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DIPLOMOVÁ PRÁCE

Pension reforms in the European Union: What can we learn?

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Prohlášení

Prohlašuji, že jsem diplomovou práci vypracoval samostatně a použil pouze uvedené prameny a literaturu

V Praze dne **podpis studenta**

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ABSTRAKT

Cílem této práce je podat celistvý přehled penzijních systémů a reforem v zemích Evropské Unie. K tomuto účelu obsahuje tato práce komparativní typologii charakteristik penzijních systémů a strategií penzijních reforem. Tato analýza navíc přináší několik poznatků o vztahu mezi typy penzijních reforem a jednotlivými vlastnostmi penzijních systémů společně s demografickými charakteristikami zemí Evropské Unie. Analýza byla provedena pomocí principální komponentní analýzy kvalitativních data a preferenčního mapování (multidimenzionální preferenční analýzy). Mezi charakteristiky penzijních systému, které byly zahrnuty do analýzy, patří popis štědrosti penzijních systémů, rozšíření privátních penzijních systémů a zastoupení starších lidí na trhu práce.

Aby byl přehled penzijních reforem v Evropské Unii úplný, práce také obsahuje výčet důvodů, které přispěly k nutnosti implementace penzijních reforem. Dále také popis jednotlivých pilířů penzijních systémů v zemích EU, popis věku odchodu do důchodu, hodnocení několika ekonomických charakteristik penzijních systémů a popis veřejných výdajů na penze. Srovnaní dvou hlavních způsobů financování penzijních systémů (PAYG a fondového systému) slouží jako základ pro pochopení hlavních strategií penzijních reforem, jejichž popis tvoří další významnou část této diplomové práce.

ABSTRACT

This diploma thesis tries to provide an overview of pension systems and pension reforms in the EU countries. To describe characteristics of pension systems together with latest reform steps more comprehensively, a comparative typology of pension systems and reforms was performed. Moreover, this analysis brings interesting findings about a link between pension reform strategies and characteristics of pension systems together with demographic situation of European Union countries. The analysis is based on principal component analysis of qualitative data and preference mapping (multidimensional preference analysis). The pension system characteristics include variables describing a pension generosity, a development of private pension schemes, and a labor force participation of older workers.

To provide a compact overview of pension reforms in the European Union, at first the reasons for implementing necessary pension reforms are listed, followed by description of the first and second tier of pension systems, pension eligibility ages, several economic indicators of pension entitlements, and expenditures on public pension systems. Comparison of two main ways of financing the pension system (PAYG and funded) is important background for examination of main reform strategies of pension reforms that is also presented in this thesis.

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Introduction

Demographers refer to rapid changes in demographic trends in society as transitions. According to them, the world population experienced two main demographic transitions. The first demographic transition took place in the beginning of the 19th century in the most developed countries (mainly Europe). The main characteristics of the first demographic transition can be summarized as a rapid decrease in mortality rates followed by the slow decrease of the fertility rates. The second demographic transition started to occur in the most developed European countries from the second half of the 20th century. The second demographic transition, which can be characterized by a decline in the fertility rate, postponement of child bearing, and an increase in life expectancy, brought many new social and economic challenges for national economic and social policies. The aging of the population is currently one of the most discussed topics that take place in developed countries.

An aging population has various consequences for social policy, economic policy, and economic development of different countries. For example, we can find many different consequences of population aging on economic growth, fiscal policy, social security and public pension systems. The social sustainability of pension systems has become and will remain a crucial challenge in all developed countries. The warning of population aging was presented by demographers many times, but typically governments did not pay attention to it and were not willing to launch painful solutions that might change pension systems but also reduce the popularity of politicians among voters. However, the reform of pension systems is not avoidable if the system is to be saved. Nowadays, the question is not if there should be reformed but in which way should the reform proceed. It is very difficult to compare different pension systems, and it is impossible to find the best one because the specific country background plays a very important role. However, comparisons of different pensions systems can bring valuable knowledge and suggestions for countries that are on the stage of introducing pension reform.

The primary purpose of my thesis is to provide an overview of pension systems in the European Union together with appropriate comparative typology of pension systems and pension reforms. The most important issue is to explore links between the pension reforms and various characteristics of pension system and demographic situation in the European Union countries. This analysis should answer questions like:

- Do countries with similar pension structure impose similar pension reforms? Are pension reforms path dependent?
- Do countries with more generous pension systems impose different pension reforms compared to countries with less generous pension systems?
- Do new member states have different pension strategies than former EU member states?
- Can we find structural pension reforms more often in countries with serious problems arising from population aging?

My thesis is divided into four parts. The first part tries to bring a list of reasons why pension reforms are necessary to be implemented in the EU countries. It starts by a descriptive analysis of the demographic trends in the European countries, mainly from 1960, with a goal of examining these trends relative to population aging. Then it brings an overview of current and future situation in labor market of EU countries and its consequences on public finance. Reasons for pension reforms can also arise from drawbacks of existing pension systems so a description of excessive generosity, failures in early stages of unfunded pension programmes, and lack of credibility cannot be left out. Other reasons contributing to need for changes in existing pension systems stem from socioeconomic changes in the EU countries and from deepening of the European Union integration.

The second part of the thesis is devoted to issues concerning the pension systems in reality. For the description of the pension system, the thesis uses the taxonomy of the OECD that differentiates three tiers of the pension system according to their particular objectives (redistributive first tier, insurance second tier, and voluntary third tier). The size of each tier and the type of pension scheme differ by country, so the analysis also contains a comparison of the tiers across EU countries. Countries also differ in the standard eligibility age, which is also discussed in this chapter. Also analyzed are the economic indicators of pension entitlements (gross and net replacement rates, a pension wealth, and contribution rates) as well as public expenditure on the pensions that became the threat of all EU countries.

The third part provides theoretical description of various pension reforms. First, important characteristics of two possibilities of financing the pension system (pay-as-you-go and funded pension system) are introduced together with presenting their advantages and disadvantages. Comparison of internal rates of return and various types of risk connected with both financing systems are also depicted in this chapter. It also includes description of main pension reform types as parametric reform, transition to full funded pension system, transition

to partially funded system, and notional defined contribution system. The end of this chapter discusses a possibility of existence of “ideal” pension reform.

