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Population ageing and labour market in Slovenia and European Union

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Abstract: In this paper we investigate the influence and importance of population ageing for labour market. Particularly we focus on unemployment, salaries and population education level. After reviewing some of the previous research on the influence of demographic ageing on labour market, we set three hypotheses, referring to the three above mentioned specific aspects of labour market, which were tested using multivariate regression analysis. Based on demographic and socio-economic panel data on Slovenian municipalities, we separately tested the three hypotheses in case of Slovenia; and using panel data on European Union countries we separately tested the three hypotheses in case of European Union and compared the results. Based on data for Slovenia and European Union we found out that population ageing increases unemployment and decreases population education level, however in case of analysis of salaries the results are somehow ambiguous.

Keywords: population ageing, unemployment, cost of labour, population education level, Europe

1. Introduction

The problem of population ageing is becoming increasingly important in the context of labour market. In 1950 there were 8 % of the world population in the age group of 60 years and over, in 2000 this percentage amounted up to 10 %. According to the expectations of the United Nations, by 2050 this percentage will increase to over 20 % and by 2150 almost every third earthling will be aged 60 years or more (Vertot 2007).

When we talk about ageing it is important to distinguish between ageing of a population as an aggregate and ageing of a single person. Ageing of a single person is a natural and irreversible process; while ageing of a



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whole population is a reversible social process, since it depends on the population's age structure which can change in any direction. Population ageing is usually measured by the percent of people aged 65 (or 60) and over. The other indicators of population ageing are population mean and median age as well as ageing index which is a ratio between young (less than 15 year old) and old (65 years old or over) people multiplied by 100 (Malačič 2003, 23).

In a view of population aging, Slovenia is no exception. In 1991, percent of population aged 65 years and over in Slovenia was over 11 %, by 2002 this value increased to 14.7% and in 2006 to 15.9 % (Vertot 2007). At the beginning of 2014, the percent of population aged 65 years and over in Slovenia increased to 17.5% (SORS n. d.e).

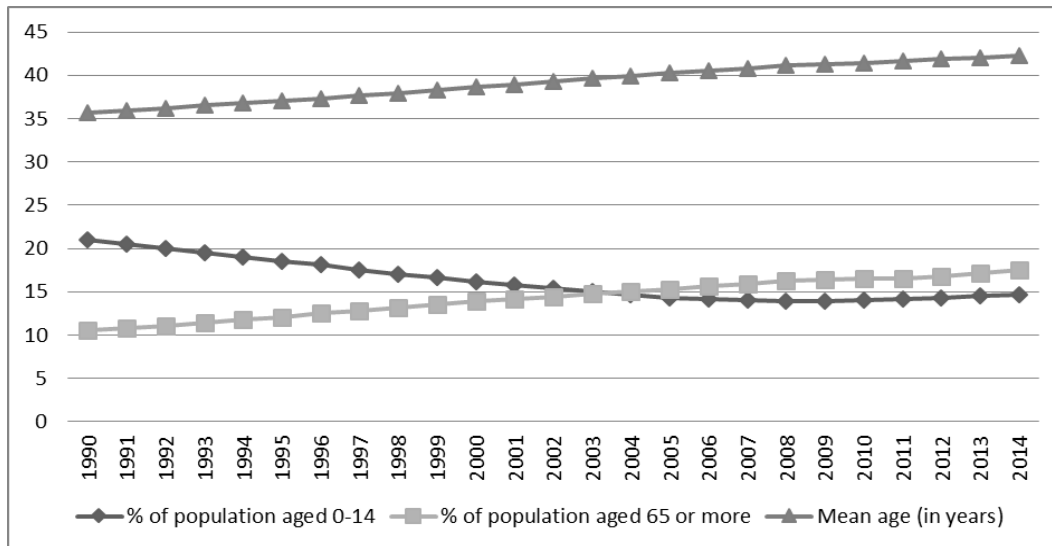


Figure 1: Population Ageing in Slovenia, 1990-2014

Source: Eurostat n. d.a; Eurostat n. d.d.

From figure 1 and 2 we can clearly see that populations in Slovenia and EU are ageing. The share of young people is decreasing, while the share of old people, mean age and ageing index are increasing over the observed period.

These data show a relatively rapid change in populations age structures, which has a direct impact on labour market. When population age structure is changed the working population age structure is changed too and thus the aggregate labour supply. All this has consequences for (un)employment, labour costs and level of education. Examining the impact of population ageing on labour market is important because of the role that labour market ultimately has for the whole economy and welfare of a society.

