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# Minimum wage in Croatia: sectoral and regional perspectives

Danijel Nestić<sup>a</sup> , Zdenko Babić<sup>b</sup> and Sanja Blažević Burić<sup>c</sup>

<sup>a</sup>The Institute of Economics, Zagreb, Croatia; <sup>b</sup>Faculty of Law, University of Zagreb, Zagreb, Croatia; <sup>c</sup>Faculty of Economics and Tourism, Juraj Dobrila University of Pula, Pula, Croatia

## ABSTRACT

In this paper, we identify the sectors and regions in Croatia most affected by minimum wage changes. By using four criteria, we identify 13 low-wage sectors. The analysis also reveals five regions (counties) in which the minimum wage can play an important role. Low-wage sectors in Croatia are found to be manufacture of textiles, manufacture of clothing, manufacture of leather and related products, manufacture of wood and of products of wood, manufacture of rubber and plastic products, manufacture of furniture, construction of buildings, specialised construction activities, retail trade, food and beverage services, security and investigation activities, services to buildings (cleaning etc.) and personal services. We analyse the employment and wage changes for these low-wage sectors in the period 2009–2015. It turns out that tradable low-wage sectors are highly affected by minimum wage changes due to a high concentration of employees with wages just above the minimum wage. However, during the recession, these sectors had a smaller employment decline and higher wage growth compared with both the manufacturing industry as a whole and non-tradable low-wage sectors.

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## KEYWORDS

Minimum wage; Low-wage sectors; Croatia

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## 1. Introduction

Minimum wage is a simple instrument for market regulation with complex effects. Complexity starts with the multiple goals of minimum wage policy and increases with implementation and the results. Each of the social partners may have and actually have different expectations from the minimum wage policy. Prevention of the exploitation of workers and reduction of in-work poverty dominate the views of trade unions, constraints to unfair low-wage competition and increased productivity are expected by employers, while higher tax revenues and increasing fairness in society are important to the government. With the desired goals, there may also be unwanted consequences of minimum wage growth, such as a decrease of employment and work intensity, shutdown of companies due to loss of profit, lower work incentives as a result of wage compression, and lower incentives for union membership and collective bargaining.

**CONTACT** Danijel Nestić  dnestic@eizg.hr

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The effects of the minimum wage on the Croatian economy have not been studied systematically.<sup>1</sup> Most of the analyses did not go beyond simple international comparisons, such as comparisons of the minimum wage levels, minimum-to-average wage ratios and proportions of workers receiving the minimum wage. However, comparisons involving data on the national level alone may hide the diversity of impacts of minimum wage due to sectoral and regional differences in productivity. Though the key indicators of minimum wage impact at the national level are known for Croatia, there has been no paper analysing the impact of minimum wage at sectoral or regional levels.<sup>2</sup> This paper intends to fill that gap, and explores wage levels and wage dynamics across sectors and regions in Croatia with the aim of identifying sectors and regions faced with persistently low wages measured in several dimensions. It also looks at employment developments in these low-wage sectors, and highlights particular policy concerns at sectoral and regional levels.

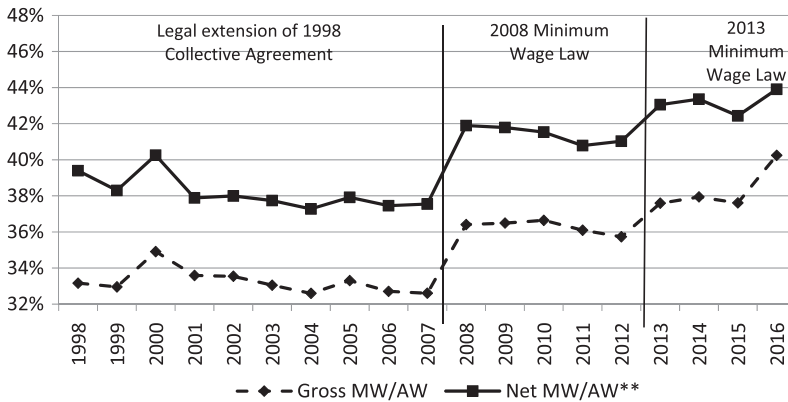
The paper is organised into eight sections. After this introductory section, there is a brief description of the minimum wage policy in Croatia. In the third section, we define the criteria for the selection of low-wage sectors and identify 13 such sectors. The fourth section presents the basic indicators illustrating the importance of minimum wage for low-wage sectors, the fifth gives an overview of employment trends, and the sixth section presents the trends in wages during the recession. The seventh section discusses wage issues on a regional level, with a selection of five regions whose economies are particularly affected by the minimum wage policy. The eighth section concludes the paper.

## 2. Minimum wage in Croatia

According to the 2013 Minimum Wage Act, the minimum wage in Croatia is determined as the lowest monthly amount of gross wage paid out to a worker for a full-time job.<sup>3</sup> Although not directly stated in the Act, it is implied that minimum wage for a part-time job is defined in pro-rata terms, that is, the ratio of the agreed part-time hours and legally defined full-time working hours is applied to the minimum wage. A legally defined minimum wage implicitly includes payment for shift work, work at night and on Sundays, holidays and other non-working days, but does not include overtime. All workers employed in Croatia have a right to the minimum wage, independently from the company headquarter or the domicile registration of the employer and regardless of their age or the type of work contract.

The law allows that collective agreements stipulate wages that are lower than the minimum wage but they cannot be lower than the 95% of the national minimum wage. In practice, sub-minimum wages are agreed rarely. We are aware of only one such agreement, the 2015 Collective Agreement for the Construction Industry. This agreement is quite important because it was extended by a Government decree to all workers in this relatively large sector.

The minimum wage level is determined every year by the Government decree following the proposal of the Minister of Labour and Pension System and after consultation with the social partners 'bearing in mind the increase of the share that the minimum wage holds in the average wage' (Article 7 of the 2013 Minimum Wage Act). That is also the sole criterion mentioned in the regular annual assessment of minimum wage level. In addition, the Act prescribes that the minimum wage cannot be defined at an amount lower than that defined for the previous year. After the passing of the Act in 2013, there were regular annual adjustments of the minimum wage amounts in January each year. Thus the minimum wage was



**Figure 1.** Minimum-to-average wage ratio, gross and net. Source: Author's calculations based on the amount of minimum wage and data of the Croatian Bureau of Statistics on the average wage. Notes: Minimum wage as of July each year. Minimum wage in net terms is estimated as the average of the lowest and highest possible net minimum wage according to tax regulation\*.

adjusted at the beginning of the year 2014 (increase by 1.1%), in 2015 (increase by 0.4%), in 2016 (increase by 3%) and at the beginning of 2017 (increase by 5%).