The forth part maps pension reforms in the EU countries by introducing comparative typology of pension systems and its relation to pension reforms progress. The analysis uses results from principal component analysis of qualitative data that sorts countries into groups according to their pension systems' characteristics and the preference mapping of individual pension variables that shows according to which pension variables are individual countries situated on the map (in other words, it shows which pension variables are related to which EU countries). This chapter also includes the European Union approach towards the pension reforms.

Chapter 1. Reasons for Necessary Pension Reforms in the EU

The pension reform debate in the European Union countries is being driven by many social and economic factors among which the most obvious is the increase of expenditures on the retirement income. According to OECD sources the expenditures on the public pensions as a share of GDP has increased from 6% in 1960 to 12% in 2000 (OECD, 2002). Moreover, it is predicted that without any reform of the public pension systems the expenditures on the retirement income will climb on the level about 20% of GDP in following decades (OECD, 2002). These budgetary consequences are not the only forces that call for comprehensive reform of the pension systems in the European Union countries. In this chapter I will present the main factors that have contributed to the bad state of the public pension systems in the EU countries.

1.A. Demographic Background – What Is Going On?

The most often cited reasons for the need of pension reform are the negative changes in the population structure and demographic behavior of the population. From the second half of the 20th century, the most developed European countries experienced similar demographic trends: decreasing or stagnating fertility and an expanding life expectancy. Those trends became so common that demographers labeled them as the second demographic transition. The speed and the level of these demographic changes differ from country to country, but we can observe the same pattern at the end. The demographic behavior of former communist countries (mainly Eastern Europe) was quite different from that of the Western European countries. The demographic transition started much later, just in 1990s, but the speed of the changes was much higher than in the Western European countries, so now the fertility rates are even lower in many Eastern European countries than in the former EU countries, and the life expectancy of the Eastern Europe inhabitants is converging very closely to the life expectancy of the Western European countries.

In this section, I present the main demographic changes of the EU countries and the future expectation of the population development. I deal with the population structure, fertility, and life expectancy because the main characteristics of the aging population can be observed in these demographic variables.

1.A.1. The Population Structure

Considering the development of a specific population does not mean considering only the size of the population but also paying attention to the gender and age structure of the

population because it has serious consequences for the future population size and development. Thus, the changes in the age structure of the population should be taken seriously. Generally, three forces can cause the changes of age structure: changes in fertility, changes in mortality, and changes in migration. Regardless of migration, population aging can arise because of decreasing number of children born (decreasing fertility rates) or increasing size of the older population (decreasing mortality). If both of these two processes happen to occur at the same time, then the population aging is more severe. The aging of population in the European countries has been occurring for both reasons. These demographic trends together with trends in the labor market will determine the future size of the labor force, and so the future output of the country.

Discussing the population aging, we have to distinguish between population aging as a dynamic process and the high share of old population in a static state (Rabušič, 1994). From this perspective, we can differentiate the old population that is aging or not aging and the young population that is aging or not. The recent trends in European population can be described as the gradual shift from the population with relatively dominant young age groups to the society with large cohorts of older people. Two main indicators can best reflect this change: the median age of population and the share of the elderly in the population.

The development of the median age of the European population from 1950 to 2000 and its projection until 2050 is shown in the Table 1. This table provides data for Europe and its four main geographical parts (clustered according to UN).

Table 1: Median Age (in years) - Medium Variant, Europe and Regions, 1950-2050

Year	Europe	Eastern Europe	Northern Europe	Southern Europe	Western Europe
1950	29,7	26,4	33,4	27,6	34,6
1960	30,7	28,3	34,3	29,6	33,7
1970	31,8	30,8	33,2	31	33,2
1980	32,7	31,6	34,1	31,9	34,5
1990	34,8	33,6	36,1	35,1	36,2
2000	37,6	36,4	37,7	38,2	38,9
2025	44,4	43	41,9	47,5	45,4
2050	47,1	47,2	43,7	50,1	46,6

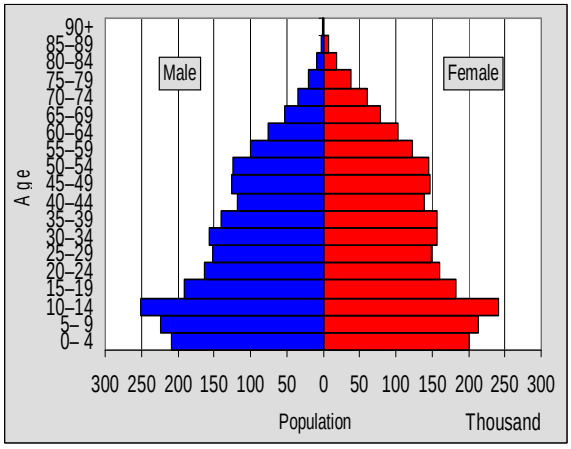
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006

We can see that the median age for Europe as a whole has been increasing for the second half of the 20th century, and it is predicted to increase even more in the future. The median age of the European population was eight years older in 2000 than in 1950. The

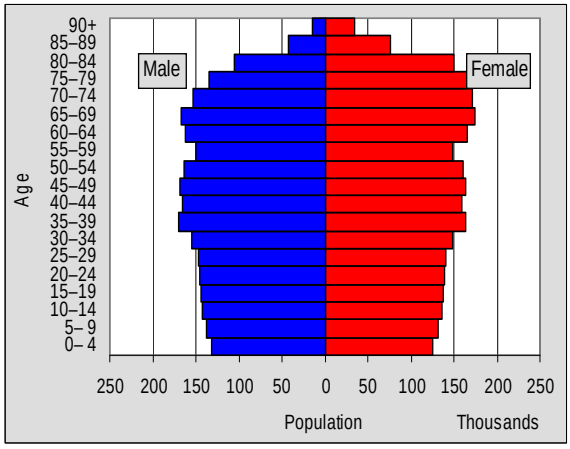
projected median age for Europe in 2050 is 47 years; half of the population will be within three years of 50 or older.

The changes in demographic behavior are well seen by comparing the age structure of the specific population over several years. As an example, we can use the population structure of Finland from year 1960 and the projection for year 2030 that are depicted in the population pyramid of figure 1. The shrinking number of the younger cohorts and the increase of the older age cohorts in the Finish population is depicted as a transition from the wide base population pyramid (in 1960) to a population pyramid with the cutoff in the base (in 2030). The population aging in Finland is not as severe as in some other countries of the EU. However, the following age pyramids still illustrate the transition to the reverse population pyramid.

