Influence of minimum wage on labour market – case of Slovak Republic

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Abstract

For the health of whole economy it is important for the labour market to follow progressive trend – either by increase of work productivity or employment. Work productivity is an instrument that should be managed by employers directly. However employment is an indicator very important in policy decision making process, because it can be influenced by policy tools binding in code of laws. It appears, that one of the policy tools preventing unemployment rate to drop is minimum wage institute that influences labour market significantly. Minimum wage in Slovakia is given in "law of minimum wage" under the auspices of Ministry of Labour, Social Affairs and Family. It says (Law from year 2007) that minimum wage changes annually according to the agreement among social partners.

To quantify the influence of minimum wage institute on labour market, we used econometric modelling (ARMA structure, Granger causality) that confirmed relation between structured employment and minimum wage according to our expectations. We studied this relation on time series on quarterly data (1994Q1-2010Q4). The influence of minimum wage in Slovakia is apparent mainly in the branches characterized by lower gross wage than average in the whole economy (KZAM 4, 6, 7, 8, 9) with exception of the first occupational group. Structurally in those branches work more than half of all employees, which is one of the reasons why knowing relation between given policy tool and labour marked is crucial for policy decision making.

JEL Classification: J21, J31, C12, C22.

Keywords: minimum wage, causality, labour demand, occupational groups

Introduction

Since year 2000 Slovakia is experiencing a period of intensive economic growth. This growth culminated before crisis in 2007, where Slovakia reached two digit economic growth expressed by GDP indicator cleaned from inflation (10,5 % GDP growth in constant prices), the highest growth among EU countries. This growth is now reduced by the strike of economic crisis that influenced all areas of economy including labour market.

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For the health of whole economy it is important for the labour market to follow progressive trend – either by increase of work productivity or employment. Work productivity is an instrument that should be managed by employers directly. However employment is an indicator very important in policy decision making process, because it can be influenced by policy tools binding in code of laws. For the policy decision-making process it is crucial to understand the impact and relation between systematic parameters and macroeconomic indicators. This requirement is even stronger in the post-crisis time, when economy starts up slightly but employment rate doesn't react appropriately by its increasing. Economic growth should be supported by curative process and systematic changes.

One of that systematic parameter is minimum wage institute anchored in code of law under the auspices of Ministry of Labour, Social Affairs and Family. We examine its influence on employment for different occupational groups in this paper.

According to Charles Brown, Curtis Gilroy and Andrew Kohen in "The Effect of the Minimum Wage on Employment and Unemployment", they claim that increase in minimum wage affects negatively particularly teenage and young adult unemployment, but in terms of adult employees the effect is uncertain. David Card and Alan B. Krueger in their paper "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania" came to the conclusion that rise in minimum wage doesn't reduce the employment in studied sector. They actually found slightly positive impact of minimum wage on employment. In response to this David Neumark and William Wascher in paper "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania: Comment" re-evaluated Card and Krueger's findings and found exactly opposite outcomes that minimum wage raising has negative effect on labour demand. They reached similar result in "Employment Effects of Minimum and Subminimum Wages: Panel Data on State Minimum Wage Laws" earlier. However, Card and Krueger in their response "Minimum Wages and Employment: A case study of the Fast Food Industry in New Jersey and Pennsylvania: Reply" only somewhat softened the arguments from the original paper, the negative effect of the minimum wage is dismissed.

In the key part of this paper we discuss modelling approach to demonstrate relation between minimum wage and employment in Slovakia. This part is divided into four sub-parts. In the first sub-part we focus on data structure used by modelling with our expectation of mutual relationship. In the second sub-part is shown influence of minimum wage on partial employment by Granger causality. Third sub-part investigates influence of minimum wage on employment more deeply by using ARMA methods. In the last sub-part we compare main results from modelling. Elasticities were estimated from the economic equation, which enables us to compare size effects. After part of examined modelling approach, we discus validity of results linked to another possible factors that can influence employment in particular occupational group. In the last section we conclude our research. This paper has annexes with outcomes of testing (Eviews tables).

Modelling Approach

Data structure

For our study we have used total number of employees in major groups of occupation (KZAM) in the Slovak Republic quarterly for years 1994-2010. The data are obtained from the Statistical Office of the Slovak Republic using method of proportional estimate based on data from the Information System on Labour Costs (ISCP). This method was needed because of the Statistical Office keeping only data on number of people working in KZAM classification – that includes also entrepreneurs/sole-traders and self-employed, to whom the minimum wage doesn't apply.

The KZAM classification is based on ISCO-88 by International Labour Organization. It divides occupations into classes according to different character of work, complexity, responsibility and skill intensity required using six digit codes. We use only the major groups of occupation but it still offers very good information.

KZAM0 group contains only professional soldiers, thus we don't work with this group.

Legislators, senior and management employees are classified in **KZAM1**. For this group the level of education is not determined, the function of policy making and management are considered more important.They formulate and implement governmental policy, as well as other policies specific for different organizations. Employees in KZAM1 group create and modify the laws, rules and regulations; represent the government; organize and govern state offices in accordance with government policy or plan and coordinate the activities of organizations and enterprises, including their internal departments. First group of occupation is the second smallest group among all occupations (6,7% of all employees in 2010, see Figure 2). The average wage in this group (see Figure 1) as well as median wage is the highest in the economy (average wage in KZAM1 is more than two times higher than the average wage in economy). Median wage is below average, which is due to specific occupation in this group. As this group is characterised by the highest average wage, we don´t expect strong influence of minimum wage on the employment in this group.