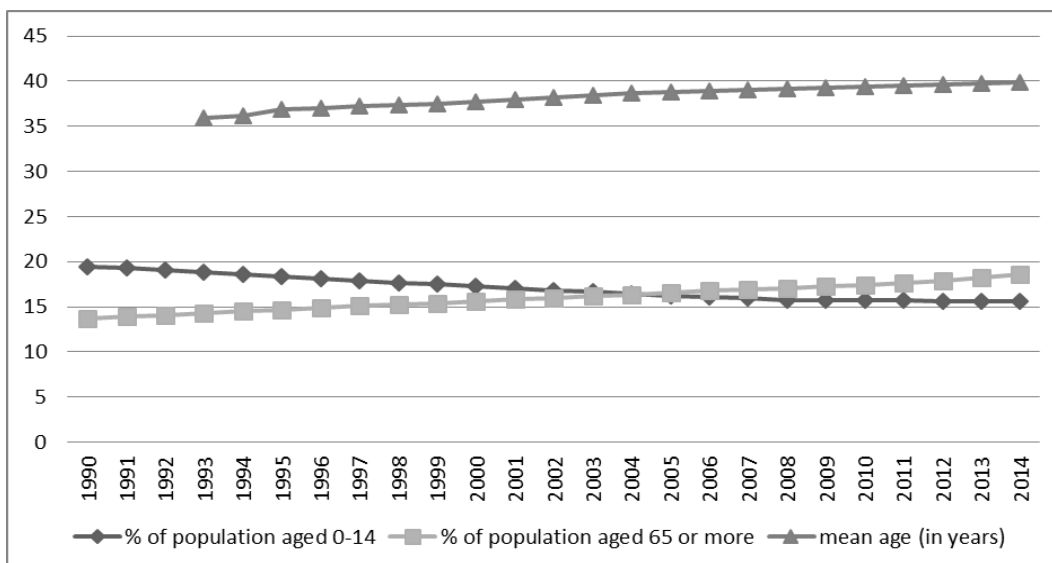


Figure 2: Population Ageing in EU-27, 1990-2014

Source: Eurostat n. d.a; Eurostat n. d.d.

In the next section we provide the review of some previous studies on impact of population ageing on labour market. Section three develops research hypotheses and describes the methodology and data used. The empirical analysis in section four provides the results of the multivariate regression analysis separately based on data for Slovenia and data for Europe. In section five we present main conclusions of our investigation.

2. Previous Investigation on Impact of Population Ageing on Labour Market

In this chapter some previous studies of different authors who investigated the impact of population ageing on various aspects of labour market is previewed.

Dixon (2003) stresses some important differences between older and younger workers. It is less likely that older workers will lose their jobs compared to younger workers, since their employment contracts are usually more secure. However when an older worker loses his job, he will be less likely to find a new one compared to his younger colleague. This is also because older workers are less flexible and less mobile in terms of geographic and sectorial mobility compared to younger workers. Consequently unemployment among older people is higher (Dixon 2003). On the other hand Bratić and Vukšić (2014) in their study on Croatian population found out that compared to older workers younger workers predominantly have fixed-term employment contracts, what means that they can be much easily fired than older workers. That is consequently supposed to lead to higher unemployment among young people compared to old people.

Population ageing could potentially lead to a reduction in the level of economic activity, since the employment rate of older people is lower than that of the younger ones. The downward trend in the level of activity of older people, especially males, in the past two decades has prompted a large number of researches, searching for the causes of early withdrawal from the labour market. Studies show that there are several factors for early withdrawal from the labour market such as improvements in before-retirement levels of savings, pension scheme, better social conditions for injured, sick or disabled workers and shift in industrial and occupational structure of employment (Campbell 1999; Disney 1999; Disney, Grundy and Johnson 1997; Department for Education and Employment 2000).

The ageing population could affect the growth of aggregate labour costs, since there is a positive correlation between the average age of workers and their salaries in their working career. Salaries of employees are normally rising with the ageing of the employees, when the salaries are linked to the age and experience of employees (Johnson and Zimmermann 1993, 5). The real impact on labour costs depends also on the presence of a trend of increasing average labour productivity, naturally if the wage growth is in line with productivity growth. Older workers are not necessarily less productive; they can be even more productive than younger workers, because they have more working experience (Disney 1996, 154).

Vodopivec (2014) researched the first ten years of transition from centrally planned socialist economy to a market economy in Slovenia and found out that the relationships between the relative wages and labour productivity changed differently between different types of workers. The relative wage differentials have increased for the educated workers, decreased for the older workers but remained relatively unchanged for the women workers.

Vanags (2007) in his study in Latvia reveals that population ageing decreases aggregate education level, makes the stock of human capital more outdated and causes the lack of necessary skills. The labour force in Latvia is already very old and no state institution is systematically solving this problem.