Figure 1: Population Structure of Finland, 1960 and 2030



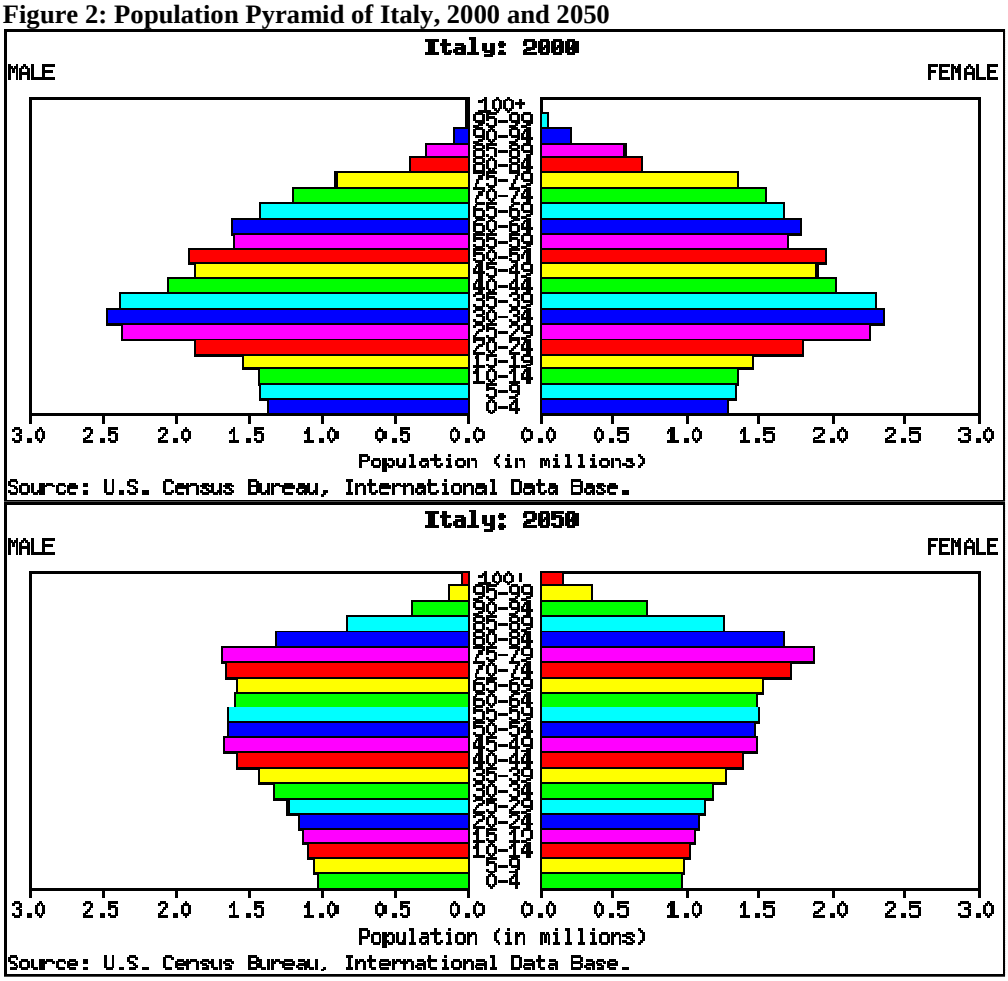
Source: Väestönmuutokset 1960



Source: Väestönmuutokset 2000

To depict the consequences of the change of demographic trends in the country with the most severe population aging, figure 2 show the age structure of Italy in 2000 and the projection for 2050. The population of Italy is labeled by Eurostat to be the oldest European population. This is already clearly seen on the graph of population pyramid of Italy in 2000 that has the narrow base, which is the result of the low fertility rates in previous decades. The projected population pyramid of 2050 has an even narrower base. The small cohorts born when fertility was low will push the fertility rate still lower, and thus the base of the pyramid will narrow. In addition, the cohorts of active labor force are getting smaller because of the previous low fertility. The top of the age pyramid 2050 will become wider, which means that the older age population will be larger absolutely as well as relatively.

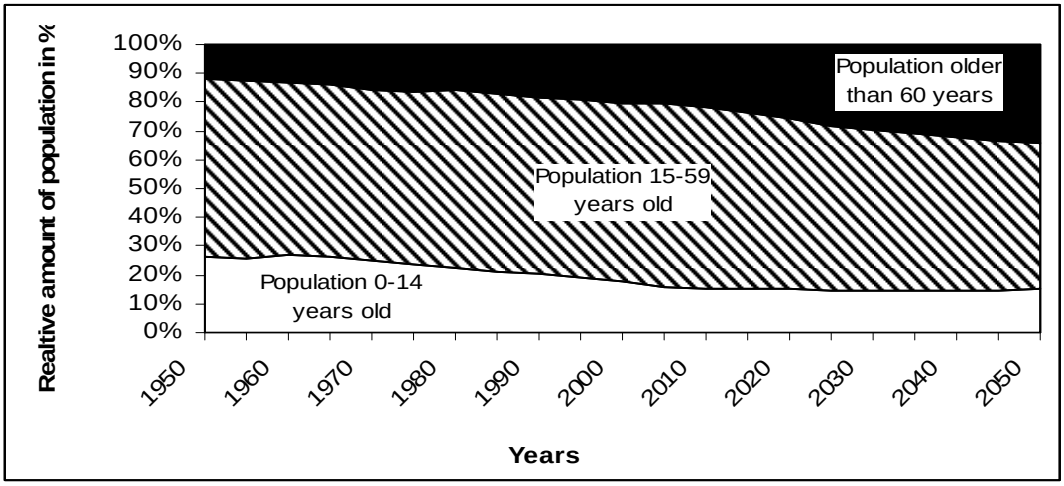
Figure 2: Population Pyramid of Italy, 2000 and 2050



Source: U.S. Census Bureau, International Data Base.