Occupations requiring knowledge and skills, appropriate higher education (university degree or scientific qualification) are classified in **KZAM2**. Scientific employees and expert knowledge workers belong to this group. They increase the current level of knowledge; deal with the practical use of scientific or artistic concepts and theories and systematically gain and get familiar with new knowledge. Job description of employees in group KZAM2 usually involves analysis, research and development of theories, concepts and operation methods; consulting or application of the current knowledge from fields of natural sciences, agroforestry, social sciences, medicine, humanities, technical and related sciences. Job also include teaching theory and practice of one or more disciplines at a certain level of educational process; providing various legal, social and business services; artwork; spiritual support or preparing scientific papers. The second group of occupation has over 300 hundred thousand of employees, which is with KZAM8 the second largest group in economy (see Figure 2). Wage conditions in the occupations are decreasing with character and demands of work, complexity, responsibility and skill intensity required (For illustration see Figure 1), therefore the average wage in KZAM2 is the second best paid occupation in average (almost 1,3 times the average wage in economy). Median wage in KZAM2 is above the average wage in this group. Our expectation about the influence of minimum wage on the employment in this group is that the influence is rather not significant. Even in the economic crisis period the demand after

labour is still high enough (the unemployment rate in KZAM2 is the lowest among the group of occupations).

Occupations requiring knowledge and skills corresponding to the achieved secondary level of education or bachelor's degree are classified as **KZAM3**. Teaching and technical staff and employees in related fields belong to this group. They perform mostly technical and related tasks connected to research and using scientific and artistic concepts or educate in all kinds of schools. Work tasks of employees in KZAM3 group usually include implementation of technical work which is related to research and usage of concepts and methods in fields of natural sciences, agroforestry, social sciences, technical sciences and humanities; teaching of children and youth; organizing and performing of various technical services in trade, finance, administration, social welfare, arts, sports and religion. These employees can be managed by members of groups KZAM1 and KZAM2. The third group of occupation is the largest group among all groups of occupation with over 440 thousand of employees (see Figure 2). Median wage in KZAM3 is slightly above average wage in KZAM3 and both of the parameters are close above the average wage/median wage in economy. Therefore we expect no influence of minimum wage changes on the employment in this group; however value of the median wage in this group is below the value of average wage in this group. Groups KZAM4, KZAM5, KZAM6, KZAM7 and KZAM8 are classified as occupations requiring the same level of education (complete or incomplete secondary level of education) and are distinguished by specialization of education.

Administrative staff and clerks belong to the group **KZAM4**. They record, organize, store, process and access information related to relevant work; perform a range of civil service roles, particularly in connection with financial operations over the counter, organizing appointments. Work responsibilities usually involve typing, working with programs for word processing and other office machinery. They store data on computers, record and compile figures, keep inventory, production and transportation records, perform clerical duties in libraries, keep records, handle mail, prepare and control material for print, perform cash transactions over the counter, arrange travel, transmit required information to clients, arrange appointments or serve switchboards. KZAM4 is not large group. They represent 7,2% of all employees (Figure 2). Groups of occupations starting from KZAM4 are characterized by wage below average wage in economy. The average wage in this group was almost by 20 percentual points lower than average wage in economy in 2010 (Figure 1). We expect the dependency on minimum wage.

Operational employees in services and trade belong to the group **KZAM5**. They provide personal and protective services related to travel, housekeeping, catering, personal care and protection against fire and crime or sell and display products in wholesale, retail trade, market stalls or similar organizations or work as models for artistic creation. Work responsibilities of employees in this group usually include providing of personal services for trip organization, housekeeping, preparing and serving food and beverages, personal care (such as hairdressing service in beauty parlours), escorting, treatment assistance, future predicting, embalming, burial purposes, protecting individuals and property, law enforcement, selling and demonstration of goods. The fifth group of occupation with 185 thousand of employees (see Figure 2) has the second lowest average wage among all group of occupations (see Figure 1), therefore we expect strong dependency on minimum wage changes.

Skilled workers in agriculture, forestry and related fields, except machinery and equipment operating belong to the group **KZAM6**. The scope of work performed by them includes soil preparation, sowing, planting, fertilizing and harvesting of field crops; cultivation of vegetables and horticultural products, collecting of wild plants; breeding and hunting primarily for meat, milk, skin, fur; breeding silkworms, bees and other; planting, maintenance and use of forests; fish breeding; cultivation and harvesting of other forms of aquatic life; storage and basic processing of products and selling products to buyers, market organizations or directly to the customers at markets. KZAM6 is the smallest group with only 15 thousand of employees (0,8% of all employees, see Figure 2). Although the average wage in this group is low (34 percentual points lower than average wage in economy, see Figure 1), the significant dependency on minimum wage changes is questionable because of turnover of employees during studied period (decrease by more than half of the number of employees in the beginning of the studied period).

