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## **EMPLOYMENT MODELLING IN SLOVAKIA: COMPARING LOGIT MODELS IN 2005 AND 2009**

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**ABSTRACT:** *In this paper we present models based on a statistical modelling approach that explain the effects of selected variables on employment in Slovakia in the years 2005 and 2009. The probability of becoming employed (employability/odds ratio) was based on individual data from the harmonized EU SILC statistical survey with some socio-economic factors. For quantification of the mentioned variables' impact on the dependent variable (employment) logistic regression was applied. The results confirmed a*

*positive effect of work experience and the highest level of education attained on employability. Conversely, in some cases age showed a negative effect on the dependent variable, and to some extent gender also had a significant effect. In terms of region, a lower chance of becoming employed was found for inhabitants in Eastern Slovakia when compared to other regions.*

**KEY WORDS:** *Unemployment, labour market, logistic regression, EU SILC, Slovakia.*

**JEL CLASSIFICATION:** J21, C21, C52

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## **1. INTRODUCTION**

Unemployment is a persistent economic, political, and social problem, which attracts particular attention from researchers and labour market policy makers in all countries. The problem of unemployment belongs to the category of social risk. Social risk presents events that significantly reduce the ability of individuals to secure their own social independence. If people are not secured against these events they live in constant insecurity and are powerless to manage the present or to anticipate a positive future (Castel, 2003).

Increasing unemployment is usually associated with a decrease in the economic cycle, which is now visible in Slovakia. Unemployment as a social risk in Slovakia is currently a significant topic from the perspective of the implementation of priorities and objectives set out in the *European strategy for smart, sustainable and inclusive growth - Europe 2020*, which was set out by the European Commission in March 2010. Within the problem of unemployment a specific focus of the strategy is relevant: “The employment rate of the population aged 20-64 should increase from the current 69% to at least 75%, including greater involvement of women, older workers, and better integration of migrants in the work force.” (EC, 2010, p. 8) Hence it is relevant to know the factors that increase the chance of employment in order to coordinate and form social policy and labour market policies. Active labour market policies in Slovakia are defined by the Employment Services Act (n.5/2004 Code), in which the most vulnerable groups are identified, i.e., disadvantaged jobseekers.

To summarize, under that Act, the most at-risk groups in terms of unemployment are:

- school graduates and people with low or incomplete education (among them a high proportion of the Roma population);
- women who have been on maternity leave;
- women aged over 40 years;
- men aged over 50 years;
- people with disabilities.

There have been several researches investigating the factors that determine employability/unemployability. Marks and Fleming (1998) concentrated on the variables affecting youth unemployment in Australia between 1980 and 1994. Gender and age were included in the variables of the model, which showed that men are more likely to become unemployed than women, and that for young

people there is a positive relation between age and the chance of becoming employed. Conversely, female disadvantage (gender) was proven in the research of Terrel and Laureova (2002) into the Czech, Polish, Russian, and Eastern German markets, and in the research of Livanos (2007) into the Greek labour market. Terrel and Laureova (2002) also pointed out the impact of education on employability, where less educated people were less likely to enter employment. Moreover, multinomial logit analysis applied to the Polish labour market in 1997-2004 also demonstrated decreasing chances of becoming employed with age and increasing chances with skill level (Bukowski and Lewandowski, 2005). Furthermore, the influences of education were detected in the determination of poverty in Slovakia (Dinh and Labudova, 2009) and relative material deprivation (Želinský, 2010), pointing out that the majority of registered unemployed people are those with lower educational attainment (primary education or no education). Education positively influences opportunities of employment by reducing the risk of unemployment at the individual and social level and increases chances of being successful in the labour market as well (Průcha, 1997).

The issue of difference in unemployment within various regions was taken into account by Livanos (2007), who demonstrated its significance in the chances of becoming employed. Alhawarin and Kreishan (2010, p. 56) conclude that “the main predictors of long term unemployment in Jordan’s labour market are gender, age, marital status, region, previous work experience and, to a lesser extent, education.” Disadvantage in the labour market is often associated with age. In most advanced countries, including Slovakia, it is possible to include women aged over 40 years and men aged over 50 years (but often more) and graduates among the highest-risk groups in terms of unemployment (Institute for Sociology, 2006).