The relative increase of the European population older than 60 years in comparison with the population that belongs to the age group below 15 years old and to the working age population (age 15-59 years) is depicted in figure 3. The chart shows the changes of population structure from 1950 until 2050 for Europe as a whole. The same pattern of demographic changes is observed in all European Union countries. The relative amount of population below 15 years in 1950 was 26,2%. It decreased over the last fifty years to 17,5%, and it is predicted to be about 2% lower in 2050. The percentage of the economically active population in Europe (age between 15 years and 59 years old) stayed close to 60% over the second half of the 20th century, but it is predicted to decrease to 50% by 2050. The most characteristic feature that occurs in this chart is the sharp growth of the percentage of older people (the age group over 60 years). The relative population size of this older age group was 12,1% in 1950 and 20,3% in 2000, and it is predicted to increase to 34,5% in 2050. So roughly, we can conclude that there will be nearly three times more old people (over 60 years) in the European population in 2050 than in1950. It is clear that this fact will cause many changes in society.

Figure 3: The Age Structure of the Population, Europe, 1950-2050

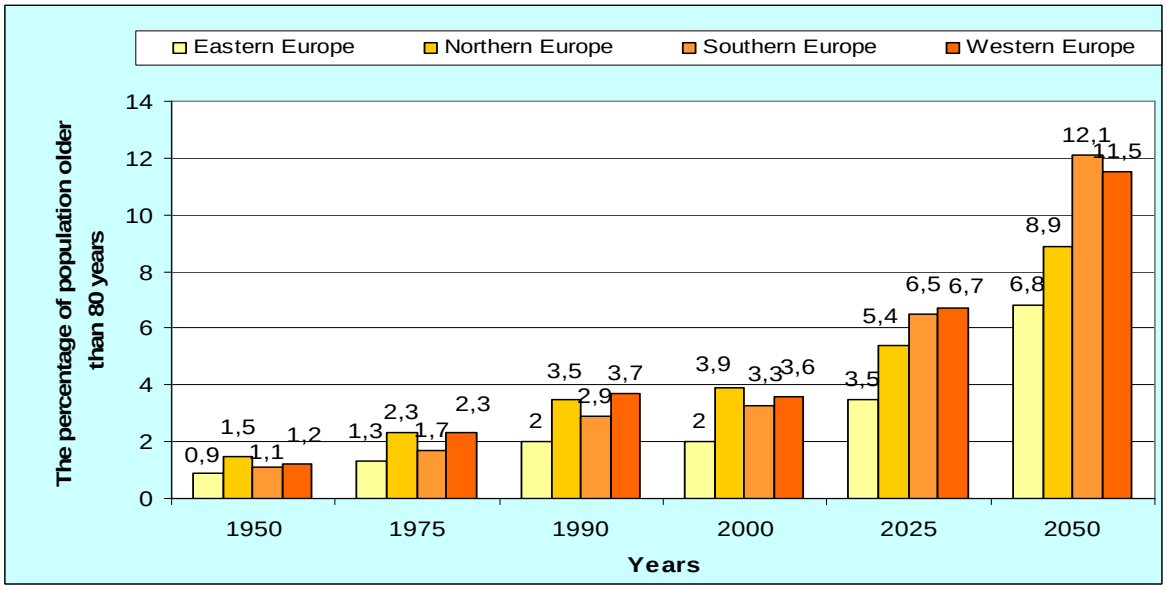


Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006

A very important variable for the future spending on the pensions is the old-age dependency ratio. This ratio expresses the share of the old people (older than 65 years old) in population relative to the population in age group 15-64. According to data of Population Reference Bureau, the dependency ratio is currently equal to 24.9% for all 25 EU countries, which means that currently there are four people of working population for every person above 65 years old (Mamolo and Scherbov, 2006). The ratio is projected to increase rapidly in the following decades, and there is an 80% chance that the ratio will more than double by 2050 (Mamolo and Scherbov, 2006). That would mean that in 2050 there would be less than two persons of working age to support one person above age 65. The Eurostat baseline projection suggests the old-age dependency ratio of 40,3% in 2030 and 52,8% in 2050. The future old dependency ratio and the labor force participation rates heavily depend on the national social and employment policies of countries (for example, on changes in the retirement age). Moreover, the dependency ratio can be even larger than projected because not everybody of working age will work because of unemployment, disability retirement, early age retirement, and other factors that decrease the actual employment. On the other hand, this ratio can improve if there are enough immigrants of working age moving to the EU countries who will participate actively in the labor market. In 2006, the highest dependency ratios in the European Union were in Italy (28,9%), Germany (27,8%), and Sweden (26,5%) (European Demographic Datasheet 2006). The old-age dependency ratio of Eastern Europe in 2000 was lower (about 19) than in the rest of the Europe (24) (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006), but in the future it will catch up to the level of other parts of Europe.

When studying the changes of population structure with emphasis on the increasing public spending on social and health protection in European countries, the very important fact that should be considered is not only the increase of the population over 60 years old but also the increase of the population in the oldest age group: the population older than 80 years. Because the life expectancy has been increasing for all European countries, the absolute as well as relative amount of the pensioners older than 80 years has increased. That has very severe consequences, especially on health care expenditures. Figure 4 illustrates the gradual increase of the percentage of population older than 80 years for four geographical regions of Europe. From 1950 until 2000, the percentage of people older than 80 years doubled in the Eastern and Northern Europe and tripled in the Western and Southern Europe (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006). Currently the percentage for the Europe as a whole is 4%, and Eurostat predicts an increase in the proportion of elderly aged above 80 to 7,2% in 2030 and 11,4% in 2050. According to a probabilistic projection, the 60% prediction interval ranges between 6,5% and 8,3% in 2030 and between 10,6% and 15,8% in 2050 (Mamolo and Scherbov, 2006). The uncertainty about the proportion of the population older than 80 years comes from the uncertainty about the development of mortality in old ages. Starting in 2025, the size of this group is predicted to increase because the cohorts born in the baby boom period are about to enter to this age group.

