EXPECTED YEARS OF SCHOOLING AND LONGER LIFE EXPECTANCY AS AN AGING POPULATION FACTOR

Anica Novak,
Elementary school Ciril Kosmač Piran, Slovenia
anicanovak@yahoo.co.uk

Žiga Čepar,
University of Primorska, Faculty of Management Koper, Slovenia
ziga.cepar@fm-kp.si

Aleš Trunk,
International School for Social and Business Studies Celje, Slovenia
ales.trunk@yahoo.com

Abstract:
Population aging is one of the major social and economic challenges of the 21st century. Major causes for population aging are reduction in birth rates and rising life expectancy. The purpose of this paper is to present the causes which affect the life expectancy of the world population. We wanted to know what factors affect the length of life expectancy; we focused specifically on the factor of expected years of schooling. Based on empirical data, we confirmed that there is a statistically significant relationship between the expected years of schooling and life expectancy at birth. Individuals with higher education earn more money and have better jobs are more aware of how to avoid the risk of the disease and how to live longer and more comfortable life.

Keywords: life expectancy at birth, expected years of schooling, population aging, human resource management, economic crisis

1. POPULATION AGING AND ECONOMY

With the onset of the major economic and financial crisis, which has severely shaken and swung the global financial markets, the global situation deteriorated, also in Slovenia. In the time of conjuncture the market value of companies were extremely high. In recent years, many companies failed, the unemployment rate increased sharply, stock indexes plummeted and some countries are on the verge of bankruptcy due to incorrect monetary policies of central banks and false / missed fiscal policies. The consequences of major financial crisis paralyzed the global economic system. Paralyzed economic system combined with an aging population and longer life expectancy of the population, which in itself affect the economy (Čepar and Bojnec, 2008, pp. 68-86) represents a growing burden on certain countries, including Slovenia.

Since 1950, the life expectancy at birth increased by 21 years, from 46.6 years in 1950-1955 to 67.6 years in 2005-2010. In 2009, the number of persons aged 60 years or more increased by 3.5 times (to 737 million). By 2050, the group of people aged 60 years and over increased to 2 billion (United Nations, 2009, pp. 6-10). The increase in the elderly population was influenced by raising life expectancy at birth and by reduction in fertility.

Population aging is one of the major social and economic challenges of the 21st century. It concerns the whole world, as well as the EU. In 2025 more than 20% of the population will be aged 65 years or more, also the number of elderly people aged 80 years and over will increase substantially (European Commission, 2013).

The number of people in the European Union will increase slightly until 2060 (517 million compared with 502 million in 2010), but people will be, on average, much older - 30% of the population will be older than 65 years. This is on one hand an important achievement, but longer life expectancy also represents an important challenge for the economies of the Member States of the European Union and their social security system. The scale and speed of population aging depend on life expectancy at birth, fertility and migration. Life expectancy at birth is expected to increase from 76.7 years (in 2010) to 84.6 years (2060) for men and from 82.5 to 89.1 years for women. Total fertility rates in the EU should only increase slightly, from 1.59 children per woman in 2010 to 1.71 children in 2060. Overall net migration into the EU by the year 2060 should amount to approximately 60 million people (European Commission, 2013b).

The purpose of this paper is to present the state of the aging population worldwide, the causes that affect aging: reduction in fertility and increase in life expectancy. Here we have a particular focus on the expected years of schooling as one of the most important factors of increased life expectancy. We hypothesized that countries with higher expected years of schooling have higher expected life expectancy. The hypothesis was empirically tested on data from various countries of the world for 2010 (we used secondary data for 187 countries from Human Development Report 2013) using a quantitative methodology, graphical analysis, correlation analysis, Chi-Square Test and regression analysis.

