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# THE AGEING OF THE POPULATION IN DEVELOPED COUNTRIES – THE ECONOMIC CONSEQUENCES IN THE CZECH REPUBLIC

**Markéta Arltová,**
*University of Economics Prague, Prague, Czech Republic,*
*E-mail: marketa.arltova@vse.cz*

**Luboš Smrčka,**
*University of Economics Prague, Prague, Czech Republic,*
*E-mail: smrckal@vse.cz*

**Jana Vrabcová,**
*University of Economics Prague, Prague, Czech Republic,*
*E-mail: xlanj18@vse.cz*

**Jaroslav Schönfeld,**
*University of Economics Prague, Prague, Czech Republic,*
*E-mail: jaroslav.schonfeld@vse.cz*

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**ABSTRACT.** The ageing of the population is considered to be a cultural and social problem of developed countries. This is not, however, only a demographic problem, as it reaches into the functioning of the entire state economy, especially in the area of expected decline in numbers of people of productive age and employment connected with it, the increase in numbers of inhabitants of retirement age and pension reforms connected therewith and, for instance, healthcare costs. The period of retirement is gradually extending, but it also leads to increase of life expectancy and time lived without significant health restrictions. The problems of ageing will probably first appear in countries with a high proportion of industry and construction in the GDP. Economies with a high proportion of services will be affected to a lesser degree. The Czech Republic is a classic example of a country based on industry and construction. It is therefore probable that it will face an unsolvable problem in the near future, as the nature of its economy will be at variance with its demographic structure. It raises a question of this problem can be solved by supporting immigration.

***Keywords***: age structure, demographic change, GDP, healthy life years, life expectancy, modal age at death, migration, Czech Republic.

## Introduction

One of the tasks of economic sciences is the endeavour to estimate the economic consequences of current development trends on the future – among other things, on the forthcoming living standard of inhabitants, but also on issues of cooperation among individuals, corporations, states and continents. A truly fundamental trend at the turn of the 20th and 21st century is the ageing of the population in developed countries. In the following text, we will attempt to explain certain consequences of this development and make certain deductions which attempt to describe the probable impacts of this ageing on economic systems which we usually label as democratic and market, based on private ownership.

For this reason, we define the term "ageing" *per se* in the way it will subsequently be worked with in the text, i.e. not as an individual question, but as a social and, understandably, an economic problem.

In order to be able to express the question of "ageing" as a crucial question of future economic development, it is necessary at least partially to deal with certain traditional concepts of collisional situations of economic development in the next decades. In respect of the fact that it is not the aim of the work to refute or confirm this theory in the given context, but only to set it into the correct context with the theme, we can assert after a relatively general analysis of the problem that, from the perspective of current knowledge, the ageing of the population is truly the main problem of the world economy of our century.

A decisive aspect of the problem of the "ageing" of the population in the 21st century is not the danger of inhabitant decline on a global scale; in this sense, there is no reason not to believe expectations that the population as a whole will increase to a level higher than ten billion people (from the current approximately seven billion) within the next decades. The decrease of numbers of inhabitants will, however, concern developed countries, despite considerable migration. Most importantly, however, a fundamental generational change of the population will occur, the impacts of which will be extremely broad on the economy. We will attempt to describe them at least schematically in the environment of the Czech Republic – for instance, for the area of industrial production or for the area of education.

## 1. The issue of "ageing"

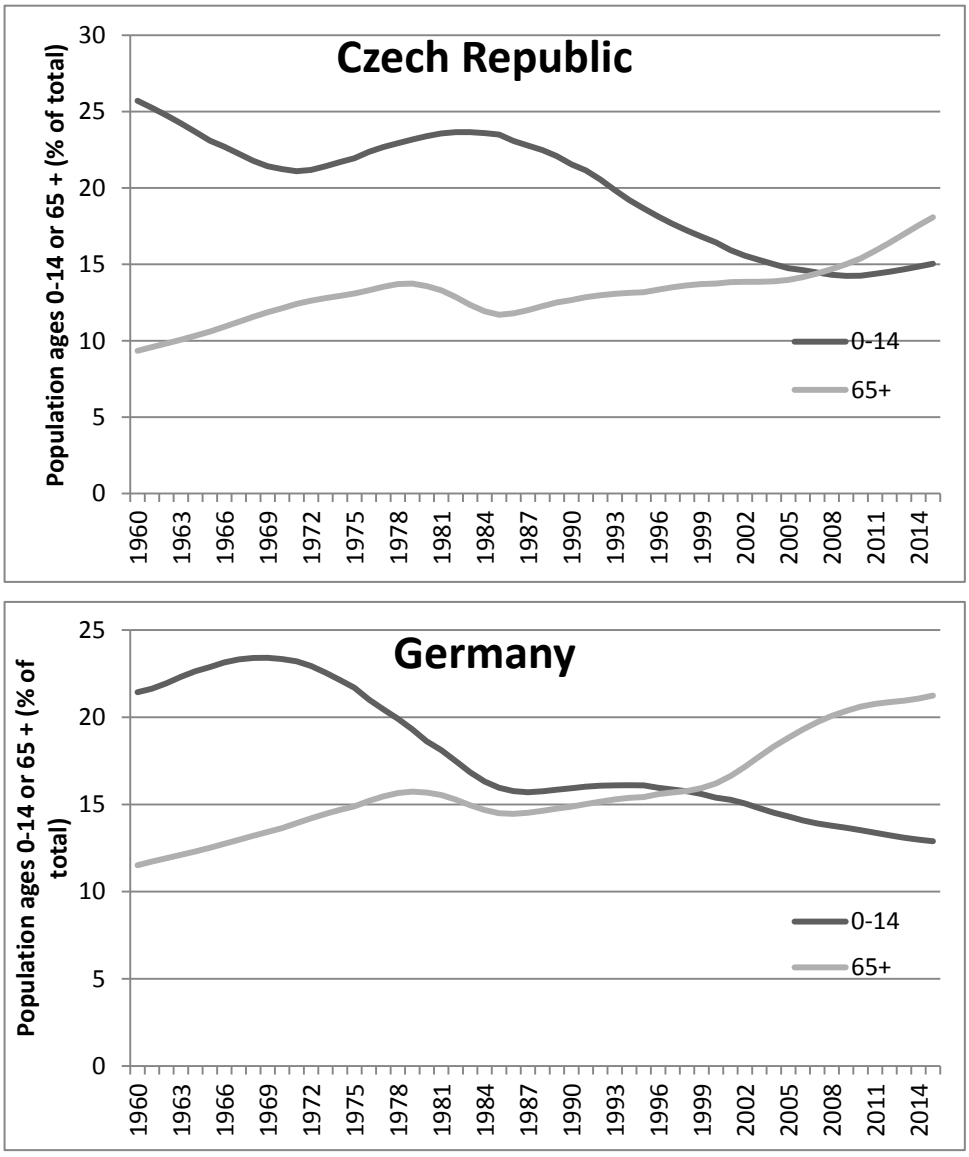
Europe is ageing overall and it is threatened by a real reduction of the original population and the national and cultural definition thereof. This fact is irrefutable; it is practically pointless to prove it statistically. Journalists (e.g. Steyn, 2006), demographers (e.g. Arltová, Langhamrová, 2010; Fiala, Langhamrová, 2009, 2010), sociologists (e.g. Scholefield, 2001) and, last but not least, we too (Smrčka, Arltová, 2012; Arltová *et al.*, 2013) have drawn attention to this issue for several years. As Mark Steyn precisely put it, we are living in a time when *"children are decreasing faster than oil"*. The problem, however, is for the most part viewed from the political, cultural, often religious, social, sociological or anthropological perspectives. These approaches have appeared in various constellations, for instance at the close of the First and Second World Assembly on Ageing in Vienna in 1982 (United Nations, 1982) and in Madrid in 2002 (United Nations, 2002). Only exceptionally, however, is it viewed as a highly economic issue, and if so, then rather in connection with the problem of poverty in old age (Walker, 1981; Phillipson, 1991), or in connection with the necessity to reform pension systems (Piňera, 2001; Peterson, 1999; Van der Noord, 1993; World Bank, 1994). Only singly is the matter treated from the perspective of the problem of ageing and inter-generational exchanges of information, experience and skills.