Craftsmen and qualified producers, processors and repairmen; except machinery and equipment operating belong to the group **KZAM7**. They extract and process raw materials; construct, maintain and repair buildings or other structures; cast and shape metal; build heavy metal structures, lifts and similar equipment; produce machinery, appliances and many other metal products; sort, set and serve machine tools; repair, assemble and maintain vehicles, engines, industrial machinery, electronic or electrical equipment; print; produce precise instruments; do art handicrafts; produce food and various items from materials such as precious metals and gems, glass, wood, textiles, leather and related materials. They work with hand, hand powered or similar instruments that reduce the physical effort and improve the quality of products. Their work requires understanding of work organization, understanding the use of tools and materials and the nature and purpose of the final product. That's why the most of the jobs in this group require either secondary level of education or apprenticeship in the field. Group KZAM7 is characterised by lower wage than average wage in the economy (approximately at the same level as group KZAM8 and KZAM4, see Figure 1). KZAM4 has unlike those two groups of occupations lower median wage, which indicates greater differences among particular occupations in this group. KZAM7 represents 13,8% of all employees (see Figure 1). We expect influence of minimum wage in this group.

Machinery and equipment operating staff belong to the group **KZAM8**. They operate and monitor the operation of industrial equipment and machinery on site or via remote control; manage and operate trains, motor vehicles or mobile equipment; compile industrial products from individual components according to precise rules and procedures. Their work generally requires experience and understanding of the functions of industrial machinery and equipment they serve or monitor. Most jobs in this group require secondary education or apprenticeship in the field. Their work duties usually consists of handling and monitoring of mining equipment or automated industrial equipment for processing metals and other minerals, glass, ceramics, wood, paper, chemicals, water treatment electricity etc. or maintenance of the above mentioned machines; bookbinding machinery; management, operation and monitoring of mobile machinery, trains and motor vehicles; compilation of articles from various parts. Wage conditions are similar to group KZAM7 (see Figure 1) unlike this group is larger by almost 35 thousand of employees (302 thousands of employees in 2010, see Figure 2). We have the same expectation about influence of minimum wage in this group as in previous group KZAM7.

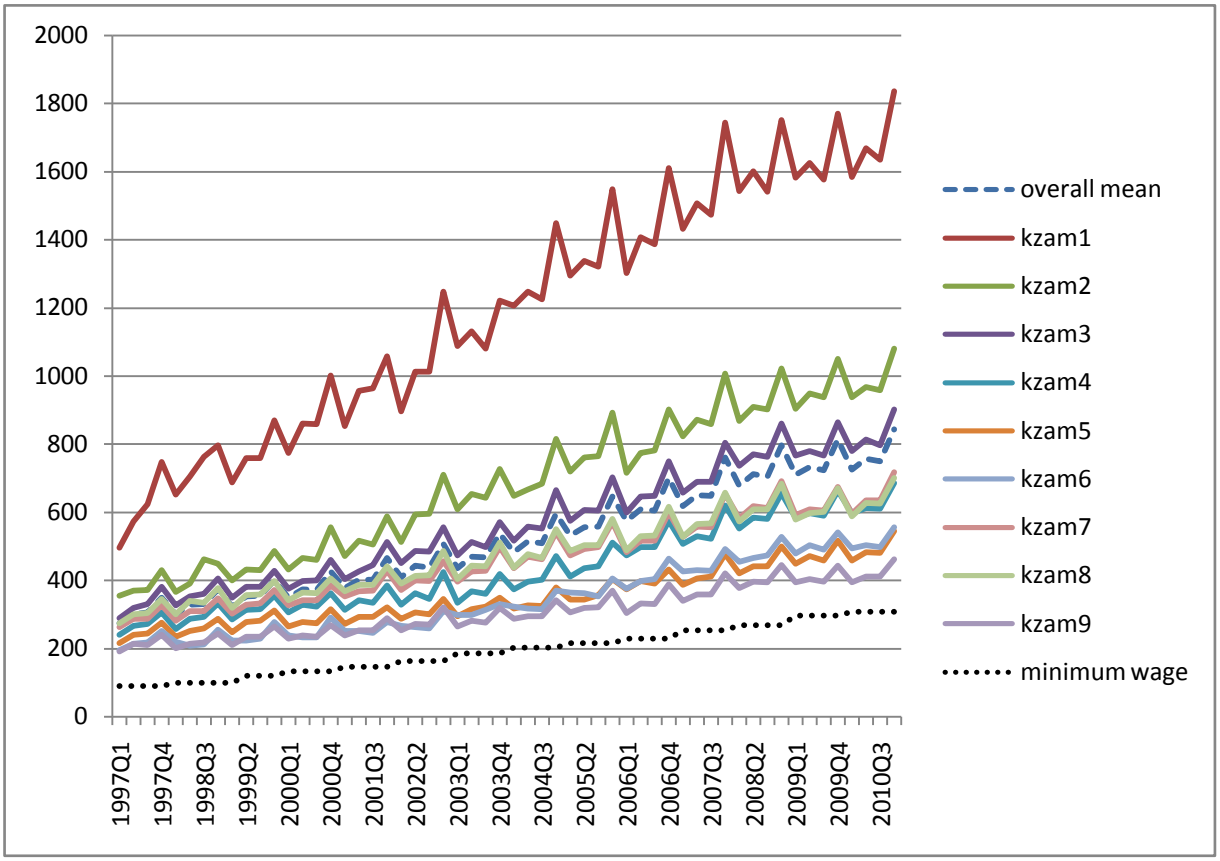
Occupations requiring only knowledge at the primary level of education are classified as **KZAM9**. Elementary occupations belong to this group. They perform routine and simple tasks requiring hand tools and often physical strength. Work duties usually involve sale of goods on the streets, public places or door sales, providing various street services, cleaning, washing, ironing and cleaning in rented houses, hotels, offices and other buildings, washing windows and glass surfaces of buildings; delivery of messages or goods; carrying luggage; guarding property, removing trash, sweeping streets and similar places; perform various simple operations in agriculture and forestry; simple implementation of various acts related to the rearing of aquatic animals and plants, digging pits, the performance of simple acts related to work in mines, on construction sites and in production, including sorting products and simple assembly operations, manual packing, cargo handling, transport of passengers materials and goods by vehicles powered by human power or animals. The last group of occupations is characterised by the worst salary conditions (see Figure 1), which is the half of average wage, therefore we expect strong dependency on minimum wage changes in this group. Statistics in 2010 in KZAM9 evidenced 160 thousand of employees (see Figure 2).