The minimum wage in Croatia since 1 January 2017 amounts to 3,276 kunas or approximately 435 euros. In 2016, it amounted to 40.2% of the average gross wage. It is the highest minimum-to-average wage ratio since the introduction of the minimum wage system in Croatia (Figure 1). During the recession, the minimum wage was frozen at first (2009–2012) but started growing with the implementation of new Minimum Wage Act in July 2013.<sup>4</sup> In terms of net wage, the share of minimum wage in the average wage is a little higher due to the lower tax burden on the minimum wage compared with the average wage. Thus the share of the net minimum wage in the average net wage in 2016 was 43.9%. At the level of gross minimum wage, there is a 20% contribution to be paid for the pension insurance. The income tax threshold was set above minimum wage in 2015, meaning that there is no taxation of minimum wage. For the previous years, the amount of net minimum wage depended on the income tax obligation of a worker, which in turn depends on personal tax allowances related to family conditions (having or not children and other dependent family members) and on place of residence due to different local tax rates.

One of the key indicators of the importance of the minimum wage is the coverage of minimum wage, that is, the proportion of minimum wage workers in the overall employment. There are no official data on the coverage of minimum wage in Croatia. To estimate the coverage in this paper we use data on the distribution of employees according to the net wage. Data are taken from the Croatian Bureau of Statistics and their Annual Reports on Employees and Wages. The Report covers employees in the incorporated sector only (without the self-employed and employees in crafts and trades). The last available figures for March 2015 indicate that 5.4% of full-time employees received a net wage lower than 2,500 kunas. Since the net minimum wage at that time was 2,424 kunas, we can say that it is upper estimate of the proportion of workers on minimum wage. The limit of 2,500 kunas is about 103.1% of the minimum wage in net terms. With statistical data defined in this way, it seems that the proportion of workers on minimum wage has even decreased a little compared with the beginning of the recession, that is, March 2009. At that time the

net minimum wage was between 2,141 and 2,196 kunas, depending on the tax obligation of the worker regarding personal tax allowances and place of residence. In their data, the Croatian Bureau of Statistics published that the wage lower than 2,200 kunas (100.2–102.8% of the minimum wage) was received by 5.8% of workers, a little more than in March 2015.<sup>5</sup>

### 3. Identifying low-wage sectors

The effects of minimum wage cannot be fully understood by analysing data on a national level. Some sectors are more exposed to the influence of minimum wage, and others less. It seems reasonable to explore the effects by focusing on sectors most affected by minimum wage changes. Although the total number of workers in the Croatian economy receiving the minimum wage is moderate, in some sectors that proportion is much higher. For that reason a change in the minimum wage level and the related regulations (types of jobs and work contracts covered by minimum wage, the stipulation of lower-than-minimum wages in specific circumstances, the modalities of definition of minimum wage, etc.) may have a strong impact on employment and productivity as well as the standard of living of workers in particular sectors.

In that sense, it is useful to identify low-wage sectors in Croatia and assess which parts of the economy will be affected by the minimum wage policy the most as a result of industry and workforce composition or/and high proportion of low-wages workers. Policymakers should base their decisions about minimum wage on the evaluation of effects in these sectors. Better understanding of the developments in these sectors should make decision-making more efficient.

The identification of low-wage sectors proposed in this paper relies on existing official statistical data on wage distribution by industry; more precisely, on the data of the Croatian Bureau of Statistics in the Annual Report on the Employees and Wages. Key data refer to the distribution of the employees according to the amount of the net wage paid out (grouped in 13 wage grades) which are available for 79 sectors at 2-digit N.A.C.E. classification. Unfortunately, the data are available only for the distribution according to the net wage, that is, after-tax wage, while the minimum wage is defined in gross terms. That is not a particular problem in 2015 because gross minimum wage is not taxed by income tax, but only subject to a 20% contribution to the pension fund. However, the distribution of employees by wage grades (wage brackets), where the first (the lowest) bracket is defined to cover all full-time employees with the net wage of up to 2,500 kunas is seen as an issue. In March 2015 the minimum wage in net terms was 2,424 kunas. Therefore, the threshold of 2,500 kunas for the first wage grade is about 3% higher than the minimum wage. For the purpose of our analysis and the assessment of the number of workers on minimum wage, this threshold is treated as the minimum wage.

The data on the distribution of the employed according to the amount of their net wage are complemented by detailed data on wages and employment across qualifications from the same source.

It is our aim to select the low-wage sectors based on clear criteria. Since there are no generally accepted criteria in the literature that we are aware of, the criteria were defined on the basis of data available for Croatia and respecting two goals. First, we wanted to obtain from 10 to 15 low-wage sectors. This was considered a reasonable number of sectors that should cover majority of minimum wage workers in Croatia, enabling at the same time

focus on the key sectors. The second goal was to have criteria that can ensure stability of the selection of sectors over time. We wanted to avoid the situation where a small relative change in employment or wages in a sector results in change of its low-wage status.

Bearing in mind the goals and data availability, we defined the following criteria for the selection of low-wage sectors:

- (a) More than 8% of workers in that sector receive minimum wage (below 2,500 kunas net),
- (b) The sector has at least 1% of the total number of workers on minimum wage,
- (c) The ratio of minimum wage to the sector median wage is higher than 60%,
- (d) The ratio of minimum wage to the sector average wage is higher than 50%.

The criteria and limits were set after preliminary testing on data for 2015 as well as for earlier years in order to check stability of selection of low-wage sectors over a longer time. Application of these criteria in 2014 and 2015 identified exactly the same low-wage sectors.

The share of minimum wage workers (criterion (a)) is the first indicator that was consulted in order to identify low-wage sectors. However, we wanted to avoid focusing on sectors with a rather small number of minimum wage workers. Therefore, the second criterion was introduced, according to which each sector needs to have at least 1% of the estimated total number of minimum wage workers in Croatia. Some sectors may be sectors with high productivity and high wages, with some segments employing minimum wage workers (for example, cleaners in a high-tech sector). These sectors cannot be treated as low-wage sectors. This was the reason for the introduction of the criteria stating that the minimum wage in the whole sector has to make up more than 60% of the sector median and more than 50% of the average sector wage. Fulfilment of these criteria means that relatively large number of employees receives wages that are relatively close to the minimum wage. Minimum wage policy is of high importance for sectors satisfying these criteria.

All four criteria were satisfied in 13 sectors. Table 1 shows these sectors as well as the main indicators that served as the basis for their selection.

Low-wage sectors can be separated into two groups in which the influence of minimum wage on business operations might be different. The first group is made of six sectors in the manufacturing (processing) industry where a large part of revenues is realised from exports. This group of industries/sectors is called the tradable sector. It is a sector whose products are exposed to strong international competition, the prices of the products are most often defined on the global market, and the producers are usually not able to pass through their increased operation costs onto prices of their products. This group consists of the textile industry, clothing industry, leather goods industry, wood and wooden products industry, furniture industry and rubber and rubber products industry.