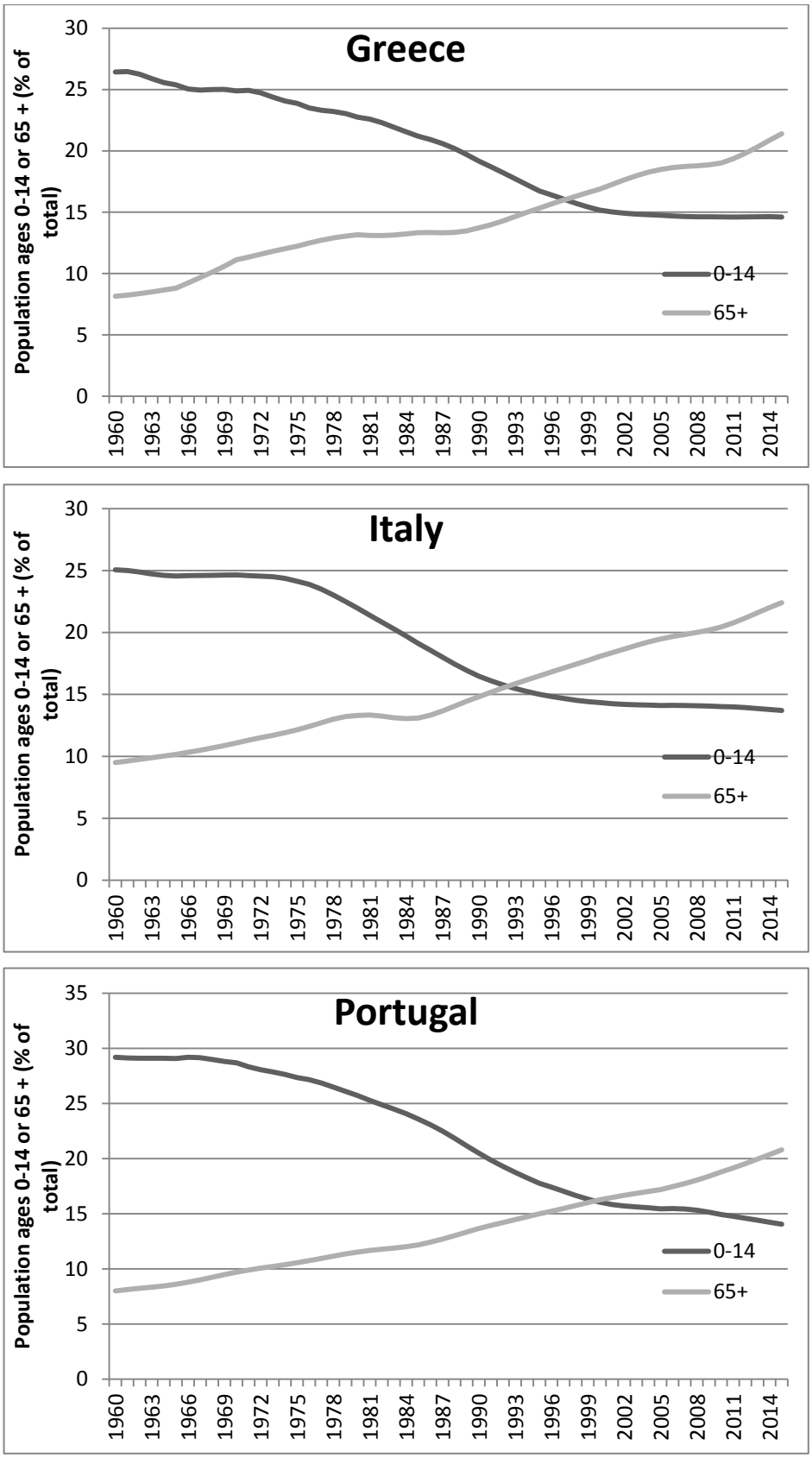
As it is known, the concept of "ageing" generally has a clearly defined individual significance. In dependence to the number of years passed from the birth of an individual, population path from birth to death marks a certain phase. It is not natural to speak of ageing in twenty or thirty year olds (although it occurs among population in objectively the same manner as any time later). In the 21st century, we no longer use such a term for the passage of age even among forty-year olds, but we will now reserve this word rather for a period of life long after reaching the age of fifty or even sixty years. Life expectancy increased dramatically in the last century, and our expression and understanding of words has shifted to the commensurate limit to which we live. So how to improve the living and economic conditions of the population began to increase steadily life expectancy, more people survived into old age. The most significant changes were recorded in modern societies in the second half of the 19th century. At this time, the life expectancy at birth for both sexes was about 41 years and in 1900 it increased to 50 years (Rabušic, 1993). Between 1899-1902 in the Czech lands, the value of life expectancy at birth ranged for men around 38.9 years and for women around 41.7 years (Kučera, 1990). In 1903, popular and acclaimed Czech poet Jaroslav Vrchlický

celebrated his fiftieth birthday, and the most influential newspaper of his time addressed him as "Honourable Patriarch…" on the occasion. There is perhaps no better comparison for how the perception of age changes.

We are, however, more interested in the social or societal and especially the economic dimension of the word "ageing". Let us take note of how the frequency of use of this concept has increased especially in the last several years. It has its clear logic – throughout the last century it applied that ageing concerned individuals; society as a whole was getting younger. We are now facing a new situation when society is ageing.

For instance, throughout our modern experience with parliamentary or presidential democracies, the group of inhabitants up to 15 years was more numerous than the group of inhabitants 65+; now the ratio is the opposite in Italy, Germany, Spain, Portugal and Greece; more and more states will follow (see *Fig. 1*).




Greece
Population ages 0-14 or 65 + (% of total)
0-14
65+
Italy
Population ages 0-14 or 65 + (% of total)
0-14
65+
Portugal
Population ages 0-14 or 65 + (% of total)
0-14
65+

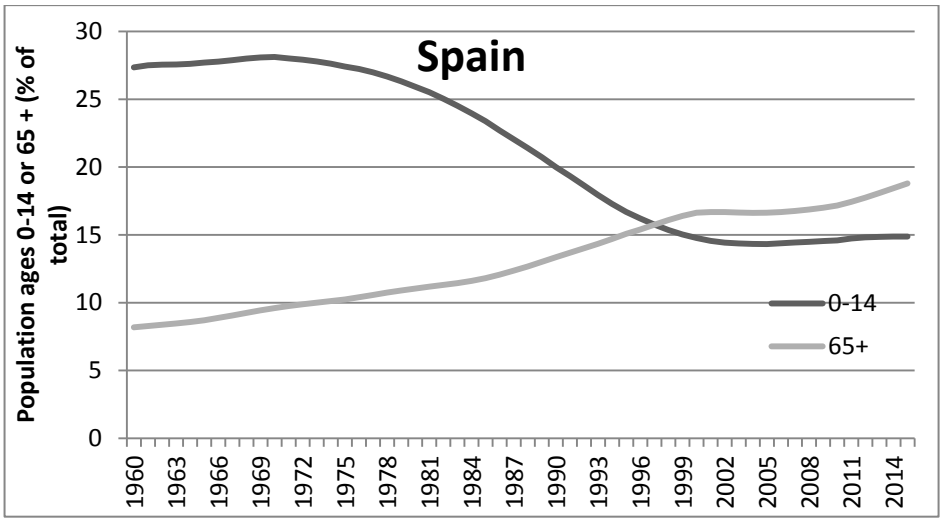



Figure 1. The share of people of 0-14 years and 65 and over in the Czech Republic, Germany, Greece, Italy, Portugal and Spain (% of total population)
*Source*: The World Bank (2016).

We can say that these youngest age groups (0-14) do not vote anyway, so no connection with issues of democracy can be seen. This, however, means something different – the traditional demographic tree (which was reminiscent of a Christmas tree with pretty, dense branches below, slowly narrowing towards the tip) has gradually changed. The branches near the ground are now sparser and they are shabby; the greatest density of the conifer is shifting to the tip where, contrariwise, longer branches are growing the more time passes. Let us demonstrate this example by mechanics and the issue of stability on the case of the Czech Republic (see *Fig. 2*) – the pedestal of the traditional tree need not be particularly elaborate, as such a tree has a low centre of gravity. What, however, will keep the tree in a vertical position if the centre of gravity shifts higher and higher? The stability of future societies will necessarily be less than that of current societies.


Figure 2. Age pyramid in the Czech Republic (December 31, 2015)
*Source*: Czech Statistical Office (2016).

*Figure 3* is very illustrative in this sense – it convincingly shows future development. According to demographers, the ratio between people of productive age (15 to 64 years) and people of post-productive age (65+) will change dynamically in all world regions over the next approximately 40 years, i.e. over roughly one and a half generations.