Minimum wage in Slovakia is valorised by Government Regulation annually, on first of January. This valorisation mechanism has been set in 2007 by Act on minimum wage[3]. According to this law (§ 6 of the Act on minimum wage), minimum wage level for the next year is discussed between representatives of employers and employees. In negotiation process, the overall social and economic situation in Slovak Republic, should be considered, especially the development of consumer prices, employment, average monthly wages in economy and development of subsistence minimum in the past two years. The base for the minimum wage adjustment is the level of minimum wage from previous year and growth index of average monthly wages in economy. The development of changes in minimum wage level is seen in figure 1.

Minimum wage is motivational parameter of social system, which should influence living standard of low income families positively, compared to pure dependence on social contribution system. Though there is a doubt that inadequate minimum wage increasing could prevent/inhibit new job creation, even though lead to decrease of demand after labour (Hazlitt, H). We will examine this hypothesis in next section. Our expectations of significant influence are focused mainly on occupational groups with lower average wages.

[3]Before year 2007, there had been laws that set the level of minimum wage or Government Regulations implied from particular lawsincreasing minimum wage.

Figure 1: Mean wage in major groups of occupation and overall, 1997Q1 - 2010Q4, values in €



Source: Statistical Office of the Slovak Republic

Granger causality

To find out, whether the minimum wage can influence the demand after labour, we used Granger causality with different lagging. The time series on both number of employees and minimum wage aren't stationary, thus we have to use first differences.

To test for simple causality from *x* to *y* it is examined whether the lagged values of *x* in the regression of *y* on lagged values of *x* and *y* significantly reduce the error variance. In direct Granger procedure the following equation is estimated by OLS:

$$y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^k y_{t-k} + \sum_{k=1}^{k_2} \alpha_{12}^k x_{t-k} + u_{1,t}$$

An F test is applied to test the null hypothesis H_0: $\alpha_{12}^1 = \alpha_{12}^2 = \cdots = \alpha_{12}^{k_2} = 0$. By changing x and y it can be tested whether a simple causal relation exists. In our case, for y we substitute first difference of number of employees in major groups of occupation and for x first difference in minimum wage in current prices, with k_1 and k_2 changing from 1 to 4. We used minimum wage in current prices by testing, because we suppose that the shocks have short-term character and that producers react close to valorization date (in first two quartiles). Index *t* represents time period of 1994Q1-2010Q4. We applied OLS for every group of $KZAM_i$.

The results, p-values of null hypothesis "Difference in minimum wage does not Granger cause difference in number of employees in group $KZAM_i$", on all major groups of occupation are shown in

table below. Lags of 1, 2, 3 and 4 are used because we assume that one year period is long enough to show the impact, furthermore with more lags the strength of test decreases.

Table 1: Granger causality with different lagging

	1 lag	2 lags	3 lags	4 lags
KZAM1	0.73523	0.91105	0.03699*	0.00780*
KZAM2	0.89071	0.37401	0.71993	0.56546
KZAM3	0.64779	0.52147	0.72439	0.54092
KZAM4	0.64412	0.61528	0.18346	0.00356*
KZAM5	0.41503	0.41981	0.53945	0.61205
KZAM6	0.41309	0.39142	0.00187*	5.5E-08*
KZAM7	0.47699	0.41145	0.14425	0.00062*
KZAM8	0.07521	0.04023*	0.05506	0.03814*
KZAM9	0.29295	0.26916	0.02939*	0.00122*
All employees	0.00137*	0.00035*	0.00680*	3.4E-06*