Unemployment in Slovakia has been always a big issue. Slovakia, with an employment rate of 66.4%, was not able to achieve the average EU employment rate, which stood at 69% in 2009. In 2010 there were almost 400,000 unemployed (Euroactive, 2010). The country deals with the so-called social trap where people, especially those with lower qualifications, have no motivation to work due to there being almost no difference between social subsistence and possible wages (Euroactive, 2010). Slovakia has a persistent problem with unemployment of low educated people (41.40% of all unemployed people in the third quarter of 2010),

achieving the worst position when compared with either other EU countries<sup>1</sup> or the EU average (Institute of Employment, 2010).

Regional disparities within Slovakia are also very visible in unemployment rates. In 2006 the highest rate of unemployment within all regions of the Visegrad countries was in the Slovak Eastern region, at 19.10%; higher by 14.50% comparing to the Slovak Western region and higher than the Visegrad average of 13.30% (Institute of Employment, 2008). In a survey conducted by the Slovak Public Affairs Institute (IVO), 64% of respondents considered the high unemployment rate to be the most troubling issue facing the country (IVO, 2011).

The aim of this paper is to examine selected factors and their effects on employability in the Slovak Republic. We assume that chances of finding employment in the labour market depend on various socio-economic factors. Above all, we presume that level of education and region will have significant impact on the chance of getting a job in Slovakia.

Data and descriptive statistics are presented in the next section of the paper. The third section deals with the methodology, and the final results are given in the fourth section. An overview of the main concerns is provided in the conclusion.

## **2. DATA AND DESCRIPTIVE STATISTICS**

The data used for the analysis is from the official statistical *Survey on Income and Living Conditions (EU SILC)* for the years 2005 and 2009, from the Slovak Statistical Office (Statistical Office, 2005; Statistical Office, 2010). Details concerning data collection can be found in publications of the Slovak Statistical Office (e.g., Statistical Office, 2010a). The results presented in the paper are based on personal cross-sectional data, which contain information on persons aged 16 years and above.

The dependent variable is the alternative (binary) variable, employment (*Emp*). It represents a self-defined current economic status, which according to the Slovak Statistical Office defines an employee as “a person who works for a public or private employer and receives payment for work in the form of wages, salaries,

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<sup>1</sup> Unemployment of low educated people in the 3rd quarter of 2010 in the Czech Republic was 24.50%, in Hungary 24%, in Poland 17.40%, in United Kingdom 1.30%, and in the Netherlands 7.40%. Source: Eurostat.

allowances, premium, bonuses based on obtained results, or payments in kind” (Statistical Office, 2010a).

The following independent variables have been included in the model:

- *Pra* – number of years spent in paid work as an employee;
- *Edu* – highest ISCED<sup>2</sup> level attained;
- *Gen* – gender;
- *Age* – age at the end of the income reference period;
- *Reg* – Slovak regions according to NUTS2<sup>3</sup>. For the purpose of centring the variables the original number of regions was reduced to three (Bratislava Region and Western Slovakia were merged).

More details about scaling variables can be found in Table 1.

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2 ISCED stands for International Standard Classification of Education (ISCED), developed by UNESCO to facilitate the comparison of education statistics and indicators of different countries.

3 NUTS2 stands for Nomenclature of Territorial Units for Statistics, according to which Slovakia is divided into four regions: Bratislava Region, Western, Central and Eastern Slovakia.

**Table 1.** Scaling variables

Scaling variables					
Variable	Category	Value	Variable	Category	Value
<b>Employment</b>	Unemployed	0	<b>Education</b>	Primary education	-2
	Employed	1		Low Secondary education	-1
<b>Gender</b>	Male	0		High and Post-secondary Education	0
	Female	1		Tertiary Education I. <sup>4</sup>	1
				Tertiary Education II. <sup>5</sup>	2
<b>Region</b>	Western Slovakia	-1		<b>Age intervals<sup>6</sup></b>	18-25
	Central Slovakia	0	26-35		-1
			36-45		0
	Eastern Slovakia	1	46-55		1
			56-59(62)		2

The variables employment and gender are bivalent while education and age are considered as ordinary variables. However, in the process of the analysis the reduction of ordinary variables in the nominal scale was performed.

The sample size was 6,621 respondents of EU SILC in 2005, and 6,454 respondents in 2009.

<sup>4</sup> Tertiary Education I. refers to BA and Masters Degrees

<sup>5</sup> Tertiary Education II.refers to PhD studies

<sup>6</sup> The upper limit of age ranges for women was established at the median of retirement age (59 years). The upper limit of age ranges for men was established at retirement age (62 years). People aged 16-18 were excluded from our sample.