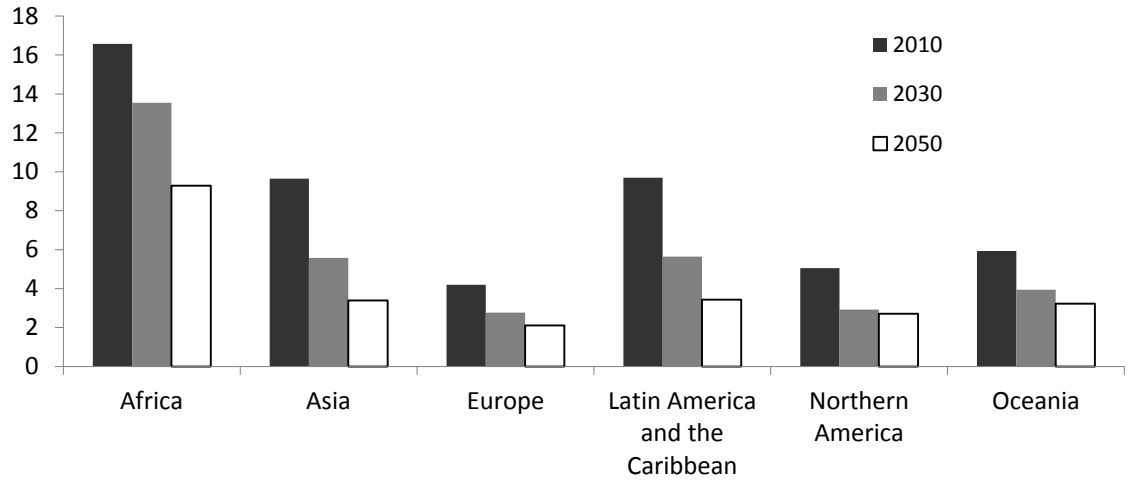



Figure 3. The number of people of productive age (15-64 years) per person of post-productive age (65+)
*Source*: International Data Base (2011), own calculation-share of people of productive age to people of post-productive age.

Let us take the data for Europe. A change of the ratio from four persons of productive age per pensioner (in 2010) on a new equation of two productive per pensioner (in 2050) will necessarily rebound in the pension system. All developed states are solving this problem (the northern part of America will undergo a reduction from five productive inhabitants per one post-productive in 2010 to a ratio of three people of productive age per inhabitant of post-productive age in 2050) and it is being discussed relatively broadly. It is, however, a question as to what impact the parallel drop of the absolute number of inhabitants of developed states and the ageing of the population will have.

Besides this, however, it is necessary to summarize and refute at least in summary certain other concepts on risks of future development which are traditional and are repeating themselves systematically. This is why several of these theories are taken very seriously to this day.

## 2. The general economic consequences of "ageing"

Numerous theories have been defined in previous years and centuries; these have contained varying measures of catastrophic expectations regarding the development of the economic environment.

As we know, in the nineteenth and over the majority of the 20$^{th}$ century, the lack of raw materials and possibly the inability of mankind to cultivate sufficient foodstuffs for its subsistence were considered to be crucial limits of economic growth and long-term economic development. The collapse of the world economic system has been prognosticated many times. The study *The Limits of Growth* (Meadows *et al.*, 1972) is probably the most famous case of similar predictions. In the original edition, the authors reported the exhaustion of the world's supplies of gold, mercury, zinc, oil and earth gas, all of which was to take place in 1981 to 1993. The fact, however, is that despite relatively massive extraction, we now know

that the supplies of all these commodities are higher than the supplies mapped and researched during the seventies. In other words – at present, we can say how long supplies of certain raw materials will last in certain specific localities, although we are unable to answer the question as to the extent to which worldwide supplies of raw materials can be extracted. All previous attempts to predict on the basis of information on extraction and consumption the time when certain raw materials would be depleted have hitherto failed entirely for several reasons.

- Firstly, it has transpired that we are evidently far from knowing all localities and deposits of raw materials, although we have assumed several times that our geological methods are now at the peak of their possibilities; for the present, new methods, thanks to which new locations where raw materials are present, have always been discovered.
- Secondly, we currently do not have an estimate of where we will be able to extract technologically in the future. Progress is very rapid in this direction, and numerous localities in which we are currently extracting were considered unusable in the past.
- Thirdly, is has transpired that certain raw materials considered irreplaceable and unique in the past have substitutes, which is why consumption of previous materials is in numerous cases not growing remotely as rapidly or in such dependence to the development of the gross domestic product as in the past.
- The development of economic technologies and derivative raw materials has in numerous cases reduced extraction which could potentially be much greater. Raw materials have in the last decades become markedly more costly with the decrease of countries with insignificant wage costs and the decrease of states where extraction occurs without abidance to safety principles and investment into security systems. Therefore, gathering and utilization of derivative raw materials have become a substitute for extraction, and the present level of recycling certain raw materials is very high in developed countries (up to 80 percent; in copper, aluminium, steel or lead, more than fifty percent of materials produced originate from recycling).

According to other forecasts, the world should already be absolutely overpopulated and suffering famine due to the inability to produce sufficient foodstuffs for all inhabitants – hundreds of millions of people were meant to be the victims. The truth is that hundreds of millions of people are indeed starving and millions of people are dying; the reason, however, is by no means mankind's inability to produce sufficient foodstuffs. The consequences of civil wars – whether national or religious – widespread corruption and poor to criminal governments are rather to blame. It seems, however, that our planet is able to provide enough food for fundamentally more than ten billion human beings without greater problems. If we were to change to vegetarian fare, the Earth would apparently provide enough food for as much as approximately 200 billion inhabitants. But any similar estimate is misleading, as calculations are undertaken with so many unknowns that their actual validity is not much higher than a random choice of randomly selected figures. In any event, overpopulation as a reason for global and economic collapse is not threatening, and the notions of Thomas Robert Malthus (Malthus, 1798) or his descendants are not being confirmed in any way.

We can, however, consider it to be a certain irony of fate that, at the present time, probably the greatest danger for the subsistence of present and future generations – besides local political and military problems – is the trend of introducing various substitutes or additives for fossil fuels which are usually termed “renewable”. The endeavour of developed countries to reduce in this manner their dependence on fossil fuel resources leads to a state of affairs where less developed countries are replacing traditional crops serving for the subsistence of the population with technical crops. These are subsequently exported to developed countries and serve to produce sufficient “substitutes” for fossil fuels. As is known, after 2007 this trend led to a significant rise in the cost of foodstuffs.

A relatively modern theory is the threat to the development of mankind and in this connection also the economy due to the influence of global warming. This long-term climactic change, however, has only very unclear outlines at present and it is evidently not possible to assess it adequately from the perspective of impact on economic development. Of course, it is impossible not to notice that if the general growth of average temperatures does indeed occur, it will have significant impacts on normal weather, which will clearly entail gradual redistribution of water supplies; it will also lead to a change of the structure of traditional flora and subsequently fauna as well. These notions are, however, so vague at present that it is impossible to work with them seriously.

## 3. The general economic consequences of "ageing"

Contrariwise, the greatest risk for worldwide economic growth in the 21st century has transpired to be the lack of people of productive age. This is not to say that the world population will decrease over the forthcoming years; the age structure of the population will, however, change and the rise of numbers will be concentrated only into less developed countries; we can even say only to the poorest countries. As it is clear from *Figure 4* and *Table 1*, after a relatively long period of dynamic growth of world inhabitants, this growth will now decelerate.

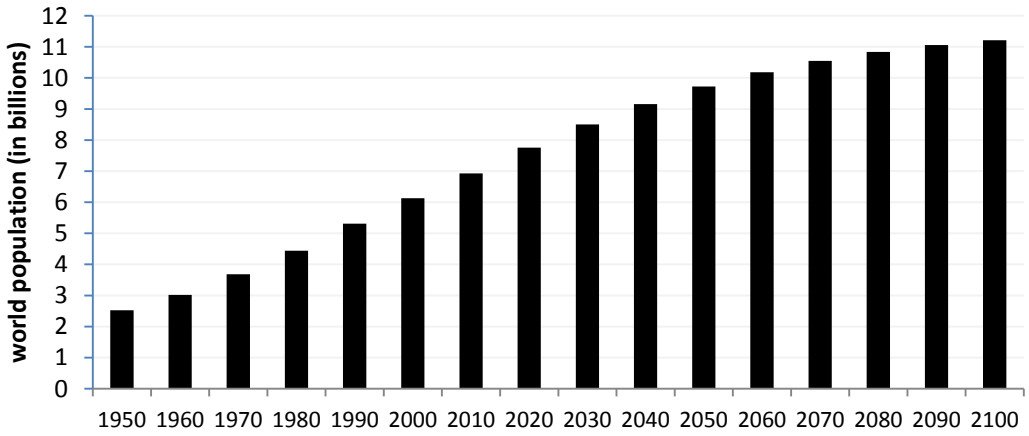



Figure 4. The development of the world population and the estimation thereof until 2100 – medium fertility variant (in billions)
*Source*: United Nations (2015).