In the last two decades, in almost all industrialized countries we can see the increasing trend of early retirement, which represents additional burden for public finance, since each retirement means a reduction in public finance income and an increase in expenditures. Besides, the cost of one pensioner greatly exceeds the cost of maintaining one unemployed person. It is interesting that the early retirement scheme has almost no effect on reducing unemployment, but the costs of early retirement increase government expenditure (Samorodov 1999).

To solve the problem of an ageing population it is necessary to pay special attention to enhancing human capital both with the training of employees and with increasing labour productivity. Trends in the demographic field and pessimistic forecasts for the future will have an impact not only in the labour market but also on the overall economy (Caron et al. 2005).

In a short run ageing population reduces spending for maternity, child allowances, health and education, since the share of young people is decreasing; but it increases spending for older people and in the long run, it increases the ratio between the elderly (over 65 years) and working age (15–64 years) population. Due to the fact that life expectancy is increasing because of advances in medicine, strong pressures on the pension and social security system are expected in the future. Because pensioners will be receiving pensions for a longer period of time and fewer people will be working and consequently contributing in the pension fund. Therefore, in the future it is almost inevitable to increase the retirement age (Serban 2012).

Some studies in developed as well as developing countries show that in certain sectors or industries population ageing can result in a decline in labour productivity (Thießen 2007).

Skirbekk (2003) points out that despite of the increase in wages by increasing the workers age, the labour productivity can decrease over this same period, leading to a mismatch between pay and productivity. If we compare younger and older workers, we find that in terms of labour productivity younger are underpaid, while older are overpaid (Skirbekk 2003). For this reason, employers prefer to opt for a younger employee, because it has a better ratio between salary and productivity than older employees. On account of the negative relationship between wages and productivity of older workers they face a harder problem of employment, because their salaries are too high in relation to their productivity, so employers prefer younger workers in this regard. Caron et al. (2005) believe that the reason for the reduction in productivity within ageing could be in reduction of their cognitive abilities. Certain abilities and skills, such as the ability of observation and memorisations are reduced within ageing process. Still other skills, such as communication skills, within ageing change very slightly. However, older people including those with plenty of experience, spend more time to learn the same as they did when they were younger (Caron et al. 2005). Similarly Čepar and Bojnec (2008) found out that population ageing decreases the aggregate stock of human capital of some country.

However, on the other hand, there are some researches proving that population ageing is actually increasing the populations education level. Just recently Kluge et al. (2014) found out that an increasing population ageing is actually increasing education level and productivity through a continuous lifelong learning and additional education of adults and older people who constantly update and build up their skills, competencies, knowledge and experiences throughout their lives.

Dixon (2003, 70-74), Johnson and Zimmermann (1993, 1-22) and (Miles 2005, 1-3) in their research find out that a workforce ageing brings an increase in labour cost, an outdated knowledge, an increase of structural unemployment, a decline in work competences, an increase in disability and sick benefits and consequently lower revenues and economic activity.

On another hand there are also some researchers who prove the opposite effect of population ageing on cost of labour. Some believe that higher salaries of older people is justified and compensated by their higher work results, work efficiency, accumulated knowledge and many years' experience about work process - know-how (Disney 1996). On the other hand, their productivity might be lower due to a higher risk for health issues and sometimes consequent early retirement which builds a pressure on a pension system (Auer and Fortuny 2000) and a downward pressure on their salaries (Skirbekk 2003; Thießén 2007) through a decreasing productivity of older people. Serban (2012) is one of those researches who believe that population ageing decreases labour cost in a short run. A downward pressure on aggregate salaries is also conducted through lower aggregate population education level of older populations however that is in some cases offset by several salary benefits and extras which increase overall older people's salaries (Fallick et al. 2010).

We can see from the previous research that population ageing impact on unemployment, population education level and cost of labour is not quite clear and unambiguous. In our empirical investigation next, we are focusing specifically on consequences of population ageing for aggregate unemployment, education level and salaries in case of Slovenia and EU and present our original findings. We want to see how our findings fit with the previous investigation in this area.

3. The Research Hypothesis, Methodology and Data

In this section we present the research hypotheses and the methodology which was used to achieve the goals of the research and to test the research hypotheses. Finally the most important data used in this investigation is explained.

3.1. The Research Hypotheses

It is obvious from previous investigation and research, that there are many different consequences of population ageing for labour market. In our research we wanted to statistically test the effects of population ageing on three aspects of labour market in Slovenia and Europe. So the following three hypotheses are investigated:

H1: Population ageing is increasing unemployment.

H2: Population ageing is increasing salaries

H3: Population ageing is decreasing aggregate population education level

3.2. Methodology

In order to test the three hypotheses, we run several regression models. First, we collected secondary data on demographic and economic variables from the databases of Statistical office of Republic of Slovenia (SORS) and Eurostat. The data used in regression analysis for Slovenia refer to 211 Slovenian municipalities for the time period 2009-2013 (observation units are Slovenian municipalities) and in regression analysis for EU refer to 26 EU countries in time period 2006-2013 (observation units are EU countries). The panel demographic and

economic data were then properly arranged, transformed and entered into a statistical computer package SPSS, which was used for regression analysis.