Figure 4: The Percentage of Population Older than 80 years, Regions of Europe, 1950-2050



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006

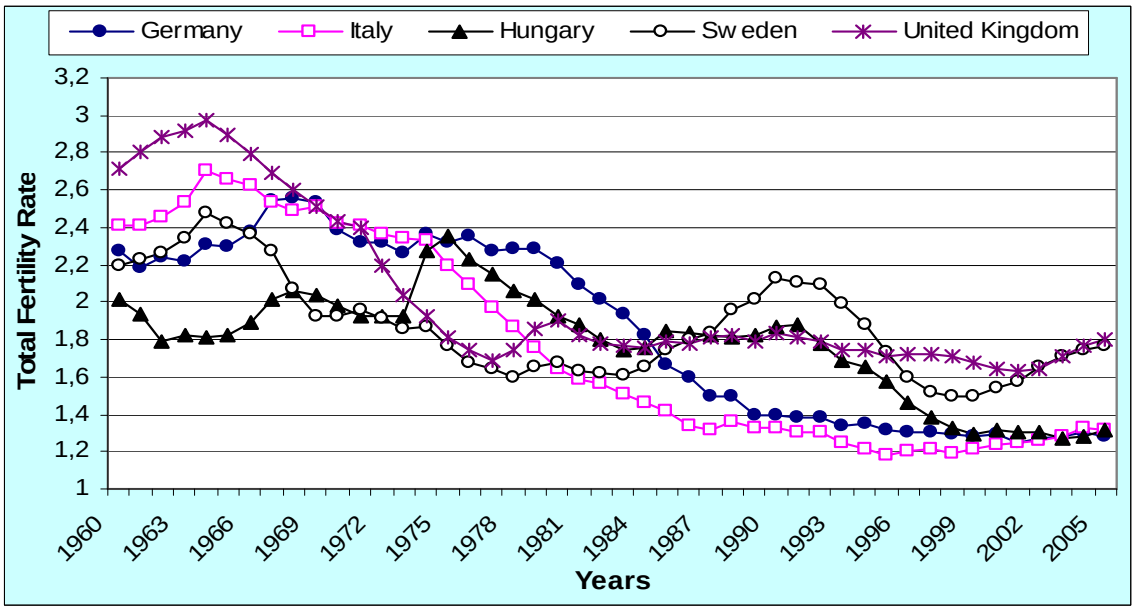
1.A.2. Fertility

As was mentioned above, the size of the population and its age structure is determined by trends in fertility, mortality, and migration. To examine the trends of European population and its probable future development, we need to examine the developments in fertility. The indicators of fertility should not only describe the number of born children each calendar year but should also consist of the information about the timing of having children. This information is the key factor of the second demographic transition.

Figure 5 shows the development of the total fertility rate in several European countries since 1960. The total fertility rate indicates how many children would be born to a woman during her reproductive period if her demographic behavior would not change. The total fertility rate (TFR) for sustaining the reproduction of population is defined as 2,1 children per woman. From figure 5, it is clear that in 1960 the total fertility rate was above this level in all countries except Hungary, where it was slightly below. Hungary, as the representative of the former communist country of Eastern Europe, differs from other countries in figure 5 also by the further development of TFR. While the TFR tended to decrease during the 1970s in all other four countries, the TFR of Hungary went up in the second half of the 1970s. This increase was probably caused by the pro-fertility policy. After the fall of the communist totalitarian regime, the fertility in 1990s went down very fast and sharply to the very low level of 1,32 in 2005. The development of fertility mentioned for Hungary is very similar for other post communist (transformation) countries. On the other hand, the gradual decrease of fertility

rates can be seen for Italy and Germany, the countries where this indicator was the lowest in 2005 (1,21 and 1,24, respectively).

Figure 5: Total Fertility Rate in Selected European Countries, 1960 - 2005



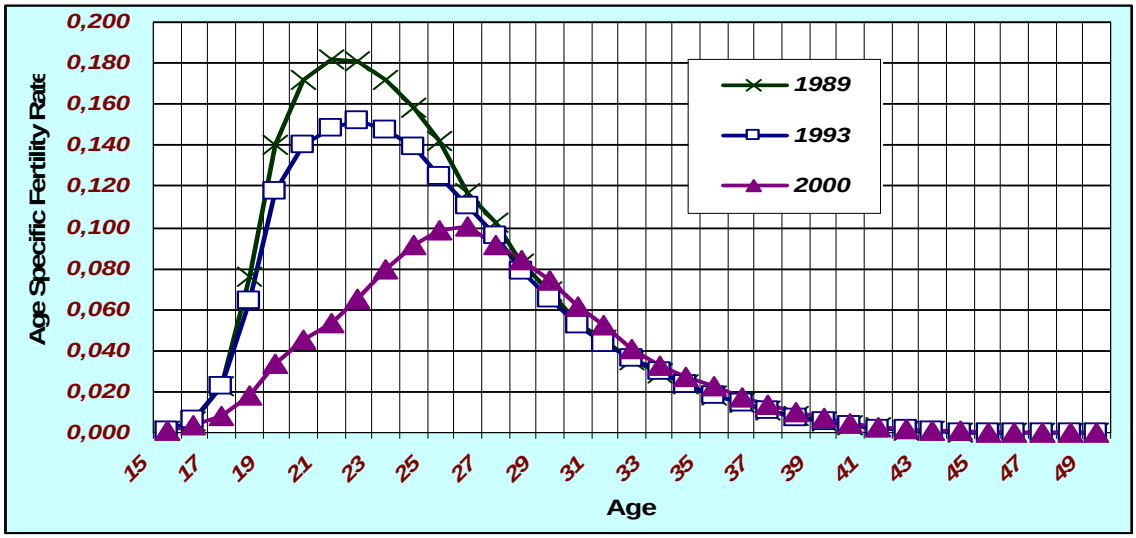
Source: Eurostat

In 2005, the total fertility rate for all 25 countries was 1,52 (Eurostat), which means that the "average" woman from an EU country would have 1,52 children during her reproductive years. Fertility in the European countries is at very low levels. Fertility is predicted to increase to 1,8 in 2050 (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2006), but the increased value is still below the border of 2,1 and does not seem sufficient to protect the population from the consequences of aging.

Fertility patterns not only refer to changes in the level of the fertility rate but also to trends in the timing of having children. Because of the changes in timing of childbearing, the fertility level of the population can change very significantly as well. The second demographic transition is characterized by postponement of having children to a higher age group of women. Since the length of reproductive age for the mother does not change and the first child is born later, there is clearly a shorter period for having other children, and thus it pushes the total fertility rate down and the mean age of having children up. Figure 6 shows the age-specific fertility rate of the Czech Republic for three years of the last decade of 20th century. The second demographic transition in the Czech Republic started in the 1990s and was faster than in the West European countries, but the patterns of this transition are the same for all countries. Figure 6 clearly shows that the curve for age-specific fertility rate not only

went down (overall decrease in fertility), but also the peak of it moved to the right (the postponement of childbearing).