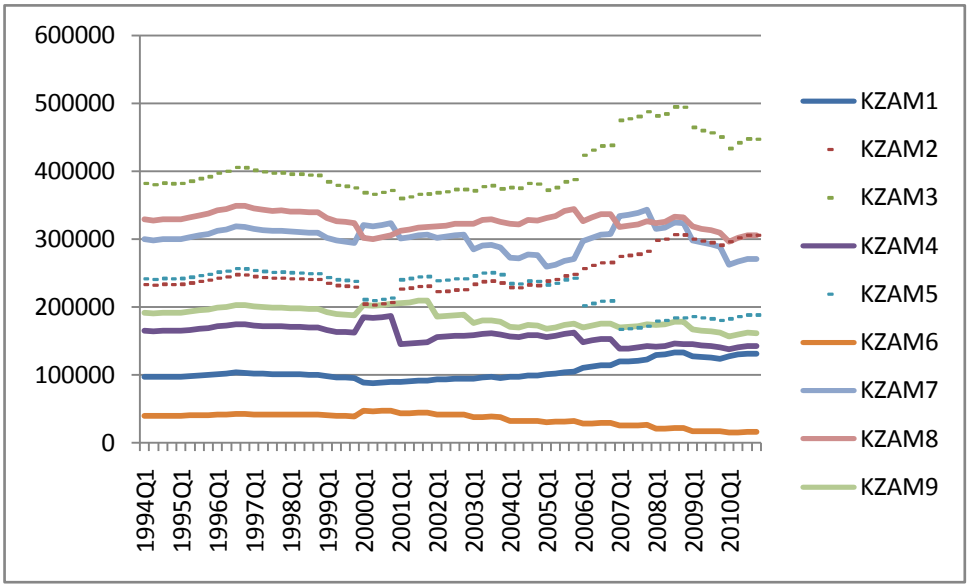
Source: own calculations

Comment: results marked * suggest causality at significance level 5%

Causality indicates that minimum wage has impact on number of employees in total as well as impact on particular type of occupational group. We don't know whether it is positive or negative so far. According to economic theory, we expect negative influence of minimum wage.

However, the Granger causality test confirmed also reverse causality in total employment (difference in number of employees in total Granger causes difference in minimum wage) so we cannot use the further modelling, because of the problem with endogenity. Partially, the minimum wage isn't affected by the number of employees in different groups, which was proved by Granger causality test. We also assumed exogenous character of minimum wage in separated occupational groups, because of thee minimum wage setting mechanism by the law (Act on minimum wage, 2007), where only total employment is marginally considered.

Figure 2: Number of employees in major groups of occupation, period 1994Q1-2010Q4



Source: Statistical Office of the Slovak Republic

Comment: Time series without causality are marked with dots; ones with causality are marked with solid line.

Significance confirmed by Granger test for total group of employment implies from the size of particular significant group of occupations. Number of employees in occupational groups affected by minimum wage sum up to more than 50% of total employment. Proved influence of minimum wage.

As we expected, mostly the KZAM groups with the average wage under the average wage in the economy are influenced by minimum wage. The only exception here is group KZAM5, where the services and trade staff belongs. Here the possible reason may be giving of tips. It can be informal part of their income, but the official wage is lower. Relation between employment and minimum wage is also seen in KZAM1. It's quite surprising that there is any relationship with the minimum wage, because in general wages in KZAM1 are much higher than in the rest of the occupational groups. For some employees in public and civil services may be an explanation that there is some legal binding of their wage to minimum wage, but in the private sector is it very unlikely.

Model testing

In this section we will investigate influence of minimum wage on employment more deeply. We use first differences of the employment time series, to obtain stationarity. Since the minimum wage changes quite rarely (compared to time series period) we use the first, second, third and fourth difference of minimum wage to explain the quarterly change in number of employees in different KZAM groups.

For testing the data we used NLS and ARMA methods in EViews. The outcomes of testing are listed in annex. As the differences in the minimum wage ($\Delta_j MINWAGE, j = 1, \dots, 4$) that are used as explanatory variables have medium correlation (0.308637- 0.667212), we use heteroskedasticity consistent coefficient covariance model approach according to White.

We used following ARMA model structure:

$$\Delta KZAMi_t = \delta + \alpha_1\Delta_1 MINWAGE_t + \alpha_1\Delta_2 MINWAGE_t + \alpha_3\Delta_3 MINWAGE_t + \alpha_4\Delta_4 MINWAGE_t + \beta_1\Delta KZAMi_{t-1} + \beta_2\Delta KZAMi_{t-2} + \beta_3\Delta KZAMi_{t-3} + \beta_4\Delta KZAMi_{t-4} + u_t - \gamma_1 u_{t-1} - \gamma_2 u_{t-2} - \gamma_3 u_{t-3} - \gamma_4 u_{t-4}$$

Where $\Delta KZAMi_t$ parameter symbolises differences in number of employees in particular i[th] occupational group in time *t* with u_t being a pure random process. Index *i* gains values of 1, 4, 5, 6, 7, 8 and 9, since only these are interesting for our research. We used data that should be affected by the minimum wage according to causality or 'less-than-mean-wage' criteria[4]. We don't consider seasonality because we suppose that seasonal adjustment would cover the effect of minimum wage, since it is changed quite regularly.

Results for **KZAM1** show that this group seems to be quite different from the others. With the model we've proved the relation between the change in employees in this group and the change of minimum wage, but this relation is different. First of all it is the only group lacking relation with the first difference of minimum wage, which means that if the change in minimum wage was applied on January first, there would be no change in labour demand in first quartile. Furthermore KZAM1 and KZAM4 are the only of all groups with more than one minimum wage terms. We can interpret resultsas as following: for every 1€ the minimum wage has raised in last three quarters 85 new jobs in KZAM1 group are created, as well as for every 1€ the minimum wage has risen in last year (four quarters) 216 employees are fired (or leave on their own). Since now the minimum wage is being raised only once a year on the first of January, the total effect in the first three quarters are 131 employees fired and in the last quarter 216 employees fired for every € of minimum wage rise.