The remaining seven low-wage sectors are dominated by production of goods and services for the domestic market and can therefore be considered the non-tradable sector. The non-tradable sector is very little or not at all exposed to international competition. In the case of minimum wage increases, it will equally affect all business entities in the sector so that the increase can eventually be covered by an increase of the product price. This does not necessarily mean that it is bound to happen, but the option of increased price of the final product or service remains open since all the producers in the sector face the same minimum price of labour input. The minimum wage can influence employment and profitability of the non-tradable sector even if the wage cost increase due to rising minimum

**Table 1.** Low-wage sectors in Croatia.

Nr.	Code (Nace Rev.2)	Sector	Share of minimum wage (M.W.) workers in the sector* (March 2015)	Share of M.W. workers in the sector in total number of M.W. workers** (March 2015)	Minimum-to-median wage in net terms*** (March 2015)	Minimum-to-average wage in net terms (2015 avg.)
1	13	Manufacture of textiles	17.8%	1.1%	77.9%	62.2%
2	14	Manufacture of wearing apparel (clothing)	23.5%	6.0%	84.0%	78.5%
3	15	Manufacture of leather and related products	18.2%	3.3%	79.1%	76.2%
4	16	Manufacture of wood and of products of wood	15.7%	3.2%	75.6%	69.3%
5	22	Manufacture of rubber and plastic products	8.1%	1.1%	61.7%	54.7%
6	31	Manufacture of furniture	15.8%	2.1%	71.8%	63.7%
7	41	Construction of buildings	15.9%	6.0%	70.5%	57.5%
8	43	Specialised construction activities	13.1%	4.3%	62.8%	52.5%
9	47	Retail trade, except of motor vehicles	8.7%	13.1%	70.3%	56.5%
10	56	Food and beverage services	12.4%	2.8%	69.2%	57.7%
11	80	Security and investigation activities	16.5%	3.8%	82.8%	76.7%
12	81	Services to buildings (cleaning etc.)	26.3%	3.6%	79.2%	72.1%
13	96	Other personal services	22.0%	1.2%	72.1%	53.8%
1-13		Low-wage sectors	13.5%	51.7%	72.9%	60.4%
1-6		-tradable sectors	17.3%	16.8%	77.2%	68.7%
7-13		-non-tradable sectors	12.2%	34.9%	71.1%	58.0%
		Croatia – all sectors	5.4%	100.0%	49.4%	42.4%

\* The share of low-wage workers related to the percentage of workers in the sector that received less than 2,500 kunas net in March 2015 and realised between T60 and 200 paid hours.

\*\* The estimated share of low-wage workers in the sector within the total number of low-wage workers in Croatia refers only to incorporated entities (without workers employed by crafts or self-employed) and workers who realised between 160 and 200 paid hours in March 2015.

Source: Authors' estimates based on data from The Croatian Bureau of Statistics, [https://www.dzs.hr/default\\_e.htm](https://www.dzs.hr/default_e.htm).



wage is fully passed to prices, because demand in the sector may be reduced depending on demand elasticity. The non-tradable sector is composed of construction activities (construction of buildings and specialised activities in construction), retail trade, catering, security, building maintenance (mostly cleaning) and other personal services (hairdressers as well as dry cleaning or beauticians).

It seems that the low-wage sectors are similar in different economies, which would mean that they are more the result of trends in the global economy and less of country-specific developments. For the United Kingdom, for example, the Low Pay Commission (2015, p. 307) identified the following low-paying industries and occupations: retail trade, hospitality, social care, food processing, cleaning, textile and clothing, security, hairdressing, childcare, transport, etc. We can see that the identified sectors are similar to those in Croatia. What is peculiar to Croatia is the construction industry being classified among the low-wage sectors. The construction industry is not a typical low-wage sector because it is a sector with high capital intensity. However, in Croatia, the low level of capital equipment seems to be compensated with low wages, and there is a large number of workers on minimum wage.<sup>6</sup> However, it may also be a reflection of the strong influence of the prolonged recession in the construction sector, so it is possible that in years to come the construction industry will no longer be in the low-wage sectors list.

#### **4. Main indicators of the importance of minimum wage for low-wage sectors**

In March 2015 in Croatia, 5.4% of employees in legal entities received the minimum wage, that is, wage lower than 2,500 kunas net (Table 1). It should be noted that those employed in crafts and the self-employed are not covered by this estimate, because of missing wage data on that segment of the labour market.

The sectors with the highest share of workers on minimum wage are maintenance services (cleaning) of buildings, where the 26.3% of the employed received minimum wage or less (2,500 kunas net), followed by the clothing industry with 23.5% of workers on minimum wage and other personal services (hairdressing and similar) with 22% of employees. Although the retail trade does not have high proportion of minimum wage workers (8.7%), this sector is important for our consideration because of a large number of employees and consequently the large number of minimum wage workers (13% of all minimum wage workers in Croatia). In recent years, the production of rubber and plastic products has recorded significant increases in the average and the median wage, and is on the right track to cease being a low-wage sector soon. However, in our classification, it still meets all the selected criteria. The construction of buildings and specialised construction activities are estimated to have a relatively large proportion of minimum wage workers in 2015. Construction is a very important sector because it employs a large number of workers. Over 10% of all minimum wage workers in Croatia come from these two sectors within the construction industry (6% in building construction and 4.3% in specialised construction activities).

The selected 13 activities employ more than 50% of all minimum wage workers in Croatia, demonstrating that focusing the research into the effects of the minimum wage on these sectors could pinpoint key effects important for the whole economy.

The largest ratio of minimum to average wage is in the clothing industry, at 78.5%. This shows that the largest share of the employed in this sector has low wages, even in cases when

they are above minimum wage. Other sectors with large ratios of minimum to average wage are security and the leather and wood processing industry. In total, in export sectors with low wages, minimum wage makes up for almost 69% of the average wage. In that sense, the exporting sectors are in a much more sensitive position than the non-tradable sectors, which have a ratio of about 58%.

The median net wage in Croatia in March 2015 was estimated to 4,903 kunas and the share of the minimum wage in the median was estimated as 49.4%. Although there are no official data on the median wage in Croatia, for the needs of the research the median net wage was estimated on the basis of data from the Croatian Bureau of Statistics on the distribution of the employed in legal entities who worked full time (160–200 h) across wage grades characterised by its lower and upper bound. Experience shows that within most wage grades (except the lowest and the highest) there is linear distribution of wages.<sup>7</sup> In our calculations, we assume linear distribution within the wage grade in which the median is found and estimated the median accordingly. In the clothing industry the median was estimated at 2,887 kunas, meaning that the minimum wage was 84% of the median (the highest of all sectors). This means that 50% of the workers in this sector receive a wage that falls somewhere in the very tight range between minimum wage and the median. Each change in the minimum wage in this sector would affect a large number of workers. The minimum wage in the selected low-wage activities was at the level of 73% of the median, at which the share in the tradable sector is around 77%. This all shows that besides a large number of minimum wage workers, there is also large number of workers whose wage is just above minimum wage.

Comparison between the tradable and non-tradable sectors reveals that the tradable sector is under a stronger influence of low wages, that is, the minimum wage policy. The tradable sector has much lower median wage (see Table 4), a larger proportion of workers on minimum wage and a stronger wage compression at the lower part of the wage distribution (smaller difference between minimum wage and the median, i.e. the average wage).