Figure 6: Age-specific Fertility Rate, Czech Republic, 1989, 1993, and 2000



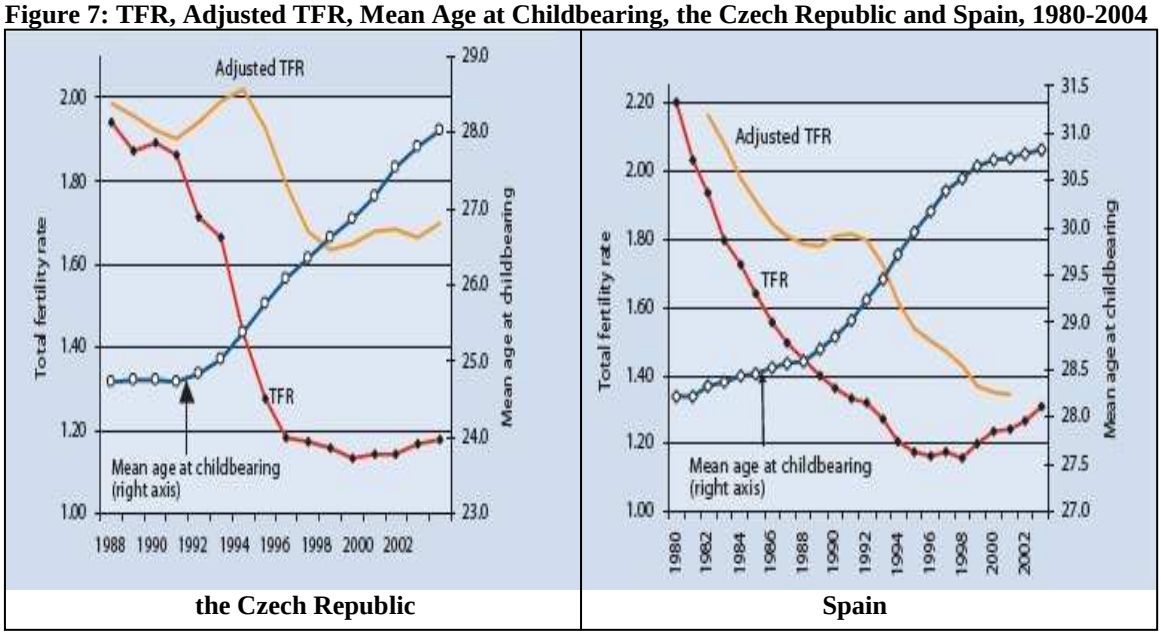
Source: POPIN Czech Republic

The total fertility rate (TFR) reflects the interplay of two components: *tempo* (timing) and *quantum* (level) of fertility, and thus the postponement of childbearing (tempo component) will decrease the TFR even if the number of born children does not decline for the population as whole (for cohorts) (Dimiter and Sobotka, 2006). Therefore, the demographers developed an adjusted fertility rate that deals with this shortage and is a better indicator for the average number of children per woman. Figure 7 depicts the TFR, the adjusted TFR (calculated on the basis of the Bongaarts-Feeney (1998) formula, which uses fertility data by birth order), and the mean age of childbearing of the first child for the Czech Republic and Spain over the last decade of the 20th century. On the left graph (for the Czech Republic) is illustrated the rapid decrease of total fertility rate after 1993 and the gradual increase of the average age at childbearing from 24,8 years in 1990 to 28,1 in 2004 (POPIN Czech Republic). From a comparison between adjusted TFR and TFR, we can say that the sharp decrease of TFR was mainly due to the fact that TFR measures fertility in one calendar year (but this does not mean that the fertility declined or will decline in the future).

A different conclusion can be made from the right hand chart for Spain. The difference between the TFR and adjusted TFR was significant only in the first half of 1990s, and then we can observe the same trend in both the fertility rates. From 2000, there is slight increase of TFR; meanwhile the adjusted TFR is still decreasing. From the chart, it can be observed that the mean age of childbearing increased only slightly from 2001. To sum it up, the fertility in

Spain declined according to both measures of fertility until 1998, and this conclusion points to serious problems for further projections (VID/IIASA/PRB).

Figure 7: TFR, Adjusted TFR, Mean Age at Childbearing, the Czech Republic and Spain, 1980-2004



the Czech Republic | **Spain**

Source: PopulationEurope.org © VID/IIASA/PRB

The future development of the European population will be influenced by the development of the fertility rate as well as other factors. The projections of future fertility trends are very difficult to make because the fertility rate can vary considerably for many socioeconomic reasons. For example, the fertility rate obviously can be affected by the population policies, but the result of these policies is unpredictable and often opposite from the original intention.

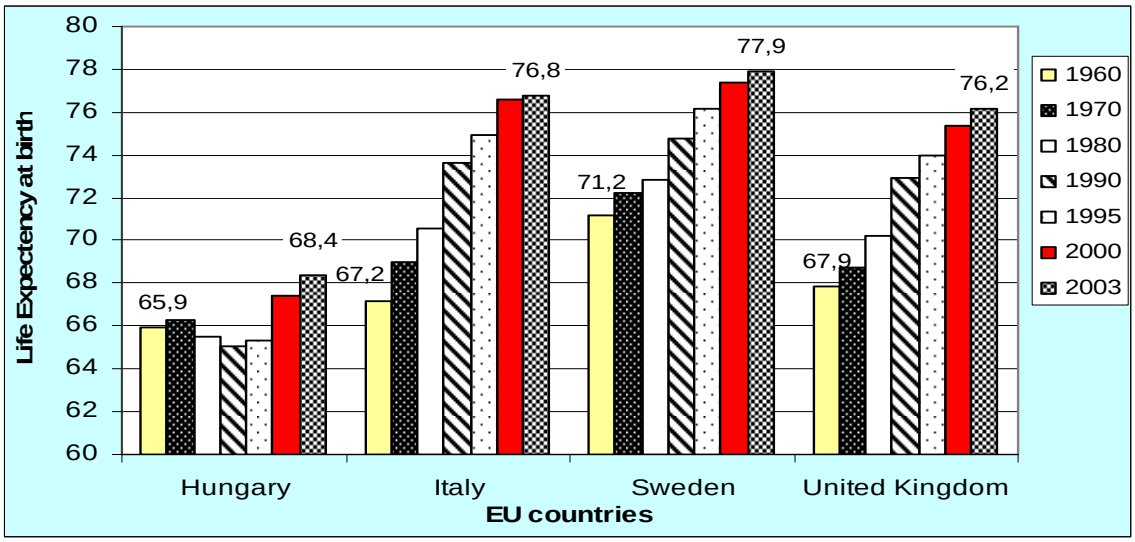
1.A.3. Life Expectancy

As was mentioned before, the extending of the length of life (increasing of the life expectancy) has been playing an important role in the changes of age structure of developed countries. After the Second World War, the mortality in the European countries declined thanks to better socio-economic conditions, better health care, and a successful fight with infectious diseases.