Table 1. The year of acquirement of billions of inhabitants until 2100

| Year | Number of inhabitants (billions) | Number of years until the next billion |
|---|---|---|
| 1804 | 1 | 123 |
| 1927 | 2 | 33 |
| 1960 | 3 | 14 |
| 1975 | 4 | 13 |
| 1987 | 5 | 12 |
| 1999 | 6 | 13 |
| 2012 | 7 | 16 |
| 2028 | 8 | 10 |
| 2038 | 9 | 18 |
| 2056 | 10 | 32 |

*Source*: United Nations (2015).

Whilst from the seventies of last century, there was an increase of a billion people after 14, 13 and later even after twenty years, this trend has decelerated markedly in the new millennium. Yet we must not forget the fact that the decrease of natality is logically far higher than the lengthening estimations of time necessary for acquiring another billion inhabitants on the Earth. If it took three and later five billion people fourteen and then only twelve years before mankind increased its numbers by a billion in the sixties to the eighties of last century, it will take seven and then eight billion people substantially longer in our century. Growth is thus drastically decelerating, and in view of natural demographic relations, we can already consider it an irreversible fact that this trend is and will be a worldwide trend. Simply put, this development had long since begun in the richest countries, after which it spilled over into new democracies which emerged from the communist imperium at the close of last century; it is gradually continuing into rapidly developing economies of Asia, it has already affected the most developed African countries and in the next decades it will gradually arrive even into the poorest states of the Third World.

For interest, we will return to *Table 1*. We can supplement it with further estimated data. In the year Jesus Christ was born, the worldwide economic population was apparently around 300 million people; in 1000 CE, it was 310 million; in 1500, it was apparently 500 million. After 1750, it is estimated at approximately 800 million; a billion people lived some time not long after 1800 CE. The beginning of the 20$^{th}$ century celebrated 1.6 billion inhabitants of the world (of which a significant part did not know that they should celebrate). As we see, during a relatively well-mapped period of the history of man, an event termed "the population explosion" thus concerns an absolutely negligible time period. This is certainly an interesting observation which should be borne in mind.

### *3.1. The gradual globalization of "ageing"*

We have already mentioned the fact that it would be a truly fatal error to get caught in the notion that the issue of "ageing" is a difficulty of developed countries and not the rest of the world.

The truth is in fact such that basically all states are undergoing similar fluctuations of natality, albeit in somewhat divergent time periods. From the global perspective, a truly dynamic growth of human population occurred in the second half of the previous century, i.e. briefly after the end of the Second World War. If UN estimates can be believed, the net inter-annual growth of numbers of world inhabitants reached up to two percent annually, in a certain period even 2.1 percent (1965 to 1969). It is necessary to observe clearly that Third World countries had the main influence on this, i.e. the states of Africa and partially Asia also (of course, especially China and also India), to some extent Latin America as well. Europe, the United States and developed countries generally may have grown, but in a fundamentally less significant manner in contrast to underdeveloped countries. At the end of the last and in the first years of the new millennium, however, natality per woman had now already dropped globally, and this led to a reduction of growth of world inhabitants – initially by 1.1 percent annually and later even below one percent annually. Of course, the growth in numbers of inhabitants is still continuing – the life expectancy of the population is rising, i.e. every age-group of inhabitants is, in contrast to older age-groups, gaining a certain amount of life years more. Therefore, it initially occurred that the process of procreation functioned all too well and led to a dynamic growth of natality. Subsequently, the process of dying ceased to "function" and "postponed" itself entirely. The number of world inhabitants is thus rising systematically and there is no doubt that it will rise over a certain period; this is clearly why there are still comparatively many people according to whom the rising numbers of people on Earth remains one of the fundamental problems of mankind.

We should also not forget considerable regional differences (see *Figure 5*). Let us observe from another angle the above-mentioned special state – in substance, it could be said that the numbers of children are decreasing with the rise of the living standard – both in time, when the living standard in 2010 was indisputably higher than it was in 1950, and in space. The more developed and wealthier a region is (with certain reservations and exceptions), the lower the fertility (i.e. the number of children per woman of childbearing age (age 15-49).

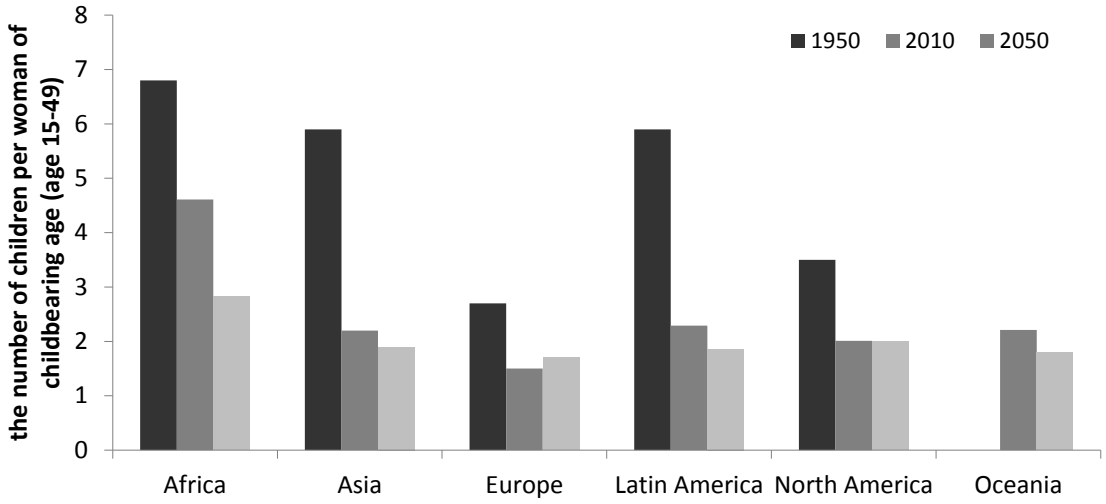



Figure 5. The development of fertility in 1950, 2010 and the estimation thereof in 2050
*Source*: International Data Base (2011).

A question logically arises: If such a rule of proportion really existed, does this perchance mean that natality will drop in rapidly developing countries (China, India, Russia) with the rise in the standard of living? This seems to be the case – Russia has one of the lowest numbers of children per woman of productive age (1.4 in 2010); the previous anti-population campaigns in China are no longer necessary. Restrictions in registering new automobiles have replaced them. If matters continue at the present pace, then in roughly 2050 the most densely populated country will no longer be China, but India.

The mean variant of the UN prognosis (United Nations, 2015) expects 9.7 billion people on Earth in 2050; of course, basically the entire growth (in contrast to the present state) will fall on African states. As a result, the black continent (with the exception of the Arabian northern part) will be the last regions where the impacts of ageing of the population and low natality will not manifest themselves. Nevertheless, let us remind ourselves that even here, development will (according to demographers) practically stop when natality per woman drops to roughly two children in Africa also, this means slightly below the level of mere reproduction.

Mathematics, however, are relentless and necessarily pose the question of what will happen in those countries which now have an extremely high proportion of inhabitants up to 25 years in the event that natality will only drop over the next thirty or forty years from the present? Precisely the same situation will arise as that towards which Europe and the majority of developed countries have progressed already at present. Population will begin to age rapidly. This also concerns little developed countries of the Third World, for which the same will begin to apply as has been the case for Europe for a long time, i.e. a period is approaching, during which the gradual, but systematic ageing of the population will occur. The proportion of people up to 25 years is unbelievably high in numerous countries; for

instance, in North Africa (the Arab region of Africa), it reaches more than 40 percent locally. But this is why natality will not sustain itself; even there, the situation will begin to turn relatively rapidly over several decades. And understandably, in places such as China, the impacts of this process will be still more dramatic in view of the truly rapid drop in natality. The proportion of persons over sixty years here amounts to about ten percent at present; according to the UN prognosis (United Nations, 2011), however, it will increase up to 30 percent within fifty years which, in absolute expression, will amount to almost 440 million inhabitants.