Several multivariate linear and log-linear regression models were run in order to analyse the connection among variables which measure a particular labour market aspect and its factors which include population ageing in Slovenia and EU.

Variables, which measure the chosen labour market conditions in Slovenia and EU were used as dependent variables and variables, which measure population ageing and other socio-economic variables were used as explanatory variables. We set assumptions about the relationships and association among several different variables used and set regression models which were tested on the available relevant data about the Slovenian municipalities and EU countries.

Using regression analysis we estimated parameters of the models and chose the best fitting models based on the standard error of the models, adjusted determination coefficient, F-tests and t-tests.

We tested the hypotheses by developing six separate final multiple regression models. Three models on data for Slovenia and three models on data for Europe. The general form of the multiple regression model used is specified as follows:

$$Y = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \dots + \beta_p * X_p + \beta_t * T + \varepsilon,$$

where Y is a dependent variable in each regression models and X_1 to X_p are the explanatory variables. These are further explained in the data section, separately for both regression analyses. The dependent variable in case of Slovenia and Europe in the first regression analysis, testing hypothesis one, is a rate of unemployment. The dependent variable in case of Slovenia and Europe in the second regression analysis, testing hypothesis two, is an average gross monthly salary. The dependent variable in case of Slovenia and Europe in the third regression analysis, testing hypothesis three, is a percentage of people with tertiary education. The term ε is a normally distributed error term with expected value 0 and variance σ_ε and T is a linear trend term.

3.3. Data

In case of analysis for Slovenia the data were collected from SORS by 211 municipalities and by years from 2009 to 2013, which sums up to over than 1,000 observations. In case of analysis for EU, the necessary data were obtained from Eurostat by 26 EU countries and by years from 2006 to 2013, which sum up to over 200 observations. We had to exclude Croatia and Cyprus, because most of the data were not available for these those two countries.

Percent of population aged between 50 and 64 years is calculated by dividing the number of inhabitants in a country (municipality) who are 50 to 64 years old by the number of all inhabitants of that country (municipality) and multiplying the ratio by 100.

Ageing index is a ratio between the number of people who are 65 years old or over and the number of people who are less than 15 years old, multiplied by 100.

Mean age is defined as a weighted arithmetic mean of the whole population.

Registered unemployment rate is used in case of analysis for Slovenia. Data on registered unemployment rate is collected by the method of Statistical Register of Employment. This data tell us the percentage ratio of registered unemployed persons in all labour force.

Unemployment rate (by International Labour Organisation-ILO) is used in case of analysis for EU. The data about the survey unemployment rate are collected by the standard method of ILO. The data tell us the percentage ratio of unemployed persons in all labour force.

Average monthly gross salary is obtained directly from statistical databases or in some cases is calculated from the annual data by dividing by 12. All the data is expressed in euros (€).

Percent of population aged between 15 and 64 years with tertiary education is the percent share of population aged between 15 and 64 years with tertiary education in all population aged between 15 and 64 years. It is used in case of analysis for EU,

Percent of population with tertiary education is calculated by dividing the number of people with completed tertiary education by the total number of inhabitants in a given year and multiplying the ratio by 100. This variable is used in case of analysis for Slovenia and is slightly different from that used in case of analysis for EU. That is because in case of Slovenia data were collected by municipalities and were consequently not available by different age groups but for total population of each municipality only.

Number of enterprises per 1,000 inhabitants is a ratio between the number of enterprises and the total number of inhabitants multiplied by 1,000.

Number of enterprises (without financial and insurance sector) per 1,000 inhabitants is a ratio between the number of enterprises (without financial and insurance sector) and the total number of inhabitants multiplied by 1,000.

Gross investments in new assets in € per inhabitant is the total gross investments in new assets in € divided by the number of residents in a particular municipality.

Size of a municipality by the number of its inhabitants was used to measure the size of a Slovenian municipality by the total number of the municipality's residents.

Convicted per 1,000 inhabitants was obtained to measure the crime level in Slovenia. The number of convicted people in a particular municipality is divided by the total number of its residents and multiplied by 1,000.

GDP per capita is most commonly used indicator to compare economic standards among countries. It is the ratio between total GDP and the number of inhabitants.

Annual inflation rate tells us by how many percent the general price level is increased between two years.

Public expenditure for tertiary education as % of GDP is the ratio between public expenditure for tertiary education and total GDP multiplied by 100.

Linear trend is included in our analysis as a technical variable in order to control for the possible linear trend effects.