**Table 2.** Distribution of the sample by profession, region, and education

Profession <sup>7</sup>			Region				
	Men	Women		Men		Women	
	2009			2005	2009	2005	2009
Agriculture, forestry, hunting, fishing	292	228	Western	1561	1453	1561	1433
Mining processing and distribution of raw materials	128	160	Central	798	839	823	804
Industry	933	357	Eastern	971	1015	907	910
Production and distribution of water, gas, electricity, construction industry	513	91	Education				
				Men		Women	
				2005	2009	2005	2009
Wholesale, retail, hotel	545	567	Primary	1	0	1	0
Transport, post and telecommunications	196	237	Low secondary	131	108	197	109
Financial consulting, business sector	101	118	High secondary, post secondary	2673	2524	2484	2331
Public administration, health, education	540	1310	Tertiary I.	506	647	596	685
Other	59	79	Tertiary II.	19	28	13	22

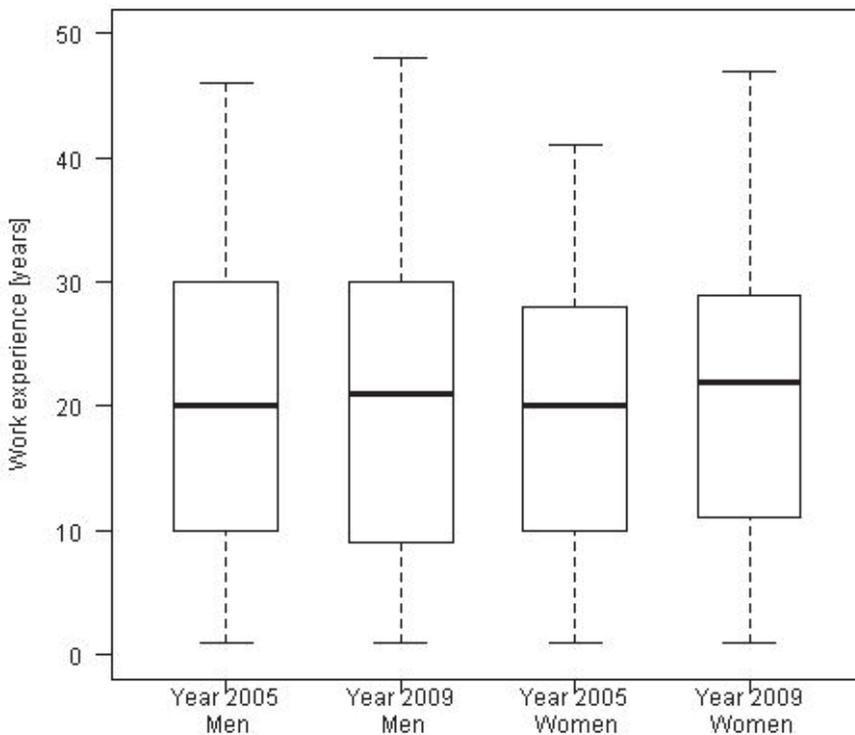
As shown in Table 2, most of the respondents (77.9% in 2005 and 75.2% in 2009) obtained high secondary or post-secondary education. Only 0.5 % in 2005 and 0.8% in 2009 obtained a second degree of tertiary education. Approximately every fifth respondent had a first degree of tertiary education.

<sup>7</sup> Categorisation of professions according to EU SILC.

In the year 2009, 28.2% of male respondents worked in industry and 41.6% of female respondents worked in financial consulting/the business sector. Only 8.8% of men (7.2% of women) worked in the agriculture, forestry, hunting, and fishing sector; 16.5% of men (18.0% of women) worked in the wholesale, retail, and hotel sector.<sup>8</sup> In the year 2005 (2009) 47.2% (44.7%) were from Western Slovakia. Approximately 25% of respondents in both years were from Central Slovakia and one third of respondents lived in Eastern Slovakia. Distribution of respondents by profession, region, and education is shown in Table 2.

The distribution of respondents by work experience is depicted in Figure 1. As shown, there are not considerable changes for either men or women in the analyzed years, and the median length of work experience was between 20 and 22 years.

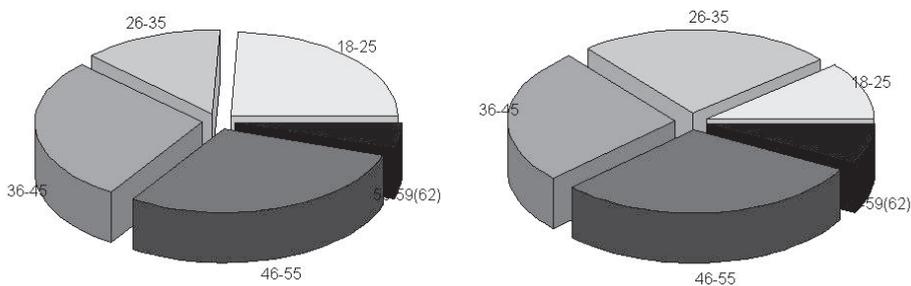
**Figure 1.** Boxplot of work experience



<sup>8</sup> Data of distribution sample by profession in 2005 were not available.