Wage compression around the minimum wage is an important feature for assessment of the potential effects of minimum wage by sector. We have considered using a specific indicator for identification of the low-wage sectors based on this feature in a dynamic context. The idea is to apply future increases in the minimum wage to the wage distribution in the base year and estimate the wage bill increase under the assumption that all the affected workers receive the new minimum wage. Such potential wage bill increases caused by a minimum wage hike may serve as indication of the impacts of minimum wage by sectors.<sup>8</sup> In application of this approach, we took data on distribution of net wages in March 2013 and estimated the rise in the wage bill if the minimum wage rose to the net level of HRK 2500 (the level actually attained in 2016) and assume that all affected people have their wages increased to the new minimum. For each sector we calculated the expected wage increases in proportion to the existing wage bill. It appeared that the resulting list of the most affected sectors is highly similar to the list of low-wage sectors identified by our four-criteria approach. The list of 15 sectors with the highest wage bill increases include all 13 sectors identified by our approach, but also 'other manufacturing' and 'other professional and technical activities'. In our approach, both sectors are excluded on the bases of small number of minimum wage workers (less than 1% of total). As these two sectors have no clear designation of activities and are of 'other' or 'not elsewhere classified' type including differing activities, we have concluded that their possible inclusion in the list would not add

anything significant to our understanding of low-wage sectors. However, the result of this alternative approach is one more indication that our approach correctly identifies sectors the most affected by the minimum wage policy.

## 5. Employment indicators in low-wage sectors

Although the low-wage sectors employ just about 21% of workers, as shown by Table 2, these sectors employ over a half of the total number of minimum wage workers in Croatia (Table 1). Some of low-wage sectors employ less than 1% of the total number of workers, but each of these sectors has at least 1% of the total number of minimum wage workers.

Low-wage sectors, especially the tradable sectors, employ relatively more low-skilled workers than is the average for Croatia or for the business sector, and have considerably fewer workers with a college education (university and non-university degree). Table 2 shows that, for example, in March 2015 in the low-wage tradable sectors, there were 24% of workers with low qualifications (unskilled, semi-skilled and basic school education) while the average for the manufacturing industry was 17%, and 10% for the whole economy. The share of workers with college education in the low-wage sectors was 10% (7% in the tradable low-wage sectors), while the economy-wide average was 32%. Low-wage sectors, especially non-tradable sectors, have a large share of employees with secondary school education, considerably more than the economy average.

During the recent economic crisis, many jobs were lost among skilled manual workers and low-skilled workers.<sup>9</sup> The loss of such jobs was even higher in the low-wage sectors. Table 3 shows actual employment changes by qualification. In an attempt to link employment changes with the minimum wage policy, the period under examination is divided in two sub-periods: (i) March 2009 to March 2013 and (ii) March 2013 to March 2015. In the first period the minimum wage level was not unchanged in nominal terms.<sup>10</sup> That was also the time of the continued deep recession in Croatia. In the second period, the minimum wage level increased by 7.7%, with an inflation rate in the same period of -0.3% and G.D.P. close to stagnation (mild declines in 2013 and 2014 and moderate rebound in 2015).<sup>11</sup>

Total job losses were stronger in the first recessionary period than in period 2013–2015. Low-wage sectors fared worse than the economy as a whole. However, in the second period total employment in the low-wage sector stagnated, or even increased in the tradable low-wage sector, while other sectors seem to continue with employment decline, although at a slower pace than before. These basic figures support the conclusion that the change in minimum wage pace from stagnation in the first period to elevation in the second period did not play the key role in employment developments in general. However, it may have had some influence on the composition of the employment by qualification level, although the simple tabulation of employment changes in Table 3 does not allow us to confirm (or reject) this indication with certainty. In the low-wage sectors, the period of minimum wage increases (March 2013 to March 2015) was characterised by a reduction in the number of low-skilled and skilled manual workers and increases in the number of workers with secondary and tertiary education. Although skills upgrading may be an effect of the rising minimum wage, it may also be the result of a long-term development trend in the low-wage sectors, because it was also evident in the previous period. Also, skills upgrading of similar magnitude was present in other sectors, as shown in Table 3 for manufacturing, the business sector and the entire economy.

**Table 2.** Employment in low-wage sectors by qualification, March 2015.

Sector	Share of sector employment in overall employment	Employment structure by qualification (share in overall sector employment)			
		College education	Second. school	Skilled manual	Low-skilled
Manufacture of textiles	0.3%	9%	56%	10%	24%
Manufacture of wearing apparel (clothing)	1.3%	7%	55%	15%	24%
Manufacture of leather and related products	1.0%	4%	54%	11%	31%
Manufacture of wood and of products of wood	1.1%	6%	56%	12%	27%
Manufacture of rubber and plastic products	0.7%	14%	62%	10%	15%
Manufacture of furniture	0.7%	10%	56%	19%	15%
Construction of buildings	2.0%	14%	39%	25%	23%
Specialised construction activities	1.7%	13%	58%	18%	10%
Retail trade, except of motor vehicles	8.4%	11%	76%	8%	5%
Food and beverage services	1.2%	6%	70%	12%	12%
Security and investigation activities	1.3%	5%	89%	4%	2%
Services to buildings (cleaning etc.)	0.8%	8%	44%	6%	42%
Other personal services	0.3%	8%	66%	9%	17%
Low-wage sectors	20.9%	10%	65%	12%	14%
-tradable sectors	5.1%	7%	56%	13%	24%
-non-tradable sectors	15.8%	11%	68%	11%	10%
Manufacturing (sector. C in Nace)	18.5%	15%	53%	16%	17%
Business sectors (sector. B-N in Nace)	66.1%	22%	56%	11%	11%
CROATIA – all sectors	100.0%	32%	50%	9%	10%

Note: The structure refers to all workers employed in legal entities.

Source: Croatian Bureau of Statistics (Statistical Report No. 1574).

The employment developments in the low-wage tradable sectors have differed from those in the non-tradable sectors and in the economy as a whole. Tradable sectors mainly rely on external demand that has been mainly increasing since 2009, while the non-tradable sectors depend on domestic demand that was on the decline over almost the entire period

**Table 3.** Employment changes in low-wage sectors, by qualification (in %).

Sector	March 2009–March 2013					March 2013–March 2015				
	Total	College educ.	Second. school	Skilled manual	Low-skilled	Total	College educ.	Second. school	Skilled manual	Low-skilled
Manufacture of textiles	-23%	-15%	-15%	-35%	-30%	-14%	-16%	-4%	-23%	-28%
Manufacture of wearing apparel	-30%	-30%	-13%	-51%	-39%	-3%	6%	1%	-13%	-5%
Manufacture of leather products	-1%	19%	21%	-20%	-15%	25%	31%	40%	1%	12%
Manufacture of wood	-15%	-8%	-5%	-28%	-23%	9%	12%	23%	-9%	-4%
Manufacture of rubber and plastic	-23%	-1%	-16%	-44%	-36%	10%	7%	17%	-4%	-3%
Manufacture of furniture	-20%	-4%	-15%	-19%	-36%	-13%	4%	-3%	-26%	-32%
Construction of buildings	-44%	-29%	-45%	-43%	-49%	-12%	-1%	-3%	-21%	-21%
Specialised construction activities	-32%	-12%	-25%	-45%	-46%	-4%	5%	2%	-12%	-25%
Retail trade, except motor vehicles	-14%	-2%	-9%	-38%	-35%	1%	8%	3%	-18%	-10%
Food and beverage services	-19%	28%	-14%	-33%	-33%	12%	-1%	21%	-8%	2%
Security and investigation activities	0%	8%	1%	-9%	-12%	7%	9%	11%	-6%	-50%
Services to buildings (cleaning etc.)	0%	21%	34%	-23%	-19%	-2%	9%	-1%	-16%	-3%
Other personal services	-22%	3%	-21%	-38%	-21%	-8%	-12%	-5%	-27%	-5%
Low-wage sectors	-21%	-8%	-13%	-39%	-35%	0%	5%	6%	-16%	-11%
-tradable sectors	-20%	-11%	-8%	-37%	-30%	3%	7%	12%	-13%	-6%
-non-tradable sectors	-22%	-8%	-14%	-40%	-39%	-1%	5%	4%	-17%	-14%
Manufacturing (sector C in Nace)	-18%	-4%	-8%	-32%	-31%	-2%	1%	6%	-17%	-10%
Business sectors (sectors B-N)	-17%	-1%	-12%	-33%	-32%	-2%	3%	2%	-17%	-13%
CROATIA – all sectors	-12%	3%	-10%	-31%	-28%	-2%	4%	1%	-16%	-13%