4. Econometric Results

Here we present the results of the final multivariate regression models for Slovenia and EU, which were used to test our research hypotheses. With all the regression models we analysed the explanatory power of the independent explanatory variables as well as the strength and the direction of the association between the dependent variable (indicator of a particular labour market aspect) and independent variables (indicators of population ageing and other economic variables). Using regression coefficients we tested the existence and the direction (positive/negative) of the association and impact that was assumed for each factor in each hypothesis. Using adjusted determination coefficient we wanted to test the share of the variance that could be explained by the independent variables. On the basis of t-test results we tested statistical significance of each individual explanatory variable, where on the basis of F-test results we tested statistical significance of the regression model as a whole. During regression analysis we run many different models, however only those which were statistically significant and those with highest explanatory power were selected for interpretation in this paper.

The values for Tolerance and VIF show that we have no multicollinearity problems, since the values for Tolerance are significantly higher than 0.1, while the values for VIF are much lower than 10 for all the explanatory variables included in our regression models.

In order to ensure the validity of regression model results, we tested also if the general assumptions of our regression models are fulfilled. In case of all our regression models the distribution of all in the analysis included variables are close enough to normal distribution, and so is the distribution of regression errors with average close to zero. The scatter diagrams show that regression errors exhibit no particular pattern and are evenly and randomly distributed over the area. There is no heteroscedasticity since constant variance of the errors is observed (homoscedasticity). All the necessary assumptions are fulfilled, so we may conclude that our regression models are efficient and unbiased.

Next we present regression models results in three separate tables, each one corresponding to one of our three hypotheses.

4.1 Results of regression analysis - population ageing and unemployment

In this section we show the results of regression analysis related to our first hypothesis. The first part of the table corresponds to the results for Slovenia and the second part to the results for EU. In case of Slovenia, dependent variable is logarithm of registered unemployment rate and in case of EU unemployment rate (by ILO).

Table 1. Regression Analysis Results – Population Ageing Among Factors of Unemployment Rate in Slovenia and EU

| | Variable | Coefficient Beta | Standardized Coefficient Beta | Sig. | Tolerance | VIF |
|----------|---|------------------|-------------------------------|-------|-----------|-------|
| Slovenia | Constant | -0.309 | | 0.016 | | |
| | LOG % of population aged between 50 and 64 years | 1.106 | 0.304 | 0.000 | 0.810 | 1.235 |
| | LOG Size of municipalities (by number of inhabitants) | 0.067 | 0.170 | 0.000 | 0.570 | 1.754 |

| | | | | | | |
|--------------|--|-----------------|-------------|----------|-------|-------|
| | LOG % of population with tertiary education | -0.553 | -0.544 | 0.000 | 0.539 | 1.854 |
| | LOG Convicted per 1000 inhabitants | 0.160 | 0.262 | 0.000 | 0.755 | 1.325 |
| | LOG Linear trend | 0.176 | 0.256 | 0.000 | 0.861 | 1.161 |
| EU | % of population aged between 50 and 64 years | 0.621 | 1.228 | 0.000 | 0.165 | 6.067 |
| | GDP per capita | -7.898E-5 | -0.233 | 0.000 | 0.301 | 3.325 |
| | Inflation | -0.459 | -0.170 | 0.001 | 0.350 | 2.858 |
| Model | Adjusted R² | F - test | Sig. | N | | |
| SLO | 0.576 | 203.249 | 0.000 | 744 | | |
| EU | 0.832 | 340.046 | 0.000 | 206 | | |

Source: Own calculations based on data obtained from SORS n. d.a; SORS n. d.b; SORS n. d.d

The value for adjusted R² in table 1 tells us that 57.6 % of variability of the registered unemployment rate in Slovenia is explained by the variations of all the independent variables included in the regression model for Slovenia. In EU, 83.2 % of variability of unemployment rate (by ILO) is explained by the variations of all the independent variables included in the regression model for EU.

Based on results of our regression analysis and by transforming the log-linearized function in power function we can compose an estimate of regression function of our multivariate regression model for Slovenia. Explanatory variables are sorted descending by their importance in the model (except for the technical variable linear trend, which is at the end):

$$\begin{aligned} \text{registered rate of unemployment} = & 10^{-0.309} + \% \text{ of population with tertiary education}^{-0.553} \\ & + \% \text{ of population aged between 50 and 64 years}^{1.106} \\ & + \text{convicted per 1000 inhabitants}^{0.160} + \text{size of municipalities} \\ & \text{by number of inhabitants}^{0.067} + \text{linear trend}^{0.176}. \end{aligned}$$

Similarly we can compose an estimate of regression function of our multivariate regression model for EU. Explanatory variables are sorted descending by their importance in the model:

$$\begin{aligned} \text{unemployment rate} = & 0.621 \cdot \% \text{ of population aged between 50 and 64 years} \\ & - 0.00007898 \cdot \text{GDP per capita} - 0.459 \cdot \text{inflation}. \end{aligned}$$