2. CAUSES OF POPULATION AGING

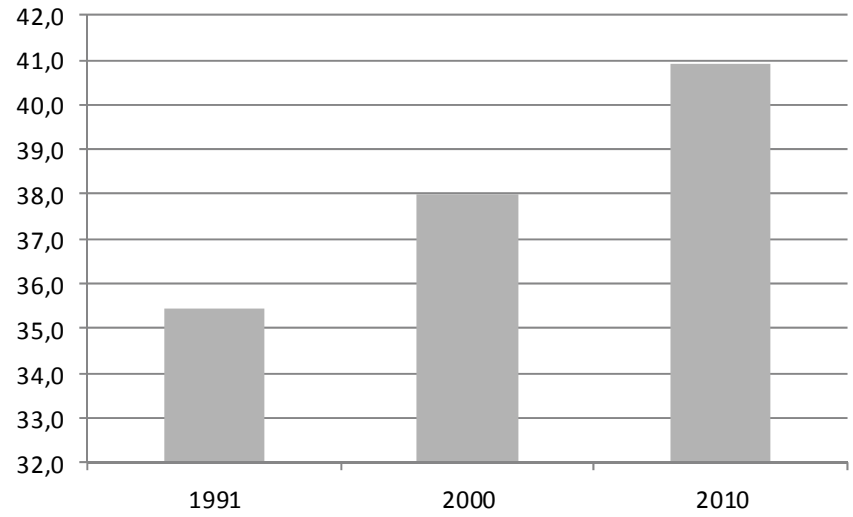
Population aging is a long-lasting trend which is visible through the increased share of elderly and reduced share of young population, which is also reflected in working population (European Commission 2013c, p. 8). The process of population aging is measured by:

- the growth of middle-aged population,
- increase of the percentage of the elderly population and
- increase of index of aging.

The middle age of the population is an age, where 50% of the population is older than the middle age and 50% is younger than the middle age. The growth of middle age means an aging population. The middle age at the global level in 1995 was 25 years, and in 2010 28.5 years (STATISTICA 2014). 31 countries had the middle age above 40 years in 2010, including Slovenia, where the middle age was 42.1 years (World map by 2012).

The figure below shows the middle age of population in the EU (27) years. Just like in the world, with a middle age is increasing in the EU. We see that the middle age in the EU (27) is higher than in the world. In 2010, the middle age in the EU (27) was 40.9 years.

Figure 1: The middle age of the population in the EU (27) for the period 1991-2010



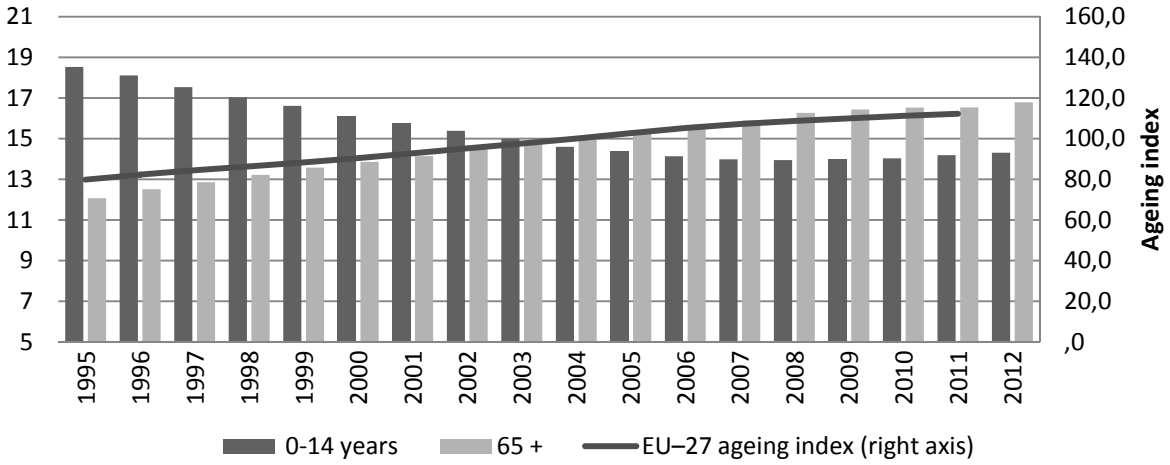
Source: Eurostat 2013.

The number of old people (65 and over) in the total population accounted for 506 million people or 7% of the total population in 2008. It is projected that by 2040 the elderly population will be 1.3 billion, or 14% of the total population (Kinsella and He, 2009, p. 7).

The aging *index* is the ratio of the elderly population (aged 65 and over) and young population (aged 0-14 years) multiplied by 100 (SORS, 2004).

The figure below shows the aging index in the EU (27) from 1995 to 2012. Columns show the number of young and old population percentage, while the curve shows the aging index. From the picture we can see that the proportion of population aged 0-14 is decreasing and the proportion of population aged 65 and over is increasing. In 2003, the proportion of the population aged 0-14 was levelled with the proportion of the population aged 65 years and over.

