

## **Wage inequalities in Romania under successive adjustments in minimum wage levels**

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**Abstract.** *In this paper we aim to identify some of the most relevant wage determinants observable at micro level and try to explain wage inequalities through the use of Mincer equations. The case of Romania is discussed for the year 2014. Because of data availability issues, the methodological framework relied on ordered logit models. Moreover, because of the two successive increases in the minimum wage levels, the paper analyses the changes occurring quarterly during Q1 2014 – Q4 2014 upon the individuals odds of moving forward to a higher decile of the wage distribution. Both social-demographic and economic characteristics are investigated.*

**Keywords:** wage inequalities, ordered logit model, micro-datasets, socio-demographic factors, economic factors.

**JEL Classification:** J31, C82.

## 1. Introduction

The aim of this paper consists in studying the changes in wage inequalities in Romania under a certain period of time that was intensively affected by several minimum wage adjustments. Because of data availability reasons, the reference period considered referred to the year 2014, for which the minimum wage registered two successive adjustments, as follows: a first change occurred in January 2014 when the gross minimum wage rate increased from 800 to 850 lei, followed by a second adjustment up to the level of 900 lei in July 2014.

Although assessing the net impact of the minimum wage levels upon the Romanian labour market in general, and wage inequalities in particular, cannot be estimated unless microdata is used and microsimulation techniques are properly applied, the current paper will focus explicitly on wage inequalities and their short-term dynamic under two successive adjustments in the statutory minimum wage level.

Thus, the paper will aim to identify some of the most relevant wage determinants that are observable at individual level and try to explain wage inequalities through the use of Mincer earnings equations. Moreover, because of the two successive increases in the minimum wage levels, the paper will investigate the changes occurring quarterly during Q1 2014 - Q4 2014 upon the individuals odds of moving forward to a higher decile of the wage distribution. This is mostly because we assume that the wage distribution is normally affected by the minimum wage increases.

The quarterly AMIGO database provided by the National Institute of Statistics was used in the current research in order to investigate the main changes in wage distribution over the period Q1 2014-Q4 2014. Regarding the information on individuals' wages, the database is limited to only the corresponding net wage decile for each person, instead of offering further information on the gross average wage, social benefits or tax burden at micro level. Under these data availability restrictions, there were a limited number of factors included in the Mincer earnings models.

According to the economic literature review, the Mincer model (1958, 1974) can be an effective tool in explaining the rate of return on education and work experience. The Mincer model captures not only how labour market rewards depend on attributes such as years of schooling or work experience, but also on the rate of return on schooling, which can be interpreted as an interest rate for investing in human capital. Although there are studies that have focused on determining the rate of return on schooling, such as those by Ashenfelter and Krueger (1994) or Ashenfelter and Rouse (1998), recent studies no longer provide valid estimates for this indicator.

In general, there are two main methodological approaches used at international level to explain wage differentials. On the one hand, there are studies applying OLS regressions for quantifying average wage inequalities, while on the other hand there are quantile regressions, which also allow for unobservable factors to be considered in order to explain each individual's position in the wage distribution.

Based on quantile regressions, Pereira and Martins (2000) studied the impact of education on wage inequality in 15 European countries (Austria, Denmark, France, Finland, Germany, Greece, Italy, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden,

Switzerland and the United Kingdom), during 1980-1995 and concluded that in most countries the dispersion of wage inequalities increases with schooling.

Several other studies used quantile regressions when studying wage inequalities (see Buckinsky, 2001; Tansel and Bircan, 2011). In terms of main earnings inequality factors Fournier and Koske (2012) studied the effects of the following factors on a group of 32 countries: the number of hours worked, the gender, the age and the highest degree of education obtained. They found that women have less employment opportunities than men, and those who work earn less than men. Moreover, policies aimed at increasing the graduation rate for upper secondary education tend to reduce wage inequalities.

At national level, the literature review on the topic of wage inequalities is less vast. Some have studied the main determinants of wages (Andreica et al., 2010; Vasilescu et al., 2010, 2014; Militaru et al., 2011). Others have focused on wage inequalities between the public and the private sectors (Voinea and Mihăescu, 2011). In this sense, Zaman and Stănculescu (2007) argued that wage increases in the Romanian public sector have not yet been correlated to the productivity growth rate, as compared to the private sector, which represents a major political concern in mitigating wage disparities.

Based on the literature review in the field, it can be concluded that identifying the main determinants of wage inequalities plays an extremely important role, providing support to policy makers in order to reduce wage inequalities.