In **KZAM4** occupational group both criteria, the Granger one and lower average criteria, are fulfilled. Although the regression is not quite like the others since there are three minimum wage terms and there is also no auto regression (AR) term. The model involves the first difference in minimum wage, so the reaction is faster than in KZAM1. (It is also quite intuitive that employees too 'expensive' for the employer after the raise of minimum wage are fired within first two quarters after the raise – as soon as possible). Results show that for every € of raise in the minimum wage in the past quarter circa 347 employees are fired, for every € of raise in past two quarters almost 26 are fired and for every € of raise in past three quarters 86 are recruited.

Assuming that the minimum wage will be increased only once a year in January, in the first quarter for every € of the last raise 286 might be fired, in the second quarter ca 67 might be hired, in the third 86 hired as well, and in the fourth quarter the minimum wage should have no impact. But in total the score is negative (-133).

[4]For sure we've done tests also on remaining two groups, but the changes in minimum wage can explain only about 5% of variance in the series).During the process, however, most of the possible regressors were removed to obtain working model with significant coefficients.

Tests for causality were negative in **KZAM5** group, so according to expectation we weren't able to create a model with valid coefficients at significance level of 5% (and R^2 high enough). But apart from this, the model is very similar to the ones for KZAM6-9.

The model contains only the first difference of minimum wage, so the reaction is quite prompt and its negative impact does not increase during the year - whole negative effect should appear during the following quarter after the change in minimum wage. The net effect of raising minimum wage on employment in KZAM5 group is job loss for 462 employees fired for every € of the raise in the past quarter. If the minimum wage is changed only once a year in January, all of them will be fired in the first quarter and the change in minimum wage won't have more impact during the year. Since there are also auto regressive terms in the model, they may reduce or deepen the total effect of minimum wage according to corresponding data.

Also in group **KZAM6** both used criteria are fulfilled and the resultant equation has traditional form. The model contains only the first difference of minimum wage, so the reaction is quite prompt and its negative impact does not increase during the year - whole negative effect should appear during the following quarter after the change in minimum wage. The net effect of raising minimum wage on employment in KZAM6 group is 176 employees fired for every € of the raise in the past quarter. If the minimum wage is changed only once a year in January, all of them will be fired in the first quarter and the change in minimum wage won't have more impact during the year. Since there are also auto regressive terms in the model, they may reduce or deepen the total effect of minimum wage according to corresponding data.

Occupational group KZAM7, KZAM8, KZAM9 is similar to previous group. The negative factor for the model with KZAM7 is quite low R^2, thus there should be some different explanatory variable(s) which haven't been considered yet. The model contains only the first difference of minimum wage, so the reaction is quite prompt and its negative impact does not increase during the year - whole negative effect should appear during the following quarter after the change in minimum wage. The net effect of raising minimum wage on employment in KZAM7 group is 572 employees fired for every € of the raise in the past quarter.

The results for the net effect of raising minimum wage on employment in **KZAM8** group is 410 employees fired for every € of the raise in the past quarter. Net effect in the last aimed occupational group **KZAM9** is lower, 349 employees fired for every € of the raise in the past quarter, though this group of employees is smaller than previous two group of employees.

If the minimum wage is changed only once a year in January, all of them will be fired in the first quarter and the change in minimum wage won't have more impact during the year. Since there is also an auto regressive term in the model, it may reduce or deepen the total effect of minimum wage according to corresponding data.

Comparison

Model for KZAM1 is hard to compare with other groups because it lacks first difference in minimum wage estimator. Since the rest of the models have the first difference in minimum wage, we can calculate the rate by using overall mean for the employment in particular group and the coefficients for the first difference. Percentage rations are listed in following table.

Table 2: Size effect of minimum wage influence on employment

Overall mean	158 918	225 150	34 357	301 279	326 108	184 515
Coefficient for D1MINWAGE	-346.764	-461.962	-176.249	-572.299	-410.994	-349.186
Percentage in modulus	0.22%	0.21%	0.51%	0.19%	0.13%	0.19%

Source: model calculations

Since we are using the differences, not the logarithms of time series for employment, there is natural similar ratio expectation. As we can see from the table above, the usual percentage is approximately -0.20%. In KZAM8 the ratio is smaller, which is probably given by the type of foreign investments which have taken place in Slovakia in past few years. On the other hand, the ratio for KZAM6 is way higher, which is supported by size of this group. Therefore the changes of minimum wage are for this group probably the most important. Moreover, jobs in group KZAM6 are mostly in countryside where firing employees causes social problems much more than in the cities.

We can summarise, that the effect of minimum wage on the most of groups is negative. Although the ratios don't seem to be too high, since the average raise of minimum wage in the history of Slovak Republic is circa 16€, the total effect of the minimum wage can be much higher.

Discussion

Results show that there is significant influence of minimum wage changes on employment. On the other hand, we must consider other facts. We cannot say for sure that these people, who have been dismissed because of minimum wage raise, became unemployed. The only thing we know, they have lost their jobs in particular group of occupation. So as well they might change their profession, because of some additional education, requalification or get retired (if the retirement age was attained). So from this point of view it seems to be correct to test also unemployment time series.

Although the Statistical Office of Slovak Republic keeps the unemployment data in KZAM structure according to former occupation based on a sample survey. This may make problem, because some respondents don't seem to be able or willing to answer this question and significantly big group with unknown former occupation appears. Nevertheless, we can use similar approach as on employed, but the interpretation won't be as credible.