Figure 2: The aging index of population in the EU (27) for the period 1995-2012



Source: UMAR 2012.

Important causes of population aging are reducing fertility rates and rising life expectancy (World Health Organization, 2011).

2.1. Decreasing fertility

Fertility is measured by the following indicators (Malačič 2003, pp. 85-86):
- *Total fertility rates* (the average number of live births per woman in childbearing age (15-49 years) in a calendar year. It is calculated by adding all values of age-specific fertility rates in the calendar year)
- *general fertility rate* (the ratio between the number of live births in the calendar year and the number of women of childbearing age (15-49 years) in the same year, multiplied by 1000)
- *age-specific fertility rates* (we show the characteristics of fertility as a function of age. It is calculated after one-year or five-year age classes. Placed in the numerator is the number of live births to mothers aged x years, the denominator is the medium annual number of women in this age group x)
- *the overall level of birth rate* (the ratio between the number of live births in a year and the number of total population in that year multiplied by 1,000) and
- the number of live births.

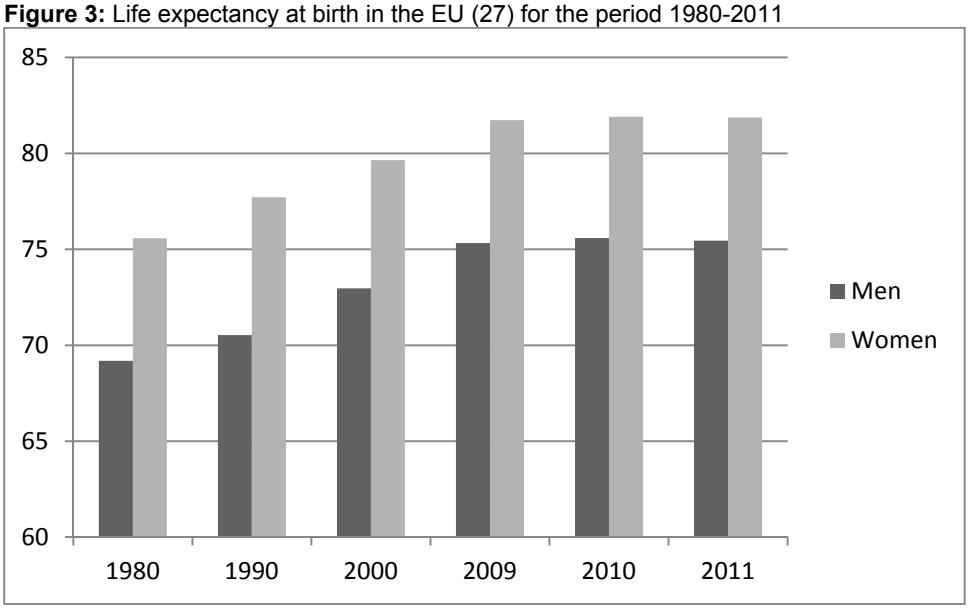
In more developed the total fertility rates has fell from already low fertility rate of 2.8 children per woman of childbearing age in the years 1950-1955 to a very low level of 1.6 children per woman in 2005-2010. This level is below the level needed to replace generations (needed an average of 2.1 children per woman). Virtually all developed countries are faced with low fertility (United Nations, 2009, p. 4).

The main decrease in fertility in the less developed regions occurred in the last three decades of the 20th century. In the developing world, the birth rate between the years 1950-1955 and 2005-2010 decreased from 6.0 to 2.7 children per woman (United Nations, 2009, p. 5).

2.2. Prolonging the life expectancy

Today one-tenth of the world population is older than 60 years, experts predict that in the next forty years this proportion will rise strongly, or even double.

Figure 3: Life expectancy at birth in the EU (27) for the period 1980-2011



Source: Eurostat 2013.

The following factors have an important impact on prolonging life expectancy (HDR 2013):
- spending on public health (public health spending as a percentage of GDP)
- gross domestic product per capita (gross domestic product per capita, expressed in U.S. dollars)
- gender inequality (a composite measure that reflects the potential loss due to inequality between female and male sex through three dimensions: reproductive health, empowerment and the labour market)
- expected years of schooling (the expected number of years of schooling from entry to school)

- employment relationship between female and male gender (the ratio between female and male working population (aged 15-64) who are actively involved in the labour market)
- relationship between men and women sex with at least upper secondary education (the ratio between female and male sexes aged 25 years or older with acquired secondary or higher education),
- urban population (population living in areas classified as urban areas, taking into account their particular area or countries) and
- proportion of births per 100 women aged 15-19 years (number of births to women aged 15-19 per 100 women aged between 15-19 years).