Figure 8 shows the development of the life expectancy at birth for males for each decade from 1960 through 2003. For this chart were chosen just four countries from different geographical regions. The development of the life expectancy of Hungary significantly differs from the other three countries. Very similar development as in Hungary can be seen in all other former communist countries. A higher number of deaths caused the lower life expectancy in the Eastern European countries from cardiovascular diseases and the lower quality of the health care. In addition, the lifestyle of the population was not as healthy as in

the rest of EU. The unhealthy habits like excessive drinking of alcohol, smoking, and nutrition shortage could considerably contribute to this development. After the fall of communist regime in the former communist countries, we can find the convergence of the life expectancy to the level of the life expectancy in the other European Union countries.

Figure 8: Life Expectancy at Birth for Male, Selected EU Countries, 1960 - 2003

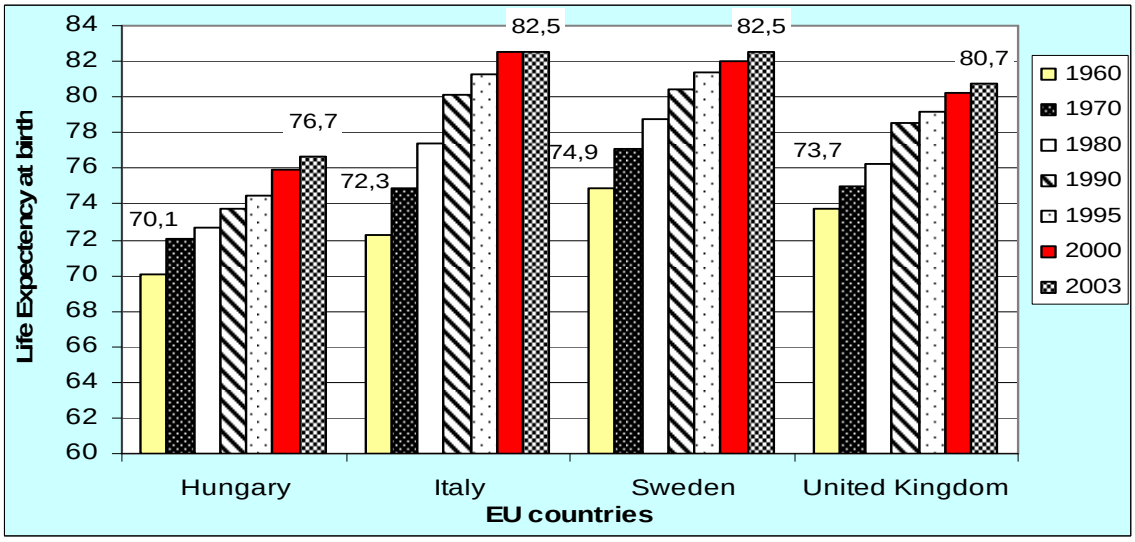


Source: Eurostat

From the figure above, we can determine that the highest increase in life expectancy occurred for men in Italy – an increase of nearly 10 years between years 1960 and 2003. A high increase of the life expectancy in this period occurred in all countries in Southern Europe (Eurostat data). The highest life expectancy in 2003 was for males in Sweden, Norway, and Iceland (about 78 years). The lowest male life expectancy in the EU was in Estonia, Lithuania, and Latvia (about 65 years).

Figure 9 depicts the life expectancy of women for the same selection of countries and the same time period used in figure 8. The male life expectancy is in all European countries lower than female life expectancy. This fact is expected because male mortality is higher than female mortality due to biological, psychological, and behavioral characteristics of men (Pavlík, Rychtaříková, and Šubrtová, 1986). From figure 9, we can determine the gradual increase of female life expectancy since 1960 in all selected countries. Nevertheless, the increase for Hungary is lower than other countries. As with men, the highest increase in life expectancy of females occurred in South Europe (Portugal, Greece, Spain, and Italy) (Eurostat data). In many EU countries, the expected life for women exceeds 80 years.

Figure 9: Life Expectancy at Birth for Women, Selected EU Countries, 1960 - 2003

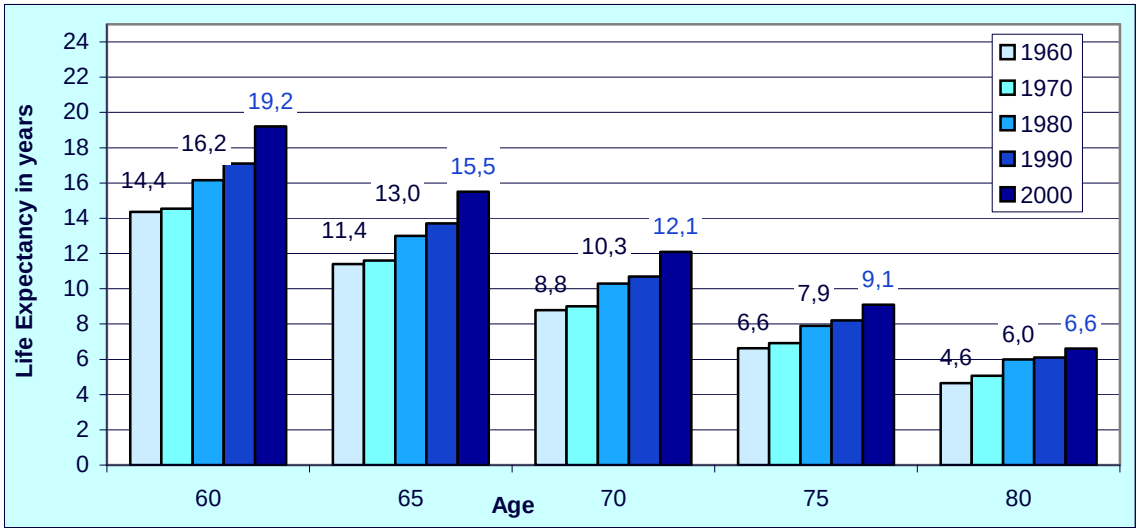


Source: Eurostat

Another interesting trend in life expectancy in the last half of the 20th century can be found when we look at the life expectancy at higher ages, for example at 60 or 80 years of age. This is crucial because it has many consequences for social and health care policies. The needs of this age group differ from those of younger age groups, and thus the pattern of consumption changes. The increase of life expectancy at age 60 was marked from the 1960s until now in all European countries. As could be expected, the highest increase of this indicator in 1990s happened in former communist countries (Eurostat data). In 2003, the expected length of remaining life at age 60 was about 19 years for males in the most EU countries, and about 23 for females (Eurostat data).