We present the table for Granger causality, again with the first differences in time series to grant stationarity for all groups. In this case we won't consider total unemployment; because it contains also people who have no working experience (or are only classified this way because they are long term unemployed) whom shouldn't the minimum wage affect.

Table 3: Granger causality on unemployment data

	1 lag	2 lags	3 lags	4 lags
KZAM1	0.25572	0.64510	0.69391	0.79426
KZAM2	0.39104	0.00599*	0.01072*	0.01052*
KZAM3	0.11318	0.20969	0.25327	0.02632*
KZAM4	0.75730	0.39111	0.63718	0.12597
KZAM5	0.21637	0.04924*	0.07458	0.06492
KZAM6	0.02730*	0.19018	0.52414	0.70951
KZAM7	0.02178*	0.03159*	0.09095	0.58587
KZAM8	0.44596	0.18153	0.22493	0.41873
KZAM9	0.00090*	0.00398*	0.01755*	0.09899
Unknown former occupation	0.19296	0.12143	0.03916*	0.04162*

Source: model calculations

The interpretation now is not so straightforward and also the approach cannot be the same. KZAM groups 1, 4 and 8 which showed causality on employment data doesn't show any here. Another difference is in the reverse Granger causality appears in groups KZAM1, KZAM6, KZAM7, KZAM8 and Unknown former occupation, thus we formally shouldn't use difference in minimum wage for modelling them.

There are other factors that should be considered and examined more deeply. Employment is not dependent just on the minimum wage what we can see on the size of estimated parameters as well. It is discussable if the increase of minimum wage by one € could have such a strong effect on job creation. This could be under the further discussion or modelling approach (for example VAR or vector error correction approach can be used here).

Conclusion

The aim of our research was to examine the impact of minimum wage on occupational groups characterized by level of average wage. According to our expectations there is significant influence on employment mainly in those groups with lower wage than average wage in the economy (KZAM 4, 6, 7, 8, 9). Our expectations were proved also by ARMA model where the results showed negative influence. This influence has different size effect, which varies from group to group. Size of the coefficient is strengthened even by size of the group. Even though there could by another factors, except minimum wage, that influences employment, this systematic parameter should be negotiated carefully.

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Annex

Table 1: Regression results for KZAM1

Dependent Variable: DKZAM1
Method: Least Squares
Date: 05/11/11 Time: 12:03
Sample (adjusted): 1995Q4 2010Q4
Included observations: 61 after adjustments
Convergence achieved after 31 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1995Q1 1995Q3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4061.577	1144.560	3.548591	0.0008
D3MINWAGE	85.01734	32.40843	2.623309	0.0112
D4MINWAGE	-216.0088	59.52250	-3.629028	0.0006
AR(3)	0.862808	0.067506	12.78126	0.0000
MA(1)	0.213407	0.060938	3.502047	0.0009
MA(3)	-0.869206	0.037434	-23.21976	0.0000

R-squared	0.406060	Mean dependent var	523.3443
Adjusted R-squared	0.352066	S.D. dependent var	2028.828
S.E. of regression	1633.092	Akaike info criterion	17.72752
Sum squared resid	1.47E+08	Schwarz criterion	17.93515
Log likelihood	-534.6893	F-statistic	7.520402
Durbin-Watson stat	1.805575	Prob(F-statistic)	0.000019

Inverted AR Roots	.95	-.48+.82i	-.48-.82i
Inverted MA Roots	.89	-.55+.82i	-.55-.82i

Table 2: Regression results for KZAM4

Dependent Variable: DKZAM4
Method: Least Squares
Date: 05/10/11 Time: 12:20
Sample (adjusted): 1994Q4 2010Q4
Included observations: 65 after adjustments
Convergence achieved after 20 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1993Q4 1994Q3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.28656	77.01298	0.315357	0.7536
D1MINWAGE	-346.7640	21.34134	-16.24846	0.0000
D2MINWAGE	-25.95092	7.896785	-3.286265	0.0017
D3MINWAGE	86.48350	6.648871	13.00725	0.0000
MA(4)	-0.990019	1.51E-05	-65415.98	0.0000

R-squared	0.591576	Mean dependent var	-348.6769
Adjusted R-squared	0.564347	S.D. dependent var	6736.548
S.E. of regression	4446.391	Akaike info criterion	19.71138
Sum squared resid	1.19E+09	Schwarz criterion	19.87864
Log likelihood	-635.6197	F-statistic	21.72650
Durbin-Watson stat	2.145763	Prob(F-statistic)	0.000000

Inverted MA Roots	1.00

Table 3: Regression results for KZAM5

Dependent Variable: DKZAM5
Method: Least Squares
Date: 05/11/11 Time: 12:16
Sample (adjusted): 1995Q2 2010Q4
Included observations: 63 after adjustments
Convergence achieved after 26 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1994Q2 1995Q1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1397.543	805.9816	1.733963	0.0883
D1MINWAGE	-461.9615	232.0890	-1.990450	0.0513
AR(2)	-0.966904	0.063850	-15.14325	0.0000
AR(4)	-0.725612	0.114091	-6.359930	0.0000
MA(2)	1.028871	0.072423	14.20631	0.0000
MA(4)	0.980452	0.051165	19.16271	0.0000