We will analyse the impact of the expected years of schooling on life expectancy at birth.

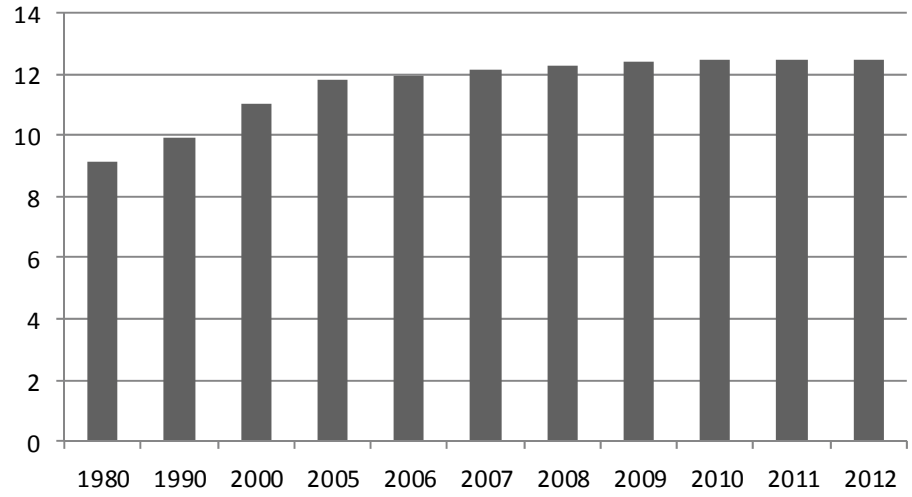
3. EXPECTED YEARS OF SCHOOLING AND LONGER LIFE EXPECTANCY

Expected years of schooling is one of the factors that is significantly related to life expectancy at birth. Individuals with higher education earn more money and have better job. This means that their household income is higher and allows them to a better quality of life. People with higher education are more aware of how to avoid the risk of disease (they have better information about health services, nutrition, hygiene ...) and how to live longer and more comfortable life (HDR 2010, p. 36).

People in the world have a much higher degree of education than in the past. From 1990 to 2010, at the global level the number of years of schooling increased by 2 years and total school enrolment by 12% (while literacy had risen from 73% to 84%). Since 1960, the proportion of pupils has increased from 57% to 85%. Progress in education has increased among emerging countries. Among people aged 65-74 years there are almost 36% who never attended school, while the generation of people aged 15-24 years there are only 7% of those who never attended school (HDR 2010, p. 36).

The figure below shows the expected years of schooling. Since 1980, there is a perceived increase in the number of years of schooling (in 1980 the average 9.1 years of schooling, 12.5 in 2012). Every 10 years, the expected years of schooling increased by 1 year.

Figure 4: Expected years of schooling in the world, 1980-2012



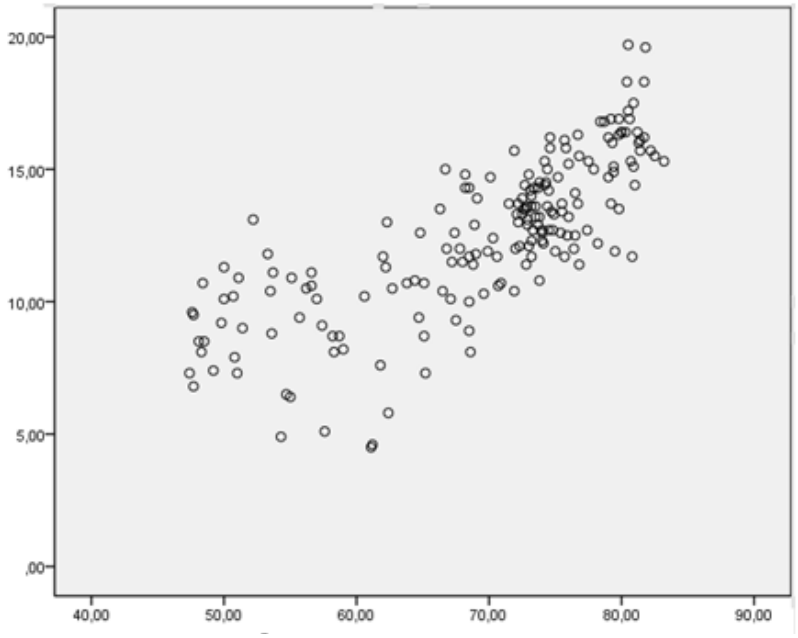
Source: HDR 2013.