Note: Without employed in legal entities that have less than 10 employed.  
Source: Croatian Bureau of Statistics (Statistical reports No. 1419, 1526 and 1574).

under examination. Differing demand trends may have caused differing responses in terms of employment by these two broad sectors despite being faced by the same minimum wage 'shocks'. Tradable sectors reduced skilled manual and low-skilled employment by less and increased employment of secondary school-level workers by more than the non-tradable sectors in period 2013–2015. In that period manufacturing of leather products even increased employment of all types of qualification. Employment growth and relatively small reduction of low-skilled employment in that period was seen in manufacture of wood, manufacture of rubber and plastic, and food and beverage services.

Diverse employment trends across sectors according to qualifications resulted in the change of the structure of employment, with an increasing share of better-educated workers and a declining share of skilled manual and low-skilled workers. Without detailed investigation of the trends and preferably the use of firm-level micro data, which are both beyond the scope of this paper, it is not possible to assess whether it was the crisis itself that contributed to such trends or whether it was a long-term trend of development of the structure of qualifications, or whether it was caused, and to what extent, by the minimum wage policy.

## 6. Wage dynamics in low-wage sectors

Discussion of wage dynamics by sectors is usually focused on developments of the average wage. In the context of the low-wage sectors, it will be useful to broaden the interest to changes in the median wage and changes in the proportion of minimum wage earners. We have estimated both indicators on the basis of Croatian Bureau of Statistics data on the distribution of employees by wages using the same assumptions as in case of the selection of low-wage sectors. Table 4 presents the results for March 2009, March 2013 and March 2015. Comparison of changes between these time points can give an insight into development in two distinct periods regarding the minimum wage policy comparable to the discussion of employment changes above.

In March 2015, the lowest median net wage was in the clothing industry (2,887 kunas) and security activities (2,929 kunas). It seems that these two sectors are potentially the most exposed to the influence of future changes of the minimum wage because the minimum-to-median wage ratio is over 80% (Table 1), showing that in these two sectors half of the workers receive a wage that is very close to minimum wage.

Median wage has increased in all sectors of the economy even in the period of serious recession (except in security and construction in 2009–2013), and even more strongly in period of consolidation (2013–2015). Minimum wage was stagnant in the first period, with the exception of the increase of 2.4% in June 2009. The median wage in the low-wage sector taken as a whole increased at approximately the same rate. In the second period minimum wage increased cumulatively by 7.7%, while the median wage in low-wage sectors increased by 7.4%. Similar magnitudes of changes in the median wage and the minimum wage in low-wage sectors may indicate the importance of minimum wage policy for overall wage dynamics in these sectors. This indication may find additional support in the more moderate increases in the median wage in the business sectors and the economy as a whole in the second period, presumably because of lower importance of minimum wage hikes for other sectors.

The relatively strong increase in the median wage in the tradable low-wage sector in the second period (10.9%) is connected to the change in the qualification structure of employees.

**Table 4.** Estimation of median wage and the proportion of minimum wage workers in low-wage sectors.

Sector	Median (net wage in kn)			Change in median		Proportion of minimum wage workers in the sector		
	March 2009	March 2013	March 2015	2009–2013	2013–2015	March 2009	March 2013	March 2015
Manufacture of textiles	2,720	2,948	3,110	8.4%	5.5%	19.7%	14.1%	17.8%
Manufacture of wearing apparel (clothing)	2,433	2,548	2,887	4.8%	13.3%	32.0%	21.3%	23.5%
Manufacture of leather and related products	2,507	2,700	3,064	7.7%	13.5%	22.7%	17.3%	18.2%
Manufacture of wood and of products of wood	2,756	2,992	3,206	8.6%	7.1%	18.2%	11.6%	15.7%
Manufacture of rubber and plastic products	3,486	3,503	3,926	0.5%	12.1%	8.3%	7.8%	8.1%
Manufacture of furniture	2,945	3,006	3,376	2.1%	12.3%	15.5%	15.2%	15.8%
Construction of buildings	3,245	3,223	3,438	–0.7%	6.7%	13.6%	10.7%	15.9%
Specialised construction activities	3,390	3,484	3,862	2.8%	10.9%	11.8%	9.4%	13.1%
Retail trade, except of motor vehicles	3,185	3,281	3,446	3.0%	5.0%	9.3%	6.8%	8.7%
Food and beverage services	2,890	3,204	3,504	10.9%	9.3%	17.0%	10.1%	12.4%
Security and investigation activities	2,850	2,773	2,929	–2.7%	5.6%	6.3%	12.7%	16.5%
Services to buildings (cleaning etc.)	2,836	2,998	3,060	5.7%	2.1%	22.2%	15.7%	26.3%
Other personal services	2,800	3,066	3,360	9.5%	9.6%	22.0%	13.5%	22.0%
Low-wage sectors	3,032	3,097	3,326	2.1%	7.4%	13.9%	10.5%	13.5%
-tradable sectors	2,766	2,829	3,138	2.3%	10.9%	21.3%	15.4%	17.3%
-non-tradable sectors	3,149	3,218	3,408	2.2%	5.9%	11.7%	9.0%	12.2%
Manufacturing (sector C in Nace)	3,700	3,955	4,163	6.9%	5.3%	9.2%	6.5%	7.8%
Business sectors (sectors B-N in Nace)	4,082	4,318	4,510	5.8%	4.4%	7.2%	5.4%	7.0%
CROATIA – all sectors	4,453	4,730	4,903	6.2%	3.7%	5.8%	4.2%	5.4%

Note: Estimation of median refers to the monthly net wage for 160–200 work hours.

Source: Authors' estimates based on Croatian Bureau of Statistics data on distribution of employees by net wage (First releases nr 9.2.5., published on 22 March 2010, 25 March 2014 and 12 April 2016).

On the one hand, there is qualification upgrade in these sectors, as shown in Table 3. On the other hand, it is possible that there is a shortage of manual workers willing to work for a very low wage, and wage increases for such workers in these sectors (Table 5) are not only caused by minimum wage pressure but also by labour supply considerations.

