | 42 |
| R2 | 0.81 | 0.73 | 0.80 | 0.71 |

Note: * p<0.10, ** p<0.05, *** p<0.01. Standard errors corrected for heteroscedasticity and clustered by region in parentheses. All equations include region and time fixed effects.

Table 5 Does the minimum wage have different effects?

| | MW/AW | | GDP/capita | | Unemployment rate | |
|------------------------|--------|----------|------------|---------|-------------------|----------|
| | High | Low | High | Low | High | Low |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Kaitz Index | 0.04 | -0.08 | 0.11 | -0.06 | 0.20 | -0.06 |
| | [0.13] | [0.09] | [0.15] | [0.15] | [0.19] | [0.10] |
| GDP per capita | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | -0.00 |
| | [0.05] | [0.02] | [0.01] | [0.02] | [0.04] | [0.01] |
| Manufacturing | 0.05 | 0.29 | 0.48 | 0.27 | 0.30 | 0.28 |
| | [0.21] | [0.12]** | [0.20]** | [0.13]* | [0.18] | [0.15]* |
| Market services | 0.01 | 0.15 | 0.20 | 0.13 | 0.20 | 0.07 |
| | [0.20] | [0.12] | [0.18] | [0.18] | [0.20] | [0.15] |
| Unemployment allowance | -0.01 | -0.02 | -0.05 | 0.01 | -0.02 | -0.03 |
| | [0.02] | [0.01]* | [0.01]*** | [0.01] | [0.03] | [0.01]** |
| Obs. | 123 | 115 | 114.0 | 124 | 52 | 186 |
| Regions | 34 | 31 | 19 | 21 | 19 | 37 |
| R2 | 0.84 | 0.84 | 0.81 | 0.84 | 0.86 | 0.80 |

Note: * p<0.10, ** p<0.05, *** p<0.01. Standard errors corrected for heteroscedasticity and clustered by region in parentheses. All equations include region and time fixed effects.

Table 6 Robustness tests

| | Labour productivity | | Logarithmic model | | First differences (2 year) | | First differences (3 years) | |
|---------------------------|---------------------|--------------------|-------------------|--------------------|-------------------------------|--------------------|--------------------------------|--------------------|
| | All sectors | Business sector | All sectors | Business sector | All sectors | Business sector | All sectors | Business sector |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Kaitz Index | 0.18 | 0.13 | 0.06 | 0.07 | 0.09 | 0.05 | 0.17 | 0.11 |
| | [0.21] | [0.17] | [0.10] | [0.12] | [0.08] | [0.07] | [0.14] | [0.13] |
| GDP per capita | 0.03 | 0.03 | 0.05 | 0.06 | 0.04 | 0.04 | 0.03 | 0.02 |
| | [0.03] | [0.02] | [0.06] | [0.06] | [0.03] | [0.02] | [0.02] | [0.01]* |
| Manufacturing | 0.36 | 0.46 | 0.29 | 0.46 | 0.35 | 0.44 | 0.56 | 0.61 |
| | [0.13]*** | [0.11]*** | [0.09]*** | [0.10]*** | [0.11]*** | [0.09]*** | [0.18]*** | [0.16]*** |
| Market services | 0.09 | 0.19 | 0.14 | 0.33 | 0.17 | 0.26 | 0.22 | 0.28 |
| | [0.12] | [0.10]* | [0.13] | [0.14]** | [0.10] | [0.09]*** | [0.16] | [0.13]** |
| Unemployment allowance | -0.03 | -0.02 | -0.05 | -0.06 | -0.03 | -0.03 | 0.00 | -0.00 |
| | [0.01]*** | [0.01]*** | [0.03]* | [0.03]** | [0.01]*** | [0.01]*** | [0.02] | [0.02] |
| Obs | 250 | 250 | 250 | 250 | 165 | 165 | 124 | 124 |
| Regions | 42 | 42 | 42 | 42.00 | | | | |
| R2 | 0.73 | 0.71 | 0.76 | 0.76 | 0.76 | 0.71 | 0.74 | 0.69 |

Note: * p<0.10, ** p<0.05, *** p<0.01. Standard errors corrected for heteroscedasticity and clustered by region in parentheses. All equations include region and time fixed effects.