This paper is organized as follows: Section 2 briefly presents the data and the methodological framework used for this study, Section 3 describes the main findings of the analysis, while the last section concludes.

## **2. Data description and the methodological framework**

In order to identify the main determinants of wage inequalities, the current study relied entirely on the AMIGO database and built up several Mincer earnings equations corresponding to the four quarters of the year 2014, when the minimum wage policy is assumed to have had several implications on the national wage distribution.

The AMIGO database provides national representative data collected through identical questionnaires applied on quarterly bases. The questionnaire is divided into two parts: one addressed to the household and a second one addressed to each individual aged over 15 regarding their professional status, work, occupation, main and secondary activity, hours worked or desire to have another job.

Our study was conducted over the period Q1 2014 – Q4 2014 and only focused on employed persons. Therefore, from the initial database all unemployed persons, as well as self-employed persons were excluded. The resulted final sample sizes were the following: 15372 individuals for the first quarter, 15631 for second quarter, 15718 for third quarter and 15523 individuals for the fourth quarter of the year 2014.

Based on the database specificity and due to econometric reasons the following types of information at individual level were considered in the study through the form of categorical variables:

- Socio-demographic characteristics, such as: age (*age15\_24*, *age25\_44*, *age45\_64*, *age65+*), gender (*Male* and *Female*) residence area (*Urban* and *Rural*) and the levels of education (*ISCED 0*, *ISCED 1-2*, *ISCED 3-4* and *ISCED 5-8*).
- Economic variables: economic sectors (*Industry*, *Constructions*, *Agriculture*, *Private services*, *public services and other sectors*) and major occupations (*GM1*, *GM2*, *GM3*, *GM4*, *GM5*, *GM6*, *GM7*, *GM8* and *GM9*).

Dummy variables were then built for each variable's category. Thus, for the age variable there were four dummy variables built corresponding to the following age sub-groups: 15-24 years old, 25-44 years old, 45-64 years old and over 65 years old. The youth group (*15-24 years*) was considered as a reference base and was therefore excluded from the estimation.

Regarding the level of education, other four dummy variables were created, as follows: *ISCED 0* for no education, *ISCED 1-2* corresponding to primary or lower secondary education level, *ISCED 3-4* for secondary or non-tertiary secondary education level and *ISCED 5-8* for higher education level. Variable *ISCED 5-8* was considered as reference base.

Regarding gender, the dummy variable *Female* was considered the reference base, while when considering the residence area, the *Rural* variable was left aside from the estimation for comparison reasons.

Further data processing was required in order to build the dummy variables corresponding to the economic sectors. Because of methodological limitations, we regrouped the initial economic sectors into the following main dummy variables: *Industry*, *Constructions*, *Agriculture*, *Private services* (G – Wholesale and retail trade; repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities were included here), *Public services* (O – Public administration and defence; compulsory social security, P – Education, Q – Human health and social work activities, as well as R – Arts, entertainment and recreation were included here), and *other sectors* (S – Other service activities, T – Activities of households as employers; undifferentiated goods and services producing activities of households for own use, as well as U – Activities of extraterritorial organisations and bodies were included here) which was considered the reference base.

Finally, although the occupations were available in the database at 3 digits codes, for the current study's purpose we regrouped the information into the main major groups of occupations and considered *GM9 – Unskilled worker group of occupations* as the reference base.

Although most empirical studies on wage inequalities typically use simple OLS regression or quantile regression, in the current study there was a distinct approach proposed because of data availability reasons. Thus, since the database only provides information on the decile each individual's net earnings belong to, ordered logit models had to be applied using micro data.

Therefore, the dependent variable is a categorical one, taking values from 1 to 10 according to the correspondent decile. Under these circumstances, an ordered logit model had to be estimated so to quantify the importance of these factors upon the odds of getting higher earnings and moving towards a higher wage decile.

The logit model is a one-period classification model for which estimates are based on a maximum likelihood function in order to determine the conditional probability of an individual belonging to a category according to certain independent variables. Thus, the logit model describes a relation between the binary variable  $Y$ , which takes values 1 or 0, and  $k$  explanatory variables  $x_1, x_2, \dots, x_k$ .

Starting from a linear probability model such as:  $\Pr(y = 1|x) = x\beta + \varepsilon$ , if we restrict probabilities to the interval  $[0,1]$  we get  $\Omega(x) = \frac{\Pr(y = 1|x)}{\Pr(y = 0|x)} = \frac{\Pr(y = 1|x)}{1 - \Pr(y = 1|x)}$ . The logit model results by applying the natural logarithm to these probabilities, reaching the following general form:  $\ln\Omega(x) = \beta_0 + \sum_{j=1}^k \beta_j x_{i,j}$ .