**Table 5.** Average gross wage growth in low-wage sectors, by qualification (in %).

Sector	2009–2012					2012–2015				
	Total	University educ.	Second. school	Skilled manual	Unskilled	Total	University educ.	Second. school	Skilled manual	Unskilled
Manufacture of textiles	2.9	-5.6	2.9	9.1	3.8	7.2	9.2	2.8	5.1	10.8
Manufacture of wearing apparel	-0.2	-2.8	-0.8	-0.6	3.3	8.4	3.3	9.4	10.7	7.3
Manufacture of leather products	4.0	-11.1	4.1	0.7	5.4	9.2	-0.7	8.3	6.8	12.8
Manufacture of wood	4.3	-0.8	3.1	3.1	6.0	8.4	-1.5	5.7	10.7	12.7
Manufacture of rubber and plastic	2.6	4.5	-0.1	6.5	2.6	6.6	-4.4	5.8	6.5	5.0
Manufacture of furniture	1.6	-3.4	-0.1	6.4	6.4	13.0	6.7	11.6	5.7	15.8
Construction of buildings	-5.0	-12.6	-4.8	-6.5	-6.1	4.7	-7.8	0.0	8.6	2.1
Specialised construction activities	-0.5	-6.8	-3.6	-3.7	-3.3	7.3	1.9	7.2	2.6	9.7
Retail trade, except motor vehicles	2.3	-1.4	1.9	0.8	-21.2	2.3	-2.3	0.2	19.3	4.9
Food and beverage services	-0.1	-8.6	-1.3	2.7	-11.5	7.0	-0.6	4.8	13.6	16.4
Security and investigation activities	-7.8	-15.1	-6.2	-18.2	-12.7	2.8	10.2	2.1	8.6	-0.9
Services to buildings (cleaning etc.)	-5.6	-3.3	-9.5	-7.3	-4.7	6.1	-5.9	-2.3	30.4	2.9
Other personal services	2.6	7.7	-0.4	9.6	-17.2	1.5	-11.4	7.5	-7.6	14.2
Low-wage sectors	0.3	-3.6	-0.3	-0.8	-4.5	4.8	-2.1	2.4	11.8	8.1
-tradable sectors	2.3	-1.1	1.2	2.7	4.8	8.9	0.6	7.8	8.6	10.9
-non-tradable sectors	-0.2	-4.1	-0.6	-2.2	-11.4	3.6	-2.7	1.4	13.2	5.5
Manufacturing (sector C in Nace)	2.9	0.2	0.4	1.7	4.5	6.3	9.6	2.8	6.2	6.4
Business sectors (sectors B-N)	2.5	0.5	0.5	-0.3	0.5	4.1	2.3	2.4	5.3	5.5
CROATIA – all sectors	2.7	0.0	-0.4	1.0	0.4	1.5	-2.3	0.0	2.9	3.7

Note: The average wage refers to the employed in legal entities who worked all 12 months and without legal entities with less than 10 employees for which no reports were delivered to the Croatian Bureau of Statistics.

Source: Calculations based on data of the Croatian Bureau of Statistics (Statistical reports No. 1449, 1549 and 1603).



Change in the proportion of minimum wage workers reflects minimum wage developments between the time points considered. Between March 2009 and March 2013, there was no change in the level of minimum wage, other than a small one in June 2009. But median wage and the average wage (Table 5) continued to increase in that period, causing a declining proportion of minimum wage workers, from 5.8% to 4.2%, for the overall economy and from 13.9% to 10.5% in the low-wage sector. Between March 2013 and March 2015 there were several increases in minimum wage level higher than the average wage increase and the proportion of minimum wage workers among all works increased, from 4.2% to 5.4% for the overall economy and from 10.5% to 13.5% in the low-wage sector. The rising share of minimum wage workers was broad based and found in all sectors under consideration. Wage developments by qualification level may give an additional insight in the channel of minimum wage influence on overall wage developments. The available data for Croatia are only for the average wage by sector, and only presented as year-average for workers employed the entire year. Table 5 shows changes in the average wage divided into two sub-periods that correspond best to the periods examined above when we looked at developments of the median wage and employment by qualification.<sup>12</sup>

The crisis period (2009–2012) saw wage declines or some mild increases in the average wage for all qualification levels, while in the subsequent period there was moderate increase in the average wage. In the low-wage sectors, the first period was characterised by the decline in the average wage for each qualification level. However, as there was a higher decline in employment for skilled and unskilled manual workers than for workers with secondary and tertiary qualifications that have higher wages (see Table 3), the average wage in the entire sector did not decline. It is interesting to note the difference in wage developments by qualification between tradable low-wage sectors and non-tradable low-wage sectors. In the tradable sectors, in both periods, workers with lower education experienced wage increases larger than workers with higher education. In the non-tradable sector this was observed only in the second period, while in the first period unskilled labour experienced a huge wage decline. It is likely that in the first period strong decline in domestic demand dominantly determined wage development in the non-tradable sector, while in the second period, with the stabilisation of domestic demand, minimum wage hikes had a significant influence on the development of wages for skilled and unskilled manual workers in both the tradable and non-tradable sectors. Also, it appears that external demand supported more broad-based wage increases in the tradable low-wage sectors, particularly in the second period, that are coupled with skills upgrade (Table 3). It is worth noting that a higher wage increase for manual workers than for medium and highly educated workers is recorded in business sectors as well as for the entire economy. This trend points to the possible influence of the rising minimum wage on the broader economy, not only on the low-wage sectors, but a possible emergence of a shortage of skilled and low-skilled manual workers cannot be excluded, as suggested by anecdotal evidence.

The combination of wage and employment developments has changed the sectoral composition of minimum wage workers. Table 6 shows the estimated proportions of minimum wage workers in March 2009, March 2013 and March 2015. The low-wage sectors, as identified by our procedure, employed more than half of all minimum wage workers in the economy. However, there is continuous decline in the proportion of minimum wage workers in the tradable low-wage sector. In March 2009 around 20% of minimum wage workers in Croatia were employed in six industries of that sector (textile industry, clothing industry,

**Table 6.** Distribution of minimum wage workers by sector.

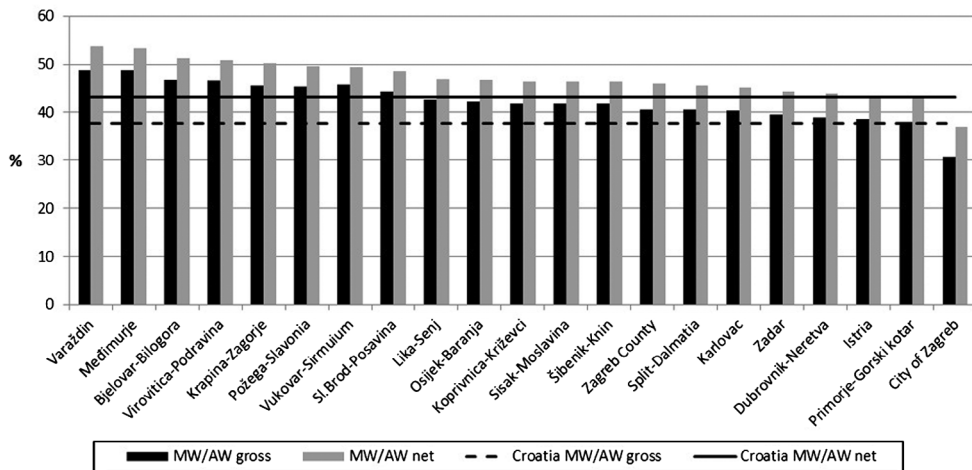
Sector	Proportion of minimum wage workers employed in the sector (Croatia=100%)		
	March 2009	March 2013	March 2015
Low-wage sectors	55.2%	50.8%	51.7%
-tradable sectors	19.7%	18.0%	16.8%
-non-tradable sectors	35.5%	32.8%	34.9%
Manufacturing (sector. C in Nace)	30.8%	29.3%	27.4%
Business sectors (sector. B-N in Nace)	88.8%	84.8%	87.1%
CROATIA – all sectors	100.0%	100.0%	100.0%