Nevertheless, numerous less developed and little developed states which are only now arriving at the period of "peak" numbers of inhabitants, have before them a time period known among demographers and economists as the "demographic window". This is a phase twenty or thirty years in duration, during which the number of people of productive age will markedly exceed the number of people before productive and of post-productive age. From the economic perspective, this is a period of time during which the economies of these countries and generally their societies also can prepare for the decades following the "demographic window". The same development as that which has taken place in the developed world will take place in them, i.e. the group of people of post-productive age will never reach the previously non-existent proportion in the make-up of society as a whole. Even now, however, we can express considerable doubts as to whether these states will be able to do this – we will return to this problem in the forthcoming passages, as it has its significance for developed countries.

### *3.2. Problems with the description of impacts on developed countries*

Prognosticating the impacts of the changed demographic situation on the developed world and its economic stability is especially complex, as there are a large number of unknowns at issue, the estimation of which is practically impossible or at least very difficult. Nevertheless, within the next few years there can be no doubt that it is necessary to focus attention in this direction and at least attempt to map schematically the consequences of present trends. Let us now attempt a certain basic notion as to which presently unknown quantities can move in the greatest manner development in developed countries as a whole. We can probably define two groups of events which will have a decisive influence.

The first is internal; events which stem from the developed countries as such are at issue. We can here name especially the actual development of the age structure of their own inhabitants, which we can estimate at least partially, and which demographers are attempting to calculate, although these will always be only rough estimates with various, markedly different variants.

The development of costs for pension and healthcare systems, which are unknowns dependent precisely on the development of the age structure of the inhabitants, also belong here. Moreover, let us not forget that, besides demographic development as such, there is here also the by no means negligible influence of advances in medicine, changes of lifestyle, improvement of the environment, all of which could lead to a further shift of the usual life expectancy of the population – thus towards a change of one of these parameters, which determines the future composition of the population of developed countries. This may be beneficial for those who will live longer, but we are here speaking rather of the possibilities of financing pension systems and of the costs for healthcare. The growth of these items could, but also need not necessarily have an influence on necessary investments into other areas. In any event, however, there will be marked changes in financial flows within the economy, with impacts which we cannot currently assess in a qualified manner.

The third internal aspect which we cannot in any way predict precisely at present is the question of the development of the economic structure of developed countries. We generally expect that it is precisely in developed countries that financial economy, services and production with high added value will be concentrated, although this is an assumption based primarily on the current distribution of work within the scope of global economy. It is very difficult to say whether development will move in precisely this direction. In any event, however, we can declare that in respect of rapid emancipation of certain economies such as those of China, India, or Russia, it is not responsible to expect that such development will take place without conflict.

As a result, we also cannot assess the extent to which the ageing of the population and the possible population decline will have an impact on individual countries from the group of states we label as developed. If we introduced a simplified case, the actual ageing of the population will clearly have a different impact on the economy where the formation of the gross domestic product is 20 percent based on production fields and 80 percent on services; the impact will be different in a country where production and services are at a ratio of 60 to 40. It can, for instance, be assumed that, given the necessity of extending retirement age above the limit of 65 years, an economy based more on services will handle the situation substantially better, as persons employed in this sector will clearly be able to perform at their professions even at such an age. In manual workers, in construction and other fields based more on manual labour or on specific mechanical skills, strength, endurance and ability to work from a health perspective, the adaptability of employees to an increase in retirement age will be poorer, which must of necessity bring about certain difficulties. We are here speaking especially of the generally elementary problem that one side of the coin is the extension of the life expectancy, although this need not necessarily also entail the extension of the time during which an individual is capable of doing manual work. Moreover, for this area there are understandably no particularly relevant statistical data and we mostly have to help ourselves with mere estimates. For interest's sake, let us examine available international comparison.

Table 2. Life expectancy and life expectancy lived in health at birth in 2012

| | Life expectancy | | Life expectancy in health (healthy life years) | | Proportion of life spent in good health | |
|---|---|---|---|---|---|---|
| Country | men | women | men | women | men | women |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* |
| Belgium | 77.1 | 82.4 | 64.4 | 65.4 | 84% | 79% |
| Bulgaria | 70.6 | 77.4 | 62.1 | 65.7 | 88% | 85% |
| CR | 74.3 | 80.4 | 62.3 | 64.1 | 84% | 80% |
| Denmark | 77.4 | 81.4 | 60.6 | 61.4 | 78% | 75% |
| Estonia | 70.6 | 80.9 | 53.1 | 57.2 | 75% | 71% |
| Finland | 76.9 | 82.9 | 57.3 | 61.2 | 75% | 74% |
| France | 78.0 | 84.7 | 62.6 | 63.9 | 80% | 75% |
| Ireland | 78.0 | 82.4 | 66.1 | 68.3 | 85% | 83% |
| Italy | 79.1 | 84.0 | 62.1 | 61.5 | 79% | 73% |
| Cyprus | 78.2 | 82.6 | 63.4 | 64.0 | 81% | 77% |
| Lithuania | 67.7 | 78.9 | 56.6 | 61.6 | 84% | 78% |
| Latvia | 68.4 | 78.3 | 54.8 | 59.1 | 80% | 75% |
| Luxembourg | 78.3 | 83 | 65.8 | 66.4 | 84% | 80% |
| Hungary | 70.9 | 78.1 | 59.2 | 60.5 | 83% | 77% |
| Malta | 78.0 | 82.5 | 71.8 | 72.4 | 92% | 88% |
| Germany | 77.9 | 82.6 | 57.4 | 57.9 | 74% | 70% |
| Netherlands | 78.6 | 82.3 | 63.5 | 58.9 | 81% | 72% |

| *1* | *2* | *3* | *4* | *5* | *6* | *7* |
|---|---|---|---|---|---|---|
| Poland | 72.1 | 80.5 | 59.2 | 62.9 | 82% | 78% |
| Portugal | 76.6 | 82.9 | 60.7 | 58.6 | 79% | 71% |
| Rumania | 70.7 | 77.9 | 57.7 | 57.8 | 82% | 74% |
| Austria | 77.7 | 82.8 | 60.2 | 62.5 | 77% | 75% |
| Greece | 77.3 | 82.6 | 64.8 | 64.9 | 84% | 79% |
| Slovakia | 72.0 | 79.3 | 53.4 | 53.1 | 74% | 67% |
| Slovenia | 76.2 | 82.5 | 56.5 | 55.6 | 74% | 67% |
| Spain | 78.8 | 84.7 | 64.7 | 65.7 | 82% | 78% |
| Sweden | 79.1 | 82.8 | 70.9 | 70.7 | 90% | 85% |
| Great Britain | 78.5 | 82.1 | 64.5 | 64.5 | 82% | 79% |

*Source*: Eurostat (2014), own calculation.

The *Table 2* above is very interesting in terms of the numbers, which are often lower than the age when one officially retires in the given countries or when one should retire in the near future. However, we here observe at least a certain fact of "health" limits of parametrical changes of pension systems. We will certainly save on pensions at the moment we fix retirement age to 65, 67 or 69 years; most importantly, however, we will achieve a state of affairs where significant groups of inhabitants will find themselves in social welfare systems, as inhabitants of a country will not be healthy enough to perform at their professions – especially if a country with a high proportion of industry, construction and agriculture on the formation of the gross domestic product is at issue.

Furthermore, we also have external moments which will indisputably influence the economic future of developed states. Firstly, an unknown volume of migration is at issue. The developed world is, as we know, the goal of migration for a significant number of inhabitants from countries which are less developed. This process has in recent years been masked to a certain degree by the fact that the "original ethnic population" is declining, especially in Europe (Gladišová, 2004). Probably about 95 percent of this migration is purely or primarily due to economic reasons, i.e. it is a similar phenomenon to that of migration of inhabitants from "poor" villages to "wealthy" cities in the past and present. But it has changed nowadays with conflicts in Syria and Islamic state. Europe experienced such a period in the medieval ages and during the first and second industrial revolutions, and currently developing countries and "backwards" states are undergoing something very similar. Only roughly five percent of migration has more significant and provable political overtones, i.e. the departure of people who are threatened by real danger or persecution in their countries. Yet we are in no way able to estimate future migration – generally, it may be considered that the endeavour of inhabitants of poor and poorer countries to move to wealthy countries will be practically constant; on the other hand, societal fear of further migration will tend rather to rise, whilst the reasons for these fears will be cultural, religious and social. In other words, developed countries tend to make conditions for immigrants more difficult rather than making them easier (e.g. Kepka, 2008). At present, about 150 to 200 million people live in countries other than their native lands, the larger part in Europe, the United States and other developed countries (the remainder primarily in "refugee camps" in countries neighbouring areas of regional conflicts or civil wars). Nevertheless, although migration is usually considered to be a major problem (migration from the poor south to the wealthy north, or from the poorer east to the wealthier west), we now cannot at all estimate whether these shifts of inhabitants will be so strong in the future that they could "supply" sufficient manpower to developed countries.