The increase in life expectancy is very significant also in age groups older than 60 years. The following figure for Finish males shows the growth of life expectancy in age groups 60, 65, 70, 75, and 80 years of age. A similar pattern appears in other European countries as well. The increase in life expectancy has been especially sharp since 1980s for men in their 60s. The life expectancy for 80 year old males increased about 2 years since 1960. This may not sound very important, but in the context of the whole population, it must be taken into account for the policy makers.

Figure 10: The Life Expectancy for Higher Age Group, Finland, 1960-2000



Source: Väestönmuutokset 1960, 1970, 1980, 1990, 2000

The prediction of the future development of mortality is probably easier than the prediction of the fertility pattern because the mortality level in the European countries has been stable (Tomeš, 2005). The prediction of OECD in 2001 was an increase of life expectancy in OECD countries of about 4,5 years until 2050, to an average life expectancy at birth of 82 years (Siebert, 2002). This projection predicts, for example, the life expectancy in 2050 to be 84 years for Sweden, 77,9 years for Hungary, and 82,5 years for Finland.

1.B. Labor force and migration in the EU countries

Another important indicator for economics of pension is the size and share of population in working age. The size of working active population is important because the financial sources for the income of non-active retired persons comes from the social security contributions of the active labor force.

1.B.1. The current facts about labor force participation

In 2005, the size of the economically active age group (ages 15-64) was 317 million (Muenz, 2007). However, given projected demographic trends, the economically active age group will be shrinking. In 2025, the size of this age group is predicted to decrease by 18% to the level of 261 million (Muenz, 2007). However, this is not the only change that is going to happen in the EU countries within the working age population. The other change that will be happening is the shift from the younger economically active population to an older economically active population. It is predicted that the youngest component of the labor force will decrease by one quarter between years 2005 and 2050, while the labor force in ages 30-

54 years old will be increasing until 2010, and the labor force in ages 55-64 years will be growing until 2030 (Muenz, 2007).

The decrease in the labor force will have important consequences on the financing of the old age pensions. Therefore, there can be reasonable intentions to increase the labor force participation rates mainly in countries with the participation rate below the EU average. The average labor force participation rate in 2003 for the earlier accessed 15 EU member states was 78,3% for males and 60,8% for females (Muenz, 2007).[1] Even from this average rate, it can be suggested that there is a need for an increase in the female labor force. However, the increase of the labor force of female is conditional on developing a better system to help women with taking care of children.

Another fact that has very important consequences on the size of the working population is the employment rate which differs from country to country. The following table shows the employment rate of different EU countries in 2003 and the average of the employment rate for the whole EU separately for women and men. In 2003, the average employment rate of males was 70,8%, and the average employment rate of females was 55,1%. From these numbers, we can see the prevailing gap between the employment of men and women in the EU countries. The highest employment for both sexes was in Denmark, and the lowest employment rate was in Poland.

Table 2: The Rate of Employment in Percent for Age Group 15-64 years, Selected EU Countries, 2003

	Total	Male	Female
Denmark	75,1	79,6	70,5
United Kingdom	71,8	78,1	65,3
Austria	69,2	75,8	62,8
Czech Republic	64,7	73,1	56,3
EU 25	62,9	70,8	55,1
Spain	59,7	73,2	46,0
Slovakia	57,7	63,3	52,2
Italy	56,1	69,6	42,7
Poland	51,2	56,5	46,0

Source: Eurostat

From the analysis above, there is hidden potential in the working participation and unemployment that could be used for getting a stronger and more numerous labor force in the EU. Another hidden potential that could be used in the future to sustain the pension system and other expenses for an aging society can be found in the older age groups (55-64 years),

[1] Earlier accessed 15 EU member states are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.

where workers go to early retirement even if they are able to work. This trend that occurs in all European countries is supported by the low labor force participation of the population in higher age groups.

Table 3: The Activity Rates of Different Age Groups (% of person in specific age group who are in employment or in unemployment), Selected EU Countries, 2004

Age group	15-24	25-54	55-64
Sweden	47,2	87,7	72,7
United Kingdom	62,9	83,7	57,9
Latvia	37,2	86,3	52,3
Czech Republic	35,2	87,8	45,
EU 25	45,1	83,6	43,9
Slovakia	39,3	88,9	31,7
Italy	36,1	77,5	31,8
Poland	35,9	81,9	29,6

Source: Eurostat

The labor force participation of the age group 55-64 is considerably lower in all EU countries in comparison with the labor force participation of age group 25-54. This fact is generally true not only for EU countries. However, in EU countries the activity rate for age group 55-64 is considerably lower than in other developed countries. For example, in 2002 the activity rate for age group 55-64 years was 65,8% in Japan, 60,2% in USA, and 49% in Australia (Tomeš, 2005). On average in the European Union, there was only 43,9% of people in age group 55-64 that were economically active. In such countries as Slovakia, Italy, or Poland, only one-third of the population in this age group still works. The exceptional share of the population in ages 55-64 that is still economically active can be found in the Northern European countries (Sweden or Finland). The low share of labor force participants older than 55 years is caused by lower retirement ages in some countries or by generous benefits for early-retired people that discourage people to work longer. It means that there is another uncovered area for dealing with the challenge of the sustainable pension system in an aging society. To increase the labor force participation rate to a level of 50 percent for people in ages 55-64 years is one of the goals listed in the Lisbon strategy accepted by the European Commission in 2000. This goal can be reached by either an increase of the retirement age or by labor market reforms aimed at raising the participation rates and tackling structural unemployment (Mc Morrow and Roeger, 2002).

1.B.2. The future prospects about labor force participation and the possible affect of migration

Muenz (2007) lists several projections about the development