Source: Authors' estimate base on Croatian Bureau of Statistics' data (Statistical reports No. 1419, 1526 and 1574).

leather goods industry, wood and wooden products industry, furniture industry and rubber and rubber products industry). In March 2015 this proportion fell to around 17%. As the proportion of minimum wage workers within the tradable low-wage sector fell by the same amount, it appears wage developments and skills upgrade were major factors behind this, while higher-than-average employment decline can explain a part of the declining share of minimum wage workers in the period up to March 2013, but not in the period between March 2013 and March 2015. The non-tradable low-wage sectors increased the proportion of minimum wage workers in spite of employment decline, meaning that minimum wage policy had increasing importance for this sector, with a rising proportion of minimum wage workers within the sector (Table 6).

## 7. Minimum wage in regional perspective

There are significant regional differences in Croatia in terms of average gross and net wages, shown in Figure 2 and Table 7. The lowest average gross and net wages are in Varaždin and



**Figure 2.** Minimum to-average gross and net wage ratios by counties, 2013 (in %). Source: Minimum wage according to relevant legislation and Central Bureau of Statistics data on wages (Statistical Report nr. 1549). Notes: Calculated with minimum wage from June 2013 and average monthly wage by counties in 2013 for workers who worked through all 12 months.

**Table 7.** Basic indicators on wages and low-wage employment shares by counties.

	Average gross wage in 2013*	Average net wage in 2013*	Minimum gross to average gross wage ratio, 2013	Minimum net to average net wage ratio, 2013	Share of low-wage workers (<2.500 kn), March 2014	Share of employment in low-wage sectors, 2013**	
						Total	Tradable sectors
Croatia	7,926	5,507	38%	43%	6.2%	20.4%	5.2%
Zagreb	7,358	5,165	41%	46%	6.5%	18.9%	4.5%
Krapina-Zagorje	6,555	4,725	46%	50%	11.3%	27.7%	15.0%
Sisak-Moslavina	7,134	5,119	42%	46%	6.4%	17.4%	5.5%
Karlovac	7,382	5,275	40%	45%	4.3%	19.2%	6.3%
Varaždin	6,118	4,429	49%	54%	10.2%	39.0%	26.5%
Koprivnica-Križevci	7,123	5,116	42%	46%	7.8%	19.0%	5.9%
Bjelovar-Bilogora	6,382	4,626	47%	51%	11.4%	25.1%	12.8%
Primorje-Gorski kotar	7,865	5,518	38%	43%	4.7%	19.9%	3.8%
Lika-Senj	7,016	5,061	43%	47%	6.1%	17.3%	4.8%
Virovitica-Podravina	6,423	4,676	46%	51%	9.2%	24.8%	15.0%
Požega-Slavonia	6,574	4,797	45%	50%	7.2%	21.1%	9.8%
Slavonski Brod- Posavina	6,750	4,887	44%	49%	9.7%	21.4%	7.6%
Zadar	7,546	5,364	40%	44%	4.8%	18.5%	1.1%
Osijek-Baranja	7,055	5,076	42%	47%	6.3%	19.5%	6.0%
Šibenik-Knin	7,124	5,120	42%	46%	4.9%	16.3%	0.6%
Vukovar-Sirmium	6,538	4,799	46%	49%	8.6%	21.1%	9.1%
Split-Dalmatia	7,366	5,215	41%	46%	6.8%	22.1%	2.2%
Istria	7,743	5,456	39%	44%	4.4%	16.9%	2.7%
Dubrovnik-Neretva	7,661	5,407	39%	44%	5.4%	17.3%	0.3%
Medimurje	6,117	4,460	49%	53%	9.9%	36.2%	19.9%
City of Zagreb	9,694	6,437	31%	37%	4.7%	17.1%	1.0%

Notes: We highlighted the counties in which minimum wage is estimated to have the largest impact on the economy (low-wage counties).

\* For workers who worked 12 month in legal entities.

\*\* Shares in total employment for workers who worked 12 month in legal entities. Low-wage sectors are defined in Chapter 3.

Source: Croatian Bureau of Statistics (Statistical Report nr. 1549).

Međimurje counties, while the highest is in the City of Zagreb. The average wage in Croatia is under the dominant influence of wages in the City of Zagreb, and therefore it is not the best indicator for understanding the situation in other parts of Croatia. For example, the average gross wage in Croatia for 2013 was 7,926 kn but the average wage in 20 counties, other than in the City of Zagreb, was lower than that average. The share of the minimum wage in the average gross wage in Croatia was 38%, but that proportion was higher in all counties, except in the City of Zagreb. For example, in Varaždin and Međimurje counties the share was 49%. The ratio between minimum and average net wage in these two counties was 54% and 53%, respectively.

In order to identify counties that are most exposed to minimum wage policy, we considered four key criteria, similar to those for low-wage sector identification, but adapted to the available data. The following four criteria are suggested:

- (a) More than 8% of workers in the county receive minimum wage (less than 2,500 kunas in net terms),
- (b) The ratio between minimum and average net wage at county level is higher than 50%,
- (c) The ratio between employment in low-wage sectors and overall employment at county is higher than 20%,
- (d) The ratio between employment in tradable low-wage sectors and overall employment at county level is higher than 10%.

Relevant data by counties are shown in Table 7. By implementing the suggested criteria, we isolated five Croatian counties that are strongly exposed to minimum wage policy. These counties are Varaždin, Međimurje, Krapina-Zagorje, Bjelovar-Bilogora and Virovitica-Podravina. All of them are located in the northwest part of the Republic of Croatia. We will refer to them as low-wage counties.

When changing the minimum wage level one should pay attention to regional effects, especially for the above-mentioned counties. With lower average wages and larger share of low-wage workers, the structure of their economy is characterised by a relatively large share of workers who are employed in low-wage sectors that are inherently more exposed to minimum wage policy. It is important to note that in these counties tradable low-wage sectors make up a significant part of their economies. Tradable sectors are not in position to make a price spillover as a result of minimum wage increase (increase of their costs), which means that cost absorption should happen at microeconomic level, that is, at the expense of the company or its workers, which in turn means that the cost of adjustment remains at the local level.