As shown in Figure 2, there were some small changes in age distribution between the years 2005 and 2009. People aged 18-25 represent 24.3% of respondents in the year 2005 and 11.1% in the year 2009. The number of respondents aged 26-35 changed by 11.2% between 2005 and 2009. There were not many significant changes in the number of respondents in other age groups between 2005 and 2009.

**Figure 2.** Age distribution of respondents in 2005 and 2009



#### 4. METHODOLOGY

We decided to apply a logistic regression as a predictive model because the dependent variable was dichotomous. Using linear regression would be inappropriate due to response values that are not measured on a ratio scale, and there is no requirement for normal distribution of error terms (Hosmer and Lemeshow, 2000).

A logistic regression model allows for quantifying the chances of modelled value occurrence depending on the values of the explanatory variables (Rimarčík, 2010). In our model, employment represents the dependent variable (log of the odds ratio) regressed against explanatory variables. Therefore, we used a logit model to quantify the chance of being employed, given selected variables chosen from a harmonized EU SILC statistical survey, namely: gender, region, education, age, and experience in the years 2005 and 2009 in Slovakia.

A priori, we consider the logit model:

$$P(y_i = 1|x_i, \beta) = \frac{e^{x_i\beta}}{1 + e^{x_i\beta}} \quad (1)$$

where:

$x_i$  - the  $i$ -th row of the regression matrix  $X$  containing the explanatory variables in columns,

$\beta$  - the estimated vector of regression coefficients,

$y$  - the column vector of dependent binary variable,

$y = 1$  if the person is employed,  $y = 0$  if the person is unemployed.

The Akaike information criterion (AIC) was applied to the best model selection from among all possible models created by diverse combinations of independent variables (gender, region, education, age, and work experience). Those models that obtained the lowest AIC values in the years 2005 and 2009 were considered to be the base models that were further developed by verifying the multicollinearity (undesirable correlation among predictor variables through variance inflation factor, VIF), widening the model by reduction of chosen ordinary variables to the nominal scale and models' significance testing through the McFadden pseudo coefficient determination.

The estimation of the regression coefficients of the econometric models, successive significance testing, and graphical display were conducted in statistical software R.

## 5. RESULTS

The resulting variables that enter Model 2005 are shown in Table 3. All the variables are significant at the level of significance  $\alpha = 0.001$ . The results of testing the multicollinearity of Model 2005 by variance inflation factor (VIF) and the verification of the adjusted model by the McFadden pseudo coefficient determination (McFadden) are depicted in Table 3.

The multicollinearity was not proven in Model 2005 (GVIF values fulfil the requirement to be lower than 5).<sup>9</sup> From the perspective of the McFadden test, Model 2005 did not represent an excellent model (as the range did not fall within the scope of 0.2- 0.4), but we could conclude that it represented the most accurate

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<sup>9</sup> Generalized variance inflation factor (GVIF) is an alternative of variance inflation factor (VIF) when categorical variables are included in model. (Fox 1992).

model from the processed sample. The resultant regression coefficients of Model 2005 independent variables are also presented in Table 3.

**Table 3.** Summary of statistical testing of Model 2005

	Estimated Coefficients	z value	GVIF	Resulting Coefficients
Edu	1.527	16.154***	1.029	4.607
Pra	0.180	18.539***	2.827	1.198
Reg	-0.194	-4.333***	1.001	0.823
Age 26-35	0.947	7.035***	1.296	2.578
Age 36-45	-1.863	-12.507***	-	0.155
Age 46-55	-3.361	-15.157***	-	0.035
Age 56-59(62)	-5.216	-15.825***	-	0.005
McFadden pseudo R <sup>2</sup>	0.129			
Significance codes:	‘***’ 0.001	‘**’ 0.01	‘*’ 0.05	‘.’ 0.1

**Note:** Age group 18- 25 is the reference group.

According to the estimated values of regression coefficients, we can conclude that people with a higher level of education are 4.61 times more likely to be employed compared to those with lower education. Moreover, those who have more work experience have 1.20 times more chance of obtaining employment than people with less experience. A negative effect on the possibility of becoming employed is presented in the variable “region”, as it obtains a value of 0.82. People from Central Slovakia have 0.82 times “higher” (thus ultimately less) chance of becoming employed, while those from Eastern Slovakia have 0.67 times “higher” chance of becoming employed when compared to Western Slovakia. In general, people are less likely to become employed with increasing age when compared to those between 18-25 years (serving as the reference group), except people between 26-35 years, which demonstrates almost 2.58 higher chance than people from the reference group. The interpretation of the results among explanatory variables reflects the situation in the Slovak labour market, where young, prospective, and educated people are preferred but, at the same time, a high level of qualification and experience is required.