Many children who enrol in primary school attend only intermittently or completely drops out. This is usually the girls who have to work at home. The causes of dropouts are lack of teachers, school fees and lack of support from the parents to send their children to school. Most difficulties with attending primary schools are in Asia and sub-Saharan Africa and South Africa, where more than 48 million children do not attend primary school (World Bank, 2012, p. 4). Here in 2010, 70% of children completed primary education (at the global level, the share was 90%). By having more and more children complete elementary education, we have more and more children involved in secondary education. Among children who do not participate in continuing education are in particular children from poor families and children who come from a rural environment (United Nations 2012, pp. 7-20).

3.1. The correlation between life expectancy at birth and expected years of schooling in 2010

We have focused on the expected years of schooling in 2010. Easiest way to show this is with the diagram below. On X-axis are the values for average life expectancy at birth in 2010 (in years) (LEB10), on Y-axis are expected years of schooling in 2010 (EYS10). From the image below you can read that the connection is positive, where with increasing life expectancy at birth increases the expected years of schooling.

Figure 5: Reflective diagram: Life expectancy at birth - expected years of schooling



Source: HDR 2013.

For a detailed review, lets use the correlation coefficient. From the table below we read the correlation coefficient is 0.775; linear correlation is strong and positive. Because the exact level of significance is smaller than 0.05, the correlation between the two variables is statistically significant. Despite the fact that the variables are related, it can not be said that they also interfere with each other.

Table 1: Correlation

		LEB10	EYS10
LEB10	Pearson Correlation	1	,775
	Sig. (2-tailed)		,000
	N	187	187
EYS10	Pearson Correlation	,775	1
	Sig. (2-tailed)	,000	
	N	187	187

Source: HDR 2013.

3.2. Contingency tables and Chi-Square Test

With contingency table, we further tested whether life expectancy at birth in 2010 (LEB10) is linked with the expected years of schooling in 2010 (EYS10) and what is the direction of the link. The selected variables were divided into groups.

1. Variable 1: Expected years of schooling were divided into groups:
- in the first group (S1) are the countries with low expectations of schooling duration, which lasts up to 12 years of schooling,
- in the second group (S2) countries with medium high expectations of the duration of schooling in which education takes between 12 and 14 years,
- in the third group (G3) are the countries with the high expectations of the duration of schooling, which lasts over 14 years.

2. Variable 2: Life expectancy at birth were divided into groups:
- in the first group (S1) are the countries with low life expectancy at birth in which the life expectancy is less than 65 years
- in the second group (S2) are the countries with middle-life expectancy at birth in which the life expectancy of between 65 and 75 years
- in the third group (G3) are the countries with high life expectancy at birth in which the life expectancy greater than 75 years.

The contingency table below shows that countries with higher life expectancy at birth (LEB10) have higher expected years of schooling (EYS10) and, conversely, that countries with lower life expectancy at birth have less expected years of schooling. In other words, the higher the life expectancy at birth, the higher the expected years of schooling.

Table 2: Contingency table

			EYS10			
			S1	S2	S3	Total
LEB10	S1	Count	47	3	0	50
		% within LEB10	94,0%	6,0%	,0%	100,0%
		% within EYS10	59,5%	6,1%	,0%	26,7%
		% of Total	25,1%	1,6%	,0%	26,7%
	S2	Count	26	35	19	80
		% within LEB10	32,5%	43,8%	23,8%	100,0%
		% within EYS10	32,9%	71,4%	32,2%	42,8%
		% of Total	13,9%	18,7%	10,2%	42,8%
	S3	Count	6	11	40	57
		% within LEB10	10,5%	19,3%	70,2%	100,0%
		% within EYS10	7,6%	22,4%	67,8%	30,5%
		% of Total	3,2%	5,9%	21,4%	30,5%
Total		Count	79	49	59	187
		% within LEB10	42,2%	26,2%	31,6%	100,0%
		% within EYS10	100,0%	100,0%	100,0%	100,0%
		% of Total	42,2%	26,2%	31,6%	100,0%

Source: HDR 2013.