From table 1, we can see that population ageing, measured by percent of population aged between 50 and 64 years, plays a very import role in both regression models, for Slovenia and EU. According to standardised coefficients beta, population ageing is the second most important factor of unemployment rate in the model for Slovenia and the most important factor in the model for EU. If percent of population aged between 50 and 64 years in Slovenia is increased by 1 %, registered unemployment rate in Slovenia is increased by 1.1 %, holding other things constant. If percent of population aged between 50 and 64 years in Slovenia is increased by 1 percentage point in EU, unemployment rate (according to ILO) in EU is increased by 0.6 percentage points, holding other things constant.

4.2 Results of regression analysis - population ageing and salaries

In this section we show the results of regression analysis related to our second hypothesis. The first part of the table corresponds to the results for Slovenia and the second part to the results for EU. In case of Slovenia dependent variable is average monthly gross salary and in case of EU logarithm of average monthly gross salary.

Adjusted R² in table 2 tells us that 27.8 % of variability of the average monthly gross salary in Slovenia is explained by the variations of all the independent variables included in the regression model for Slovenia. In EU, 95.5 % of variability of average monthly gross salary is explained by the variations of all the independent variables included in the regression model for EU.

Table 2. Regression Analysis Results – Population Ageing Among Factors of Average Monthly Gross Salary in Slovenia and EU

| | Variable | Coefficient Beta | Standardized Coefficient Beta | Sig. | Tolerance | VIF |
|--------------|---|-------------------------------|-------------------------------|-------------|-----------|-------|
| Slovenia | Constant | 1366.228 | | 0.000 | | |
| | Mean age | -5.929 | -0.073 | 0.020 | 0.922 | 1.084 |
| | % of population with tertiary education | 10.061 | 0.194 | 0.000 | 0.805 | 1.242 |
| | Size of municipalities by number of inhabitants | 0.002 | 0.236 | 0.000 | 0.845 | 1.183 |
| | Gross investments in new assets in € per inhabitant | 0.019 | 0.245 | 0.000 | 0.935 | 1.069 |
| | Linear trend | 23.073 | 0.183 | 0.000 | 0.930 | 1.075 |
| EU | Constant | -5.100 | | 0.000 | | |
| | LOG GDP per capita | 1.165 | 0.993 | 0.000 | 0.967 | 1.034 |
| | LOG Mean age | 2.251 | 0.096 | 0.000 | 0.963 | 1.038 |
| | LOG Number of enterprises per 1.000 inhabitants | -0.189 | -0.091 | 0.000 | 0.964 | 1.037 |
| Model | | Adjusted R² | F - test | Sig. | N | |
| SLO | | 0.278 | 61.844 | 0.000 | 791 | |
| EU | | 0.955 | 783.145 | 0.000 | 112 | |

Source: Own calculations based on data obtained from SORS n. d.a; SORS n. d.c; SORS n. d.d; SORS n. d.e; SORS n. d.h; Eurostat n. d.a; Eurostat n. d.b; Eurostat n. d.c; Eurostat n. d.i.

Based on results of our regression analysis we can compose an estimate of regression function of our multivariate regression model for Slovenia. Explanatory variables are sorted descending by their importance in the model (except for the technical variable linear trend, which is at the end):

$$\text{average monthly gross salary} = 1366.228 + 0.019 \cdot \text{gross investments in new assets in € per inhabitant} + 0.002 \cdot \text{size of municipalities by number of inhabitants} + 10.061 \cdot \% \text{ of population with tertiary education} - 5.929 \cdot \text{mean age} + 23.073 \cdot \text{linear trend}$$

Based on results of our regression analysis and by transforming the log-linearized function in power function we can similarly compose an estimate of regression function of our multivariate regression model for EU. Explanatory variables are sorted descending by their importance in the model:

$$\text{average monthly gross salary} = 10^{-5.100} + \text{GDP per capita}^{1.165} + \text{mean age}^{2.251} + \text{number of enterprises per 1000 inhabitants}^{-0.189}$$

From table 2, we can see that population ageing, measured by mean age in this case, plays a significant role in both regression models, for Slovenia and EU, even though it is not the most important factor. If mean age in Slovenia is increased by 1 year, average monthly gross salary in Slovenia is decreased by 5.929 €, holding other things constant. If mean age in EU is increased by 1 %, average monthly gross salary in EU is decreased by 2.3 %, holding other things constant.

4.3 Results of regression analysis - population ageing and aggregate population education level

Here we show the results of regression analysis related to our third hypothesis. Similarly as in previous cases, the first part of the table corresponds to the results for Slovenia and the second part to the results for EU. Dependent variable is percent of population with tertiary education in case of analysis for Slovenia. In case of analysis for EU dependant variable is percent of population aged between 15 and 64 years with tertiary education.