We have applied the same steps when estimating the model for the year 2009. The resulting variables that enter Model 2009 are presented in Table 4. All the variables are significant at the level of significance  $\alpha = 0.001$ , except gender which is significant at the level of significance  $\alpha = 0.1$ . The results of testing the multicollinearity of Model 2009 and the McFadden pseudo coefficient determination (McFadden) are

also depicted in Table 4. Again, the multicollinearity was not proven in Model 2009. Moreover, the McFadden test proved good characteristics of the model adjustment.

**Table 4.** Summary of statistical testing of Model 2009

	Estimated Coefficients	z value	GVIF	Resulting Coefficients
Gen	-0.211	-0.928.	1.012	0.810
Edu <sup>10</sup> High Secondary	-0.175	-1.679***	1.010	6.837
Edu Tertiary I.	1.922	10.402***	-	42.159
Edu Tertiary II.	3.741	14.756***	-	51.235
Pra	3.936	3.791***	2.501	1.245
Reg	0.219	19.038***	1.005	0.813
Age 26- 35	-0.207	-3.462***	1.263	0.254
Age 36- 45	-1.371	-7.652***	-	0.037
Age 46- 55	-3.296	-13.519***	-	0.005
Age 56- 59(62)	-5.399	-16.452***	-	0.001
McFadden pseudo R <sup>2</sup>	0.215			
Signif. codes:	*** 0.001	** 0.01	* 0.05	ˆ 0.1

**Note:** Reference group is people who obtained low secondary education. Age group 18-25 is the reference group.

According to the results from Model 2009, employability was also affected by gender (on the significance level  $\alpha = 0.1$ ). Women are 0.81 times more likely to be employed than men (thus less). Other variables affect employment in similar ways as in the year 2005, although the sensitivity of change/impact on the dependent variable changed as follows: people with higher education are 51.23 times more likely to obtain a job than people with low secondary education (reference group), and those with high secondary education have 6.84 times more chance of finding work when compared to the reference group. Again, we observed a positive effect of work experience on the chance of competing in the labour market. However, age demonstrated a negative relation to the chances of becoming employed – the older the person, the harder to become employed.

<sup>10</sup> Reference group is people who obtained low secondary education.

## 6. CONCLUSION

In this paper we estimated a logit model of employment in Slovakia in the years 2005 and 2009. Age, region, education, and work experience were proven to have significant impact on the employability in both models (Model 2005, Model 2009). It was found that gender significantly influenced employability only in the year 2009.

In particular, the chances of becoming employed are higher for more educated people who have 4.6 times (6.8 times) more chance of getting job, as demonstrated in Model 2005 (Model 2009). The importance of education grew with the development of Slovak society and its labour market. Regarding the regions in Slovakia, a lower chance of being employed was proven for residents outside Western Slovakia. These chances differ by 0.8 times between neighbouring regions (Western – Central – Eastern Slovakia). With respect to work experience, a positive relationship with employability was confirmed in both models. However, employers prefer to employ young people; thus the chance of becoming employed diminishes with age. This implication is valid in our Model 2005, except for people aged 26-35 years, who have the highest employability. Employability is not affected by gender in Model 2005. However gender has significance in Model 2009. It was proven that women have 0.8 “higher” (thus lower) chance of becoming employed than men.

Results of quantifying the effects of selected variables on employability can be used as a basis for identifying the most vulnerable, high-risk groups in terms of unemployment. Such identification appeals especially to active labour market policy makers.

The most vulnerable groups regarding unemployment, as defined by the Employment Services Act, correspond to results of our analysis where the people with the lowest chances of becoming employed were identified:

- people with low qualifications and little work experience;
- citizens of Eastern Slovakia;
- people belonging to age group 36-45 years and above.

It should be noted that the negative impact of age starts much earlier than the Employment Services Act states (in the age group 36-45 years within both models), which means that the risk of unemployment affects people in the group even with the highest potential economic activity.

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