It is necessary to check whether the connection is also statistically significant. Therefore, we design the null hypothesis, which says that there is no connection and an alternative assumption, which says that there is connection. From the table below we read the value of Chi-Square Test, 109.571.

Table 3: Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	109,571	4	,000
Likelihood Ratio	118,334	4	,000
Linear-by-Linear Association	85,716	1	,000
N of Valid Cases	187		

Source: HDR 2013.

The test showed a statistically significant difference, because the exact level of significance is less than 0.05. In the end, we give a substantive decision on the basis of sample data - for negligible risk level error of first kind (the exact level of significance = 0.000), which is much lower than the required maximum value for the exact level of significance 0.05 – we can reject the null hypothesis and accept the alternative hypothesis that says that there is a statistically high significant relationship (higher the life expectancy at birth, the higher the expected years of schooling and vice versa).

3.3. Univariate linear regression

With a simple univariate linear regression model we tested whether the level of expected years of schooling (EYS10) is the reason for higher life expectancy at birth (LEB10) and how much of the variance for the amount of life expectancy at birth can be explained by varying the amount of expected years of schooling. The results of the regression model are shown in Tables 4 and 5. Relatively high coefficient of determination R^2 (adjusted R^2), which is 0.599, indicates that you can explain 59.9 % of

the variability of LEB10 by the variability of EYS10. This is a extremely high explanatory power even for a simple regression model, where it is quite clear that LEB10 is influenced by many other factors, which together explain the variability of the rest of the LEB10 (the remaining 40.01 %). But it is obvious that factor EYS10 is one of the most important factors in LEB10. The model is statistically highly significant (sig. the F- test is 0.000), as well as the beta coefficient (sig. the t- test is 0.000).

Table 4: Model Summary

					Change Statistics			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	,775	,601	,599	6,16276	,601	278,762	1	185	,000

Source: HDR 2013.

From Table 5 it is clear that the beta coefficient is positive, which in turn confirms that the higher EYS10 leads to a higher LEB10. The results of the regression analysis, that EYS10 has statistically significant effect on LEB10. Based on the sample data we can conclude that if the expected years of schooling increase by one year, the life expectancy at birth increases by 2.5 years.

Table 5: Coefficients

		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	37,710	1,949		19,348	,000					
	EYS10	2,535	,152	,775	16,696	,000	,775	,775	,775	1,000	1,000

Source: HDR 2013.

Based on the results of the regression analysis we can write the estimate of the regression function:

$$LEB10 = 37{,}710 + 2{,}535 \times EYS10$$

Constant (alpha = 37.7) shows that the life expectancy at birth would be only 37.7 years, if the amount of expected years of schooling would be equal to 0, which corresponds to the situation in most of undeveloped countries of the world.

4. CONCLUSION

Life expectancy at birth in the world is increasing and the number of elderly people over 60 years old is due to increase from 737 million in 2009 to 2 billion in 2050 (United Nations, 2009, pp. 6-10). The life expectancy at birth is influenced by a variety of factors, including the expected years of schooling. The research on the data confirmed the hypothesis that in countries with higher expected years of schooling there is higher life expectancy at birth, and vice versa, that in countries with lower expected years of schooling there is lower life expectancy at birth. Based on reflective diagram and Chi-Square Test, we confirmed a high and positive correlation between the two variables, using regression analysis, we showed a high dependence of the life expectancy at birth on the expected years of schooling in terms of cause and effect relationships.

Understanding and acceptance of longer life expectancy at birth is and will continue to be in the future of utmost importance for the understanding of the financial and economic operations of both companies as well as for the country, as the prolongation of life, and thereby changing age structure of the population have significant economic implications. People are older every year, which affects the labour market, since this ages the working population also. There is undoubtedly the requirement for an adjustment of supply and demand for labour and dictates reform of government operations. In addition, a higher level of education of the population also means higher labour costs, on the other hand, higher productivity. These changes which already affect the pension system, social welfare system and the structure of demand will be even more pronounced in the future. If the companies and the countries will not properly prepare, this may lead to an even sharper financial and economic crisis.

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