R-squared	0.270811	Mean dependent var	-858.6825
Adjusted R-squared	0.206847	S.D. dependent var	9381.174
S.E. of regression	8354.794	Akaike info criterion	20.98945
Sum squared resid	3.98E+09	Schwarz criterion	21.19356
Log likelihood	-655.1677	F-statistic	4.233800
Durbin-Watson stat	1.938062	Prob(F-statistic)	0.002424

Inverted AR Roots	.43+.82i	.43-.82i	-.43+.82i	-.43-.82i
Inverted MA Roots	.49-.87i	.49+.87i	-.49-.87i	-.49+.87i

Table 4: Regression results for KZAM6

Dependent Variable: DKZAM6
Method: Least Squares
Date: 05/10/11 Time: 14:53
Sample (adjusted): 1995Q2 2010Q4
Included observations: 63 after adjustments
Convergence achieved after 22 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1994Q2 1995Q1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	208.8326	107.4878	1.942850	0.0570
D1MINWAGE	-176.2488	22.65694	-7.779019	0.0000
AR(3)	-0.525115	0.124146	-4.229825	0.0001
AR(4)	-0.453783	0.044461	-10.20629	0.0000
MA(3)	0.781914	0.078546	9.954832	0.0000
MA(4)	0.309125	0.057434	5.382238	0.0000

R-squared	0.484662	Mean dependent var	-383.6825
Adjusted R-squared	0.439457	S.D. dependent var	1821.083
S.E. of regression	1363.434	Akaike info criterion	17.36379
Sum squared resid	1.06E+08	Schwarz criterion	17.56790
Log likelihood	-540.9595	F-statistic	10.72142
Durbin-Watson stat	2.183423	Prob(F-statistic)	0.000000

Inverted AR Roots	.60-.76i	.60+.76i	-.60+.37i	-.60-.37i
Inverted MA Roots	.57-.82i	.57+.82i	-.45	-.70

Table 5: Regression results for KZAM7

Dependent Variable: DKZAM7
Method: Least Squares
Date: 05/10/11 Time: 15:47
Sample (adjusted): 1995Q2 2010Q4
Included observations: 63 after adjustments
Convergence achieved after 44 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: OFF (Roots of MA process too large)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1791.638	1106.660	1.618960	0.1109
D1MINWAGE	-572.2993	100.2047	-5.711302	0.0000
AR(4)	0.459471	0.115578	3.975428	0.0002
MA(3)	0.335385	0.053733	6.241724	0.0000
MA(4)	-0.985097	0.074236	-13.26981	0.0000

R-squared	0.274094	Mean dependent var	-467.1746
Adjusted R-squared	0.224032	S.D. dependent var	9955.972
S.E. of regression	8770.122	Akaike info criterion	21.07213
Sum squared resid	4.46E+09	Schwarz criterion	21.24222
Log likelihood	-658.7720	F-statistic	5.475043
Durbin-Watson stat	1.710912	Prob(F-statistic)	0.000827

Inverted AR Roots	.82	.00-.82i	.00+.82i	-.82
Inverted MA Roots	.91	.08+1.00i	.08-1.00i	-1.08
	Estimated MA process is noninvertible			

Table 6: Regression results for KZAM8

Dependent Variable: DKZAM8
Method: Least Squares
Date: 05/10/11 Time: 16:07
Sample (adjusted): 1995Q1 2010Q4
Included observations: 64 after adjustments
Convergence achieved after 16 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1994Q2 1994Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1068.722	626.0230	1.707161	0.0931
D1MINWAGE	-410.9943	101.6969	-4.041366	0.0002
AR(3)	0.553333	0.135466	4.084674	0.0001
MA(1)	0.272904	0.083590	3.264811	0.0018
MA(3)	-0.835500	0.049364	-16.92536	0.0000

R-squared	0.389978	Mean dependent var	-366.6875
Adjusted R-squared	0.348621	S.D. dependent var	5920.996
S.E. of regression	4778.721	Akaike info criterion	19.85664
Sum squared resid	1.35E+09	Schwarz criterion	20.02530
Log likelihood	-630.4124	F-statistic	9.429467
Durbin-Watson stat	2.132609	Prob(F-statistic)	0.000006

Inverted AR Roots	.82	-.41+.71i	-.41-.71i
Inverted MA Roots	.86	-.57-.81i	-.57+.81i

Table 7: Regression results for KZAM9

Dependent Variable: DKZAM9
Method: Least Squares
Date: 05/10/11 Time: 16:18
Sample (adjusted): 1995Q1 2010Q4
Included observations: 64 after adjustments
Convergence achieved after 10 iterations
White Heteroskedasticity-Consistent Standard Errors & Covariance
Backcast: 1994Q2 1994Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	757.4455	378.4178	2.001612	0.0499
D1MINWAGE	-349.1855	72.93286	-4.787766	0.0000
AR(3)	-0.827261	0.075803	-10.91329	0.0000
MA(3)	0.956309	0.032026	29.86061	0.0000

R-squared	0.361063	Mean dependent var	-456.5781
Adjusted R-squared	0.329117	S.D. dependent var	4656.557
S.E. of regression	3814.068	Akaike info criterion	19.39124
Sum squared resid	8.73E+08	Schwarz criterion	19.52617
Log likelihood	-616.5197	F-statistic	11.30201
Durbin-Watson stat	2.000090	Prob(F-statistic)	0.000006

Inverted AR Roots	.47+.81i	.47-.81i	-.94
Inverted MA Roots	.49+.85i	.49-.85i	-.99