As it is known, key destination countries of migrants in the European Union have admitted through the mouths of their political elites that the existing strategy of multicultural

states (in which various nationalities can coexist beside one another whilst fully practicing their religion, traditions and social values) has essentially failed. This, however, means that the official perspective on migration as a phenomenon which, through the import of new "cultural, religious and social stimuli", enriches the original society and "gives it new dimensions" is changing in a decisive way. Migrants will thus be required to accept "societal values" and "assimilate" into society to a far higher extent. This requires some explanation. As M. Steyn (Steyn, 2006) absolutely correctly observed: *"European liberals have very fine antennae. Whenever we ask whether Italians will still live on the territory called Italy in one or three generations, the cry "Racism!" is heard. Concerning oneself about the proportion of white inhabitants in the world population is truly grotesque and inappropriate. Yet not race, but rather culture is at issue. When 100 percent of the population trusts liberal and pluralistic democracy, it is all the same whether 70 or only 5 percent are "white". Yet when one part of the population trusts that liberal and pluralistic democracy and the other does not, it is then very important if that part which does trust it connects 90, 60 or 45 percent of the population".* We probably all understand well that not even racism nor religious intolerance, but rather the preservation of civil, democratic and cultural values is at issue here. And we must also add: perhaps in first place, economic freedom.

We mentioned the situation around the approaching period when natality will decrease even in poorer countries and the demographic situation of these primarily African states will begin to change – if, over several decades, this situation reaches a state of real lack of manpower in the given areas, the current strong pressure on migration will to a large extent drop or disappear. This is one of the main reasons why we are unable to estimate the future migration potential.

The unknown professional quality of migrants is also a problem for the future. Migration at present concerns mostly those groups of inhabitants and their departure to such countries where adequate quality of education is not ensured and thus, from the perspective of quality of manpower, people who are usable in sophisticated economic branches only with difficulty are at issue. At present, we can in no way estimate the future quality of education of migrants, but it will probably not be fundamentally higher than it is at present. In this connection, it is necessary to note that the frequently mentioned "outflow of brains" from less wealthy countries is not a mass issue in the true sense of the word, and thousands or tens of thousands of people annually are at issue. From the demographic perspective, it is a phenomenon so peripheral that we could term it as being marginal. Another matter is the impact on the economy of those countries from which these people depart; that is understandably very serious.

## 4. An outline of the problem of the Czech Republic

Similarly to the majority of other developed countries, the Czech Republic is undergoing a population crisis, which is manifesting itself, first and foremost, in low natality. Fertility, i.e. the number of children falling to one woman of fertile age, dropped to 1.14 children in the first years of the 21st century; in 2012, it grew to 1.45 children, although this is still far below the border of mere reproduction of 2.14 children. The replenishment of the population is thus dependent on the migration balance – even the mean variant of projection of population numbers without migration (CSO, 2009) expects a decline in the number of inhabitants from 10.3 million (2012) to about 8.12 million (2050), i.e. a clear decline by more than two million people. The low variant projection without migration would even bring about a decrease in numbers of inhabitants to below 7.5 million.

According to the level of positive migration balance, the projections expect the number of inhabitants in the Czech Republic by 2050 to be between 8.1 million (a positive

balance of ten thousand persons annually) and 9.4 million inhabitants (25 thousand annually) up to 10.8 million inhabitants (a positive balance of 40 thousand persons annually), whilst these are estimates based on the mean variant of the future development of the population. In respect to the development of migration until now, we cannot realistically assume that it would be possible to attain a migration balance of 40 thousand persons annually, and this variant has to be understood as being truly theoretical. In 2010, foreigners represented roughly 4.2 percent of the population of the Czech Republic; if the projection with a high balance is fulfilled, 2.8 million migrants in various phases of integration would have to live in the country around 2050 and they would represent roughly 25 percent of the inhabitants. Despite the forty-year perspective, this is a socially inconceivable change which would necessarily evoke unsolvable problems (Arltová, Langhamrová, 2010).

The expected immigration as such will elicit a relatively marked probability of numerous further phenomena accompanying this development – especially significant burdening of the education system through tutorial of at least basic knowledge of the language, probably inappropriate composition of the knowledge structure of immigrants, i.e. burdening of education programs for their rapid integration into the work process. In connection with this, it is also necessary to apprehend the fact that even given a relatively high migration balance, the entire economy will face a dramatic lack of manpower – in 2010, about 6.6 million people were of productive age (20 to 65 years); in 2050, despite significant immigration (the already-mentioned balance of 10 to 25,000 persons annually), this will be roughly 4.2 to 4.6 million inhabitants of the Czech Republic.

Table 3. The population structure according to sex and selected age groups in %

| | | 1990 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|
| men | 0-14 | 22.27 | 17.11 | 14.85 | 16.19 | 14.35 | 13.32 | 14.29 |
| | 15-64 | 67.93 | 71.99 | 72.71 | 66.64 | 65.54 | 62.59 | 56.82 |
| | 65+ | 9.0 | 10.90 | 12.43 | 17.16 | 20.11 | 24.09 | 28.89 |
| | 80+ | 1.51 | 1.45 | 2.28 | 2.95 | 5.30 | 7.15 | 8.40 |
| women | 0-14 | 20.02 | 15.42 | 13.58 | 14.99 | 13.33 | 12.42 | 13.40 |
| | 15-64 | 64.67 | 68.05 | 68.50 | 62.10 | 60.68 | 58.10 | 53.23 |
| | 65+ | 15.31 | 16.53 | 17.91 | 22.91 | 25.99 | 29.48 | 33.37 |
| | 80+ | 3.43 | 3.26 | 4.76 | 5.50 | 8.86 | 11.47 | 12.23 |
| total | 0-14 | 21.11 | 16.24 | 14.21 | 15.59 | 13.83 | 12.87 | 13.84 |
| | 15-64 | 66.25 | 69.97 | 70.57 | 64.35 | 63.09 | 60.34 | 55.02 |
| | 65+ | 12.64 | 13.78 | 15.22 | 20.06 | 23.07 | 26.80 | 31.13 |
| | 80+ | 2.50 | 2.37 | 3.54 | 4.24 | 7.10 | 9.32 | 10.32 |

*Source*: data CSO (2009), own calculation – share of age groups to total population.

From the projection of the CSO (CSO, 2009), it follows (see *Table 3* and *Figure 6*) that the proportion of inhabitants of the Czech Republic at ages from birth to 14 years will drop from 14.2 percent (2010) to 13.8 percent in 2050. In the same comparison, the proportion of people at age 65 and more will rise dramatically from 15.2 percent to 31.1 percent, and at age 80 and more from 3.5 to 10.3 percent. And what is worse, the proportion of inhabitants of productive age (15 to 64 years) will drop from 70.6 percent to roughly 55 percent.