Table 3. Regression Analysis Results – Population Ageing Among Factors of Percent of Population with Tertiary Education in Slovenia and EU

| | Variable | Coefficient Beta | Standardized Coefficient Beta | Sig. | Tolerance | VIF |
|--------------|---|-------------------------------|-------------------------------|-------------|-----------|-------|
| Slovenia | Constant | -0.229 | | 0.002 | | |
| | LOG Size of municipalities by number of inhabitants | 0.080 | 0.220 | 0.000 | 0.741 | 1.349 |
| | LOG Ageing index | -0.288 | -0.187 | 0.000 | 0.983 | 1.017 |
| | LOG Number of enterprises per 1000 inhabitants | 0.775 | 0.658 | 0.000 | 0.751 | 1.331 |
| | LOG Linear trend | 0.128 | 0.184 | 0.000 | 0.999 | 1.001 |
| EU | Constant | 38.527 | | 0.000 | | |
| | % of population aged between 50 and 64 years | -1.691 | -0.383 | 0.000 | 0.910 | 1.099 |
| | Public expenditure for tertiary education as % of GDP | 10.091 | 0.584 | 0.000 | 0.968 | 1.033 |
| | Linear trend | 0.719 | 0.183 | 0.009 | 0.909 | 1.100 |
| Model | | Adjusted R² | F - test | Sig. | N | |
| SLO | | 0.700 | 492.067 | 0.000 | 841 | |
| EU | | 0.437 | 34.357 | 0.000 | 130 | |

Source: Own calculations based on data obtained from SORS n. d.a; SORS n. d.d; SORS n. d.e; SORS n. d.f; Eurostat n. d.a; Eurostat n. d.f; Eurostat n. d.h.

Similarly as in previous two sub-section, adjusted R² in table 3 tells us that 70.0 % of variability of the percent of population with tertiary education in Slovenia is explained by the variations of all the independent variables included in the regression model for Slovenia. In EU, 43.7 % of variability of the percent of population with tertiary education is explained by the variations of all the independent variables included in the regression model for EU.

Based on results of our regression analysis and by transforming the log-linearized function in power function we can compose an estimate of regression function of our multivariate regression model for Slovenia. Explanatory variables are sorted descending by their importance in the model:

$$\text{percent of population with tertiary education} = 10^{-0.229} + \text{number of enterprises per 1000 inhabitants}^{0.775} + \text{size of municipalities by number of inhabitants}^{0.080} + \text{ageing index}^{-0.288} + \text{linear trend}^{0.128}.$$

Based on results of our regression analysis we can compose an estimate of regression function of our multivariate regression model for EU. Explanatory variables are sorted descending by their importance in the model:

$$\text{percent of population aged between 15 and 64 years with tertiary education} = 38.527 + 10.091 \cdot \text{public expenditure for tertiary education as \% of GDP} - 1.691 \cdot \text{\% of population aged between 50 and 64 years} + 0.719 \cdot \text{linear trend}$$

We can see from table 3 that population ageing, measured by ageing index (in case of Slovenia) and percent of population aged between 50 and 64 years (in case of EU), is one of the statistically significant factors in both regression models. If ageing index in Slovenia is increased by 1 %, the percent of population with tertiary education in Slovenia is decreased by 0.29 %, holding other things constant. If percent of population aged between 50 and 64 years in EU is increased by 1 percentage point, the percent of population aged between 15 and 64 years with tertiary education in EU is decreased by 1.7 percentage points, holding other things constant. The impact of the other control variables in all the above regression models is explained in the following section.

5. Key Findings

Based on the results of our empirical investigation we may draw the following conclusions. The first regression model for Slovenia and EU investigating the role of population ageing and other factors for unemployment shows not only that population ageing is increasing unemployment but also that population ageing is one of the most important factors of unemployment among all the factors included in the regression

model. Therefore we cannot reject our first hypothesis that *population ageing is increasing unemployment*. That is probably because older people are less likely to find a job because of their lower geographical mobility and their lower flexibility when losing their job compared to younger people. Older people are less likely to be requalified when necessary, their mental abilities are decreased as well as their formal education is more likely to be lower and their knowledge outdated compared to that of younger people. Our findings are consistent with finding of many other researchers who came to the similar conclusions (Munnell 2014; Serban 2012; Dixon 2003; Campbell 1999; Disney 1999; Disney, Grundy and Johnson 1997; Department for Education and Employment 2000).

Besides, we can see, from the other explanatory variables in the first regression model for Slovenia and EU, that unemployment is lower when people are more educated as expected, countries with higher GDP per capita and higher inflation rate have lower unemployment as consistent with economic theory and the well-known Phillips Curve which describes the trade-off between unemployment and inflation.