## 8. Conclusion

In order to focus on the sectoral and regional effects of minimum wage in Croatia, this paper proposes a set of criteria to define low-wage sectors and by their implementation identifies 13 low-wage sectors. In these sectors, (a) more than 8% of workers receive minimum wage; (b) there is at least 1% of the total number of workers on minimum wage; (c) the ratio of net minimum and sector median wage is higher than 60%; and (d) the ratio of net minimum and average sector net wage is higher than 50%. The following sectors are found to be low-wage sectors: manufacture of textiles, manufacture of wearing apparel (clothing), manufacture of leather and related products, manufacture of wood and of products of

wood, manufacture of rubber and plastic products, manufacture of furniture, construction of buildings, specialised construction activities, retail trade, except of motor vehicles, food and beverage services, security and investigation activities, services to buildings (cleaning, etc.) and other personal services.

Low-wage sectors are divided into tradable and non-tradable sectors. For tradable sectors, the increase in costs caused by minimum wage hike cannot be passed on to consumers, while non-tradable sectors can do that, because they are not exposed to international competition and a minimum wage increase is applied to all competitors in the market. By taking into account wage indicators in these two low-wage sector groups it follows that the tradable low-wage sectors are under strong influence of minimum wage policy. The tradable low-wage sectors have lower average wages in comparison to the non-tradable low-wage sectors, a higher proportion of low-wage workers and greater wage compression (small difference between minimum and median or average wage). However, with more active minimum wage policy and its increasing level in the period after adoption of the 2013 Minimum Wage Law, the non-tradable low-wage sectors evidenced a rising proportion of minimum wage and a significant decline in employment of skilled manual workers and low-skilled works in general. Such a development calls for increased attention to these sectors in designing the minimum wage policy.

During the 2009–2014 recession Croatia underwent a significant structural change in sectoral employment and employment by educational attainment. At this moment, without a thorough study, it is not possible to understand more about the drivers of the change and their relative importance. It may be due to a long-term trend of education upgrade of the labour force, structural adjustments in the production processes, economic policy or, of interest for our study, as a result of minimum wage policy.

Disproportionally many jobs among skilled and low-skilled industrial workers were lost during the crisis 2009–2013, and that loss was most intense in low-wage sectors. Considerably fewer jobs were lost among workers with university degrees. In that case, also, the low-wage sectors fared worse than the average. Employment in low-wage sectors fell more than total employment at the national level. Still, that was not the case for tradable low-wage sectors, which had a somewhat better performance than the average manufacturing industry. For tradable low-wage sectors there has been a smaller employment decline than the industry average, especially for the employment of low-skilled workers. The increase in the average gross wage in the sector was comparable to the average growth for the entire economy in the crisis period, and even higher in the period of moderation of negative trends (2012–2015). One of the reasons is that these sectors were not so dependent on the depressed domestic market, but on the foreign, mostly European, market that went through fast recovery after the 2008–2009 shock and continued to grow in the following years. Another reason is structural adjustment, that is, education upgrade, as suggested by changes in the employment structure of the sector.

In this paper, we identified five counties in which the minimum wage is of great importance for the local economy. These are Varaždin, Međimurje, Krapina-Zagorje, Bjelovar-Bilogora and Virovitica counties. Their economies and employees are the most affected by the minimum wage policy as a result of high wage compression (high minimum-to-average wage ratio and minimum-to-median wage ratio), as well as the high proportion of low-wage workers.

Continuous monitoring of low-wage sectors and regions, particularly in regard to trends in employment, wages, productivity and profitability, should facilitate the decision-making process on minimum wage increase. In the consultation process regarding minimum wage policy, special attention should be given to representatives of social partners (trade unions, employers, local authorities) from low-wage sectors and regions. In this regard, we believe that this paper makes a small contribution towards the recognition of these sectors and regions.

## Notes

1. There have, however, been several studies of the effects. See for example Mrnjavac and Blažević (2014), Nestić (2010) and Šućur, Družić, Kletečki, and Babić (2015).
2. Banyuls, Grimshaw, Nestić, and Neumann (2013) and Bosch et al. (2013) analysed the situation in the retail and construction sectors, including examples for Croatia, by studying the minimum wage developments in the context of collective bargaining practice in these sectors. However, the impact on other sectors of the economy is not studied.
3. The first legal definition of minimum wage was stipulated by the Minimum Wage Act in 2008, and the new Act, which was passed in 2013, maintains the elements of the original definition. However, there was a stable characterisation of minimum wage even before its statutory regulation. The lowest wage a worker could receive for regular work was defined by the National Collective Agreement on the Lowest Wage from 1998. Immediately after conclusion of that agreement, the Government issued the Decision on the Extension of the National Collective Agreement on the Lowest Wage. That Decision made that collective agreement compulsory for implementation by all employers and all workers employed in Croatia. The lowest wage level determined by the agreement has de facto become the national minimum wage.
4. After Greece, Croatia had the longest period of recession in the E.U., with the G.D.P. continuously dropping in the period 2009–2014 with a cumulative drop of 12.6%; the unchanged minimum wage in that period should not come as surprise.
5. It is not unusual for the minimum wage coverage to be estimated by taking into consideration a threshold higher than the minimum wage. It can happen for various reasons, such as there being a large number of workers receiving wage just above the minimum while they are, in reality, a group that is directly under the influence of minimum wage trends. Eurostat reports on the share of workers with a wage below 105% of the minimum wage on the basis of the Structure of Earnings Survey. The last such available data are for October 2010, with Croatia having estimated coverage of 9.2% based on full-time employees older than 21 and working in business entities larger than 10 employees outside agriculture and public administration.
6. For a short discussion on this see Bosch, Nestić, & Neumann, 2013.
7. See Cowell, 1995.
8. The authors would like to thank an anonymous reviewer for the suggestion to test such approach in the dynamic context.
9. Official classification of workers' qualifications in Croatia is a mix of school-level attainment and vocational training completed. Here we use adjusted terminology to better comply with common understanding of qualifications. Low-skilled workers are those who are officially classified as 'unskilled', 'semi-skilled' and 'basic school education'. Skilled manual workers are those described as 'highly skilled' and 'skilled' in official statistics, although they are actually manual workers having completed specific vocational training and not highly educated personnel. Workers with secondary education have completed secondary education of general type, or vocational secondary education without being granted title of highly skilled or skilled worker. Workers with college education are those holding 'university' and 'non-university college degree'.



10. In fact, there was small increase of 2.4 % to 2,814 kunas in gross terms in June 2009, just equal to inflation rate at that period. That level was maintained until June 2013.
11. Data on employment according to qualifications and activities are available only for March each year. Data for earlier years (up to 2008) are available according to the older classification of activities which is not comparable with the actual classification.
12. Qualification levels presented in Table 5 are slightly different than those in Tables 2 and 3 in the discussion on employment composition, but broadly comparable. In Tables 2 and 3 similar qualifications recorded in official statistics are merged to form four groups. Table 5 presents original qualification levels as shown by the Croatian Bureau of Statistics for qualifications with the highest number of employees. For example, employees with a university education are the majority of employees with a college degree (others have non-university college degree). Similarly, unskilled manual workers are the largest group among the low-skilled workers.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

## ORCID

Danijel Nestić  <http://orcid.org/0000-0002-9434-6568>

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