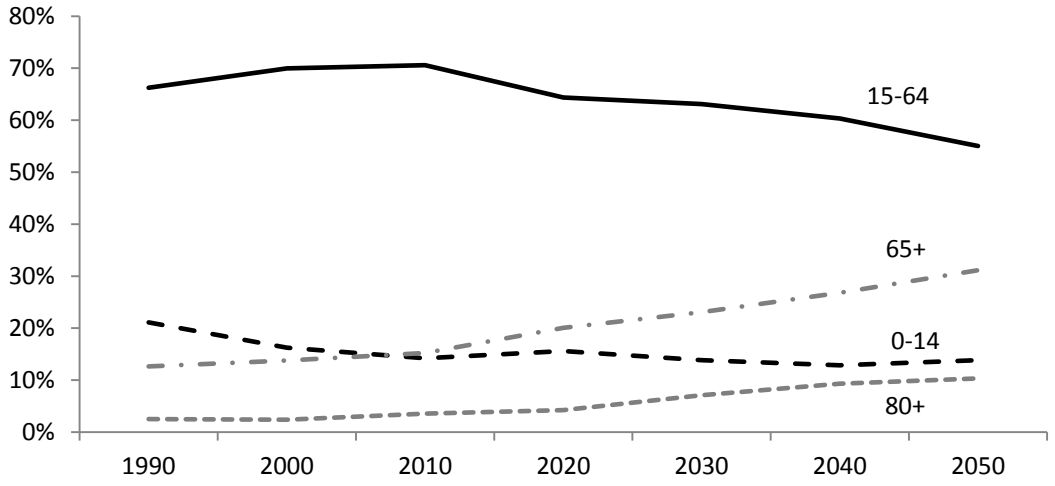



Figure 6. The structure of the population of the Czech Republic in selected age groups
*Source*: data CSO (2009), own calculation – share of age groups to total population.

The drop in numbers of workers will manifest itself in various ways in various fields. In 2009, the employee structure in the Czech Republic was influenced primarily by the dominant status of the processing industry (1.242 million employees) and further by the strong status of trade (0.631 employees), construction (0.497 million employees) and transport (0.331 million employees). Yet the total number of employed in the entire national economy was 4.934 million people. At the same time, there were 0.352 inhabitants unemployed (in the sense that they were registered at the pertinent employment offices), of which over two thirds were people without education or only with secondary education without A-levels. Experiences with workers from abroad have shown that, as regards education structure and level of qualification, it is probably not possible to expect some improvement from this direction. In the time of the greatest economic boom, about 290 thousand people worked in the country legally in this manner (the second half of 2008); their numbers dropped sharply during the crisis – nevertheless, roughly seventy percent of them were employees in worker and still less qualified professions. Qualified employees came almost exclusively from Slovakia. In view of the fact, however, that the Slovak economy has been growing faster than the Czech economy for several years, it is probable that a further influx of workers from this region is not to be expected.

As a result, one can expect that the change of demographic composition and the drop of numbers of inhabitants – even in the event that it will be balanced to a marked extent or alleviated by a positive migration balance – will lead to comprehensive changes in the composition of the economy of the Czech Republic. We can expect this shift in the forthcoming twenty years already; pressure for change, however, will continue to strengthen continuously. Businesses based in the Czech Republic will be forced to relocate abroad a significant amount of their production capacity due to lack of manpower – taken by the present gauge, we can speak of at least thirty percent of production, which will lead to a marked and continually increasing difference between the gross domestic product and the gross national product. Fundamental problems will result on the level of innovative abilities, as the generations which are the main bearers of innovation (20 to 35 years), will play a substantially smaller role in society, both in proportion and especially in absolute number.

Yet it must be asserted that the newer the demographic work, the more dramatic the development appears to be, and conclusions are less optimistic (see the conclusions from the

last Projection of Population for the Czech Republic by 2050, CSO, 2009) which we can see illustrated on *Figure 7* and *Figure 8*.

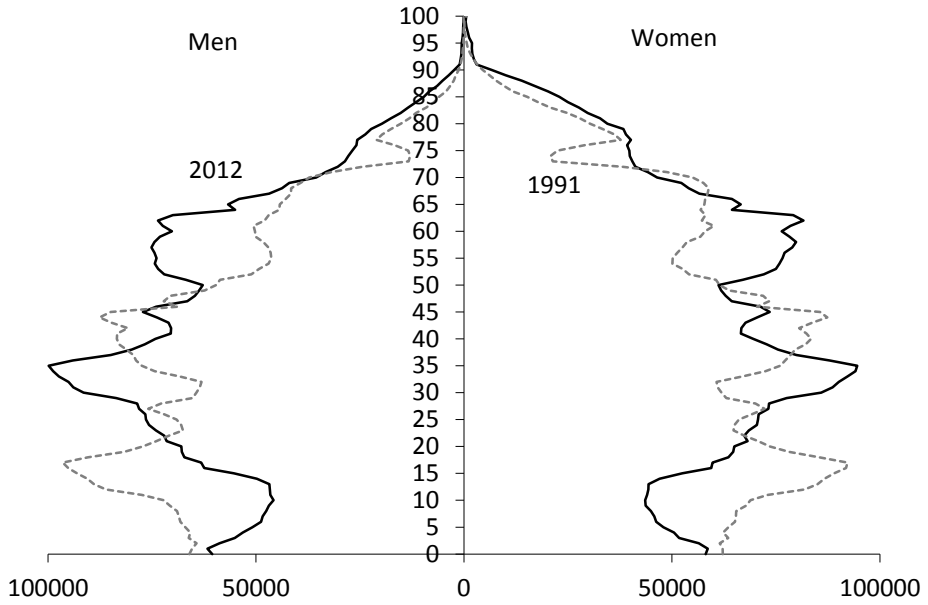



Figure 5. The age structure of the population in 1991 and 2012 (as at 31.12.)
*Source*: CSO (1992, 2013).

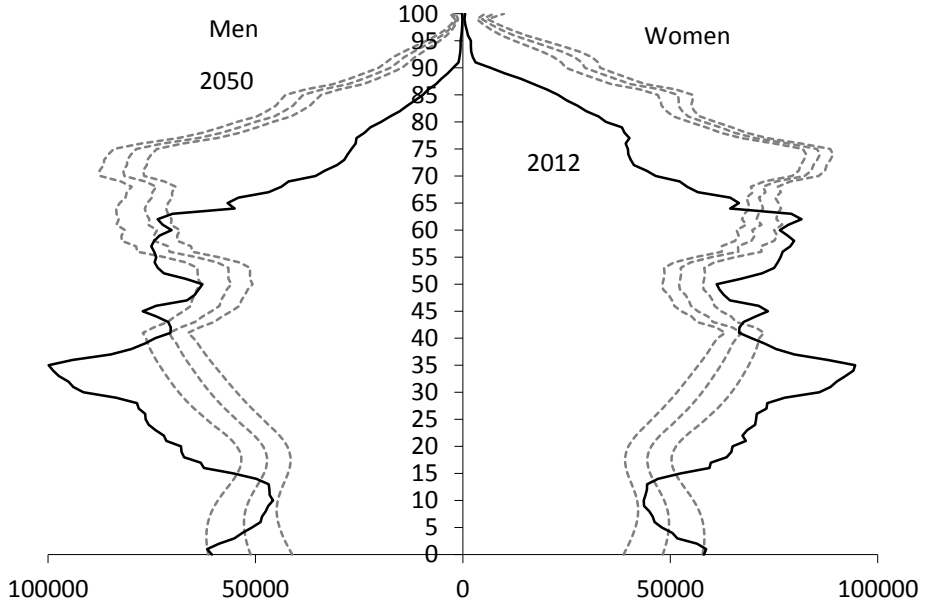



Figure 6. The age structure of the population in 2012 and the estimate thereof for 2050 in the low, medium and high variant
*Source*: CSO (2009, 2013).

If we continue further to the middle of the century, the prognosis is progressively more negative; strong age-groups are decreasing and practically the entire weight of the demographic tree shifts to higher age groups.

Projects of inter-generational sharing of experience will necessarily gain proportionally higher significance. In no case they can prevent the impacts of the demographic crisis on the economies of developed countries, but they can at least help to alleviate certain specific manifestations of this development and its devastating influence on the economic stability of the country.

As it has been mentioned many times, the Czech population is ageing and this has and will have an impact on the economy of the country. There is increasing number of people in the elderly age, but also these people live longer in better health than in the past, as shown in *Table 4*. Of these values it is evident that not only life expectancy increases, but also the time spent in good health.

Table 4. Life expectancy and life expectancy spent in health at birth and for 65 years old persons in selected years

| | | | years | | |
|---|---|---|---|---|---|
| | | | 2005 | 2009 | 2012 |
| For 0 years old | Men | Life expectancy | 72.9 | 74.3 | 75.1 |
| | | Healthy life years | 58.0 | 61.1 | 62.3 |
| | | Proportion of life spent in good health | 80% | 82% | 83% |
| | Women | Life expectancy | 79.2 | 80.5 | 81.2 |
| | | Healthy life years | 60.0 | 62.7 | 64.1 |
| | | Proportion of life spent in good health | 76% | 78% | 79% |
| For 65 years old | Men | Life expectancy | 14.4 | 15.2 | 15.7 |
| | | Healthy life years | 6.6 | 8.1 | 8.3 |
| | | Proportion of life spent in good health | 46% | 53% | 53% |
| | Women | Life expectancy | 17.7 | 18.8 | 19.2 |
| | | Healthy life years | 7.0 | 8.5 | 8.9 |
| | | Proportion of life spent in good health | 40% | 45% | 46% |

*Source*: Eurostat (2014), own calculation – share of healthy life years to life expectancy.