The second regression model for Slovenia and EU investigating the importance of population ageing and other factors for salaries shows that population ageing is a significant factor which affect salaries. However we came to the contradictory results in case of analysis for Slovenia and EU regarding the direction of the impact on salaries. In the first case we found the population ageing decreases salaries, while in the second case we found that population ageing increases salaries. Thus we can neither reject nor confirm our second hypothesis that *population ageing is increasing salaries*. However we are not surprised by our ambiguous result since also in the previous studies of other researchers we may encounter many different and opposing findings. With our empirical findings in case of analysis for Slovenia we join to the group of researchers who prove that older people have lower education or more outdated knowledge, lower productivity and lower efficiency also due to the health issues, are less flexible and less innovative and consequently have lower salary (Skirbekk 2003; Thießen 2007; Serban 2012). However our empirical findings in case of analysis for EU support those studies which prove that accumulated experiences and salary benefits sometimes and in some cases offset factors that decrease older people salaries. So consequently population ageing may lead to an increase of cost of labour (Johnson and Zimmerman 1993; Disney 1996; Miles 2005, 1-3; Fallick et al. 2010). Maybe the positive association between population ageing and salaries is more typical for economically more developed countries and the negative association between population ageing and salaries is more typical for countries which level of development is lower than the average level. That is for example the case in Slovenia, where level of economic development is lower than the average EU level of economics development and association between population ageing and salaries is found to be negative.

By including some other control variables in the second regression model for Slovenia and EU, we confirmed that higher gross investments in new assets, higher size of municipality (and consequently the level of development of a municipality), higher level of education and higher GDP per capita increase average salaries. On the other hand higher relative number of enterprises decrease average salaries, probably because higher relative number of enterprises leads to higher competition among them and consequently to the greater need to decrease cost of labour and salaries.

The third regression model for Slovenia and EU investigated the role of population ageing and other factors for aggregate education level. It confirms the relevance of population ageing for the aggregate human capital quality as well as the negative impact of population ageing on aggregate education level in case of analysis for Slovenia and EU. Thus we cannot reject our third hypothesis that *population ageing is decreasing aggregate population education level*. We believe that population ageing means an increasing share of those older people who were typically less included in higher education when they were young, compared to today's young generations. Consequently that leads to lower aggregate population education level. Younger generations which are typically mostly included in formal tertiary education are getting relatively smaller due to the declining fertility and consequently there is lower inflow of young educated people. Older people also find it more difficult to learn and to acquire new knowledge because they have more difficulties with their memory, find it more difficult to concentrate and focus and are also less motivated compared to young people. Consequently, knowledge and competencies of older people are more likely to be outdated compared to younger people which number is in decline. Our findings thus support the results of some other studies, which prove, that population ageing decreases populations' education level (Caron et al. 2005; Dixon 2003; Vanags 2007) and oppose to some other studies which try to prove the opposite (Kluge et al. 2014).

Moreover, from the other explanatory variables in the third regression model for Slovenia and EU we can see, that aggregate education level is higher also when percent of public expenditure for tertiary education in GDP is higher and when the relative number of enterprises and size of municipalities is higher (in case of analysis on data by municipalities for Slovenia). We believe that is because enterprises attract younger working-age people with higher education attainment. On the other hand, many municipalities with lower number of people have older population age structure, since emigrant are normally younger working-age people with higher education. Besides, many municipalities with higher number of people are younger also because bigger municipalities are more likely to have universities or at least some faculties and are together with their better

infrastructure and other positive externalities generally friendlier to young people and their families, which additionally attract younger people and consequently increase education level.

Based on all obtained results and findings of all our analysis we make the opinion that the countries will have to continue with reform of labour market, continue increasing the retirement age and reforming pension system. In addition to that, the countries should continue with intensive promotion of education not only for younger population but also to older population. Another important thing would be to improve the conditions for younger people and conditions for starting families and thereby encouraging a higher birth rate, which is a good way to cope with an ageing population.

Our own original empirical findings thus contribute to and upgraded the vast body of literature and research on the interrelation between population ageing and labour market. Here we bring forward another empirical evidence of a negative impact of population ageing on aggregate education level and rate of employment, however the direction of impact of population ageing on aggregate cost of labour is not quite unambiguous, yet the impact is obviously there.

Our findings imply that that proper population policy might also be used as an instrument of a long run government labour market policy in a wider sense. Prudent migration policy as well as encouraging higher fertility and higher number of children per family would change the population age structure and consequently mitigate the unfavourable consequences of population ageing for labour market in a long run.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://sepd.tntu.edu.ua/images/stories/pdf/2015/15ktaaeu.pdf>

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