This equation is called the logit form of the model, where  $\ln\Omega(x)$  is the logarithm of the probability that an individual belongs to one category or another in relation to the explanatory variables  $x_{i,1}, x_{i,2}, \dots, x_{i,k}$ . In the case of the ordered logit model, the probability of an individual belonging to a category versus a smaller or a larger category is estimated, since the values of the dependent variable are ordered:  $\Omega_{\leq m | > m}(x) = \frac{\Pr(y \leq m|x)}{\Pr(y > m|x)}$  (Hosmer et al., 2013).

Thus, one of the characteristics of the ordered logit model consists in the fact that the values of the dependent variable are assumed to be equally spaced and that the ordering makes sense. This hypothesis is called the hypothesis of proportional chances (or the hypothesis of parallel regression) which generates a set of estimated coefficients for the logistic model.

### 3. Main findings

To evaluate the inequality of earnings, we estimated four ordered logit models corresponding to each quarter of the year 2014. The main estimation results are summarized in Table 1, from where we notice that all coefficients are statistically significant.

The model is valid and although the Pseudo  $R^2$  test value is rather small in all four cases, we accept such biases due to the current data limitations.

Regarding wage inequalities, the most notable result corresponds to the case of the second quarter of the year 2014, when according to the estimated odd ratios, male employees have 2.4 times higher chances of earning more and move forward to a higher wage decile of the distribution than female employees. This is by far the highest value of wage inequalities registered among the period Q1 2014 – Q4 2014.

The second most relevant indicator of wage inequality was noticed in the first quarter of the year 2014, when the logistic estimation suggested the fact that male employees have 1.97 times higher chances of moving forward to a higher wage decile than females.

**Table 1.** Ordered logit models for the period Q1 2014 – Q4 2014

	Variables	Q1 2014		Q2 2014		Q3 2014		Q4 2014	
		Odd ratio	P-value	Odd ratio	P-value	Odd ratios	P-value	Odd ratios	P-value
Gender	Male	1.97	0.00	2.41	0.00	1.92	0.00	1.92	0.00
Residence area	Urban	1.34	0.00	1.34	0.00	1.28	0.00	1.22	0.00
Level of education	ISCED 0	0.27	0.014	0.15	0.007	0.03	0.004	0.20	0.036
	ISCED 1-2	0.30	0.00	0.35	0.00	0.38	0.00	0.37	0.00
	ISCED 3-4	0.54	0.00	0.56	0.00	0.62	0.00	0.56	0.00
Age structure	age25_44	1.62	0.00	1.41	0.00	1.65	0.00	1.63	0.00
	age45_64	1.87	0.00	1.65	0.00	1.90	0.00	1.92	0.00
	age65plus	2.13	0.03	1.28	0.474	1.79	0.083	1.84	0.022
Economic sector	Industry	0.13	0.00	0.08	0.00	0.09	0.00	0.07	0.00
	Constructions	0.12	0.00	0.08	0.00	0.12	0.00	0.08	0.00
	Private services	0.10	0.00	0.06	0.00	0.08	0.00	0.06	0.00
	Public services	0.09	0.00	0.06	0.00	0.08	0.00	0.05	0.00
	Agriculture	0.09	0.00	0.05	0.00	0.08	0.00	0.05	0.00
Major occupation	GM0	7.94	0.00	9.57	0.00	9.07	0.00	10.68	0.00
	GM1	9.48	0.00	9.48	0.00	9.25	0.00	10.38	0.00
	GM2	8.13	0.00	7.92	0.00	8.62	0.00	8.78	0.00
	GM3	6.03	0.00	5.96	0.00	5.74	0.00	6.19	0.00
	GM4	4.50	0.00	4.07	0.00	4.26	0.00	5.11	0.00
	GM5	1.81	0.00	1.77	0.00	1.77	0.00	1.80	0.00
	GM6	6.64	0.00	4.32	0.00	3.89	0.00	5.70	0.00
	GM7	2.60	0.00	2.44	0.00	2.51	0.00	2.75	0.00
	GM8	3.32	0.00	3.20	0.00	3.23	0.00	3.25	0.00
Main test statistics	No. of obs. =	15372		15631		15718		15523	
	LR chi2(22) =	3922.7		4109.4		3692.8		3749.7	
	Prob. > chi2 =	0.00		0.00		0.00		0.00	
	Pseudo R2 =	0.0558		0.0574		0.0511		0.0526	

**Source:** authors' own calculation.

Among the other socio-demographic characteristics, the comparative age sub-groups analysis highlighted that the chances of moving from one decile to a higher one are positively correlated to age. This is especially notable for the age sub-groups 25-44 and 45-64 years old as compared to youth employees (the 15-24 years old sub-group). For instance in the first quarter, the chances of the individuals between 25 to 44 years old are 1.6 times higher than youth employees, while the chances increase for those between 45 and 64 to a 1.87 times higher than young employees. However, even in case of the age group of over 65 years old, positive chances are registered as compared to youth employees as well. As a peculiarity, the highest chances are registered in the first quarter of the year 2014 when individuals over 65 years old have 2.13 times chances more than young employees to move forward on the wage distribution.

Regarding the residence area, the results indicate that higher chances in moving to a higher wage decile correspond to those living in urban areas as compared to rural residents, although the chances tend to drop slightly from 1.34 times more to 1.28 times more over the year 2014.

Regarding the level of education, the logistic outputs confirm the human capital theory suggesting that education contributes to better labour remuneration. In this case the lowest chances in having higher earnings correspond to those with no education (ISCED 0), for which the chances to move to a higher decile are actually 73% lower than those with

higher education level in the first quarter of 2014. Surprisingly, chances decrease even more in the following two quarters and only improve in the last quarter of 2014, when reaching 5 times lower than those with higher education (ISCED 5-8).

The chances are still low for graduates of primary or lower secondary education level (ISCED 1-2), being of approximately 70% less in comparison to highly educated employees in the first quarter of 2014 and tending to increase in the following quarters. A rather similar tendency is registered for the graduates of secondary or non-tertiary secondary education (ISCED 3-4), for which the chances in the first quarter were this time only 46% less than highly educated employees.

Among the economic determining factors of wage increases, quite notable for all quarters of the year 2014 are the influences of the major groups of occupations. More precisely, in comparison to the case of GM9 – *Unskilled worker group* all other major groups of occupations tend to bring higher chances to the employees to move to a higher decile. These results are in accordance to the capital theory, suggesting that specialization and qualification contribute to higher labour rewards. The comparison at quarterly level indicates an increasing tendency of the chances of the employees belonging to GM0 (Armed Forces Occupations) and also for GM1 (Legislative body members) to earn more as compared to unskilled workers. More precisely, chances increase for GM0 from 7.9 to 10.7 times higher than GM9, while for GM1 from 9.5 to 10.4 times more than GM9.

When considering the main economic sectors, the logistic models suggest that there are lower chances for the employees working in Industry, Construction, Private and Public services, as well as in Agriculture to move to a higher decile as compared to other economic sectors. Based on first quarter estimation, for instance, employees in the Industry sector have 87% chances less in moving to a higher decile as compared to those working in other sectors. As a peculiarity however, it is worth mentioning the fact that chances tend to drop even further in the following quarters as compared to first quarter, and seasonality might also be present, especially in the Construction sector, where chances tend to drop more significantly in the last quarter as compared to the previous one. Moreover, it is notable that the highest chances are registered in the first and the third quarter, corresponding to the periods of minimum wage adjustments.

#### 4. Conclusions

In this paper we aimed to identify some of the most relevant wage determinants that are observable at individual level and try to explain wage inequalities through the use of Mincer earnings equations. The case of Romania was discussed for the year 2014 and because of data availability issues, the methodological framework relied entirely on ordered logit models. Moreover, because of the two successive increases in the minimum wage levels, the paper conducted a comparative analysis of the quarterly changes occurring during Q1 2014 – Q4 2014 upon the individuals' odds of moving forward to a higher decile of the wage distribution. Both social-demographic and economic characteristics were investigated and the results were consistent to the human capital theory.

In general, employees living in urban areas tend to have higher odds of moving to a higher decile. Moreover, the return on education was also found to be positive and higher

chances to earn more were estimated for those with higher education level. The odds are also expected to increase with age, while wage inequality was present, with the highest degree registered in the second quarter of 2014, when the odds of male employees to move to a higher wage decile were 2.4 times higher than female employees.

Regarding the economic factors, all major occupation groups tend to generate higher earnings compared to unskilled workers, while employees in Industry, Construction, Agriculture, Private or Public sectors tend to have lower chances to move to a higher decile than those working in other sectors.

Even though we are aware of the methodological limitations of our study implied by data availability issues that prevent us from providing net impact assessment results of the minimum wage policies, we believe that this paper brings valuable insights on the short-term changes on employees' odds of moving from one wage decile to another one under a period of intense adjustments of the minimum wage level.

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