In the case of healthy life years there are not available very long time series, which would have been based on the same methodology. For this reason, and also because of the qualitative nature of this characteristic it is not possible to make judgments on the basis of subjective evaluation of health.

In studies of longevity the most often used indicators are life expectancy and modal age at death. Life expectancy is an indicator like average, as it is known. It represents the average age of deaths in a stationary population. Modal age at death is an indicator like mode and it is kind of a typical age, which most people in the population are expected to live.

The increase of life expectancy is generally seen as a positive process. Primary impulse of the increase of life expectancy was caused by decline of infant mortality and consequently by decrease of mortality in older age groups. Due to the improvement of mortality ratios, modal age at death is increasing and life expectancy is gradually approaching. While examining trends in mortality, life expectancy and modal age at death should be followed synchronously. As long as mortality rates of different age groups tend to improve, life expectancy and modal age at death will increase as well. The spe,ed of

development will depend on the ages that contribute to the improved mortality rates (Wilmoth, 2000).

Unlike life expectancy at birth, modal age at death is substantially affected by mortality of adults and therefore it reacts more sensitive to changes that occur among older aged population (Horiuchi 2008; Kannisto, 2001). In countries with low mortality rates, where most of the deaths are recorded in old age, the indicator modal age at death becomes primary for monitoring the changes in the age-at-death distribution (Ouellette, Bourbeau, 2011). After improved mortality in the first years of life, the current answer for extending life expectancy and modal age at death is associated with reducing mortality rates in old ages.

Life expectancy is extending due to low child mortality and modal age at death is increasing due to the decline in mortality rates at high ages (Canudas-Romo, 2010). The differences in the trends over time of these indicators of longevity well reflect their orientation to various aspects of mortality (Cheung *et al.*, 2009). Life expectancy is currently the most commonly used mortality indicator despite the fact that it includes disadvantages of mean. Modal age at death has no disadvantages of average, it is the modal age at death among adults.

For comparison purposes, time series of life expectancies and modal age at death were used calculations by Fiala (Fiala, 2005) using the Gompertz-Makeham function. A detailed method of calculating the modal age at death using parameters of the Gompertz Makeham formula is presented by Langhamrová (Langhamrová *et al.*, 2014).

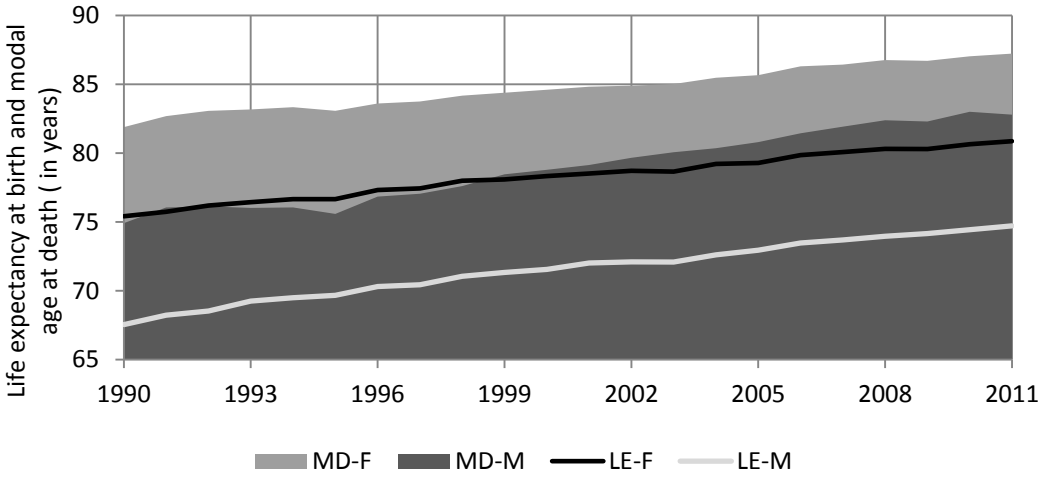



Figure 9. Development of life expectancy at birth (LE) and modal age at death (MD) for men and women in the Czech Republic in 1990-2011
*Source*: data Eurostat (1990-2011), own calculation.

An interesting opportunity of investigation finding mutual links and relationships between demographic indicators among demographic time series can be considered. For this purpose we selected time series of life expectancy at birth for men and for women in 1990-2011. It will not be quite simple to explain any links and relationships, they are subject to a number of other factors that affect the values. It is not easy to create a well-functioning model in demography. For example, some models used in time series analysis may work in economics, but they may not be completely valid to demographic phenomena.

In given periods time series of life expectancy at birth for men and women show similar developments. Examination of the relationship between the time series is possible only if they are integrated series of the same order, i.e. the order of 0 (stationary series) or the order of 1 (non-stationary series). For this verification we will use the unit root test, namely

augmented Dickey Fuller test – ADF. The results show that the observed time series in 1990-2011 are for both men and women non-stationary, so that there can exist in both the short and long-term relationship between the series.

So that all the rules made under enough, on the significance level of 5% unsystematic component of the model must be not correlated, in the model there is on the same significance level homoscedasticity and it applies here normality of residues.

The resulting model of the relationship of the two time series for the period 1990-2011 can be described by following equation:

$$Y_t = -30{,}6 + 1{,}3X_t, \qquad (1)$$

The parameter $\beta$ = 1.3, there is not only the regression parameter, but also long-term multiplier, it indicates that it is between the two time series directly proportional relationship where increasing of life expectancy of women by a year in this period causes an average increase in life expectancy for men by 1.3 years.

## Conclusion

On the basis of all of the facts stated above, we can reach a conclusion on a general level as to the pressing need for detailed research into the problem of ageing from its economic aspect. Economists will have to unify more with demographers within the shortest possible time as the economy of the 21st century will not be the theory of functioning of relationships and becoming familiar with economic regularities, but a science which will attempt to discover mechanisms as to how our world will survive the hitherto incomprehensible, difficult to describe and impalpable demographic shock which awaits us.

It is proved on the previous pages that the Czech society has been coming elderly. On one hand the society is coming elderly, on the other hand also a number of years spent in good health has significantly increased even for last two decades. Our own research shows that this is noticeable especially in the case of men. The research is based on the examination of relationships between the time series (life expectancy of men and women) in the time period 1990-2011. The level of current fertility does not enable simple reproduction in the Czech Republic. There will be detectable a lack of manpower in the following decades.

Although we constantly use terms from demography or from the field of sociology, the truth is such that this is in principle an economic problem. Let us remind ourselves that societies of developed countries are fundamentally weakened by the fact that the number of descendants of the original inhabitants are decreasing with every subsequent generation. If we, for instance, reach a fertility of only 1.5 children per woman in one generation, this in principle means that the following generation will be smaller in number by a quarter. If this fact is not to entail the absolute collapse of developed economies, then there is no choice but to allow immigrants to enter the "house", i.e. allow a relatively free course of migration from less developed to more developed states – at least in the sense of "supply of manpower".

Even so, we will be the witnesses to a marked shift of economic activity outside of the currently richest countries, but the above-mentioned decline of inhabitants simply has to be replaced in order for an absolute collapse of the system not to occur.

Although Czech society does not have such broad experience with co-existence with foreigners as do European democracies, it will probably have to come to terms with the notion that within a relatively short time, the proportion of foreigners in the Czech Republic will increase from the current four to twenty to thirty percent of the population. It is practically inconceivable that it would be possible to handle such development condensed into a few decades without greater social and political changes. It will require a dynamic change of the

schooling system, implementation of comprehensive systems of education and assimilation programs for migrants, whose qualification and education will with a high measure of probability not correspond to the needs of the Czech economy; from this perspective, the language problem will be rather a smaller difficulty.

What has to be emphasized yet again is the fact that regardless of all consequences, the problem of ageing is, first and foremost, an economic issue. All other connections can be solved in an effective manner only if we think of the matter as an economic problem, i.e. as an issue of development of the economic environment, development of market relationships or supply and demand. If political or social considerations dominate in this consideration, it will probably lead to a deepening of economic difficulties, not to the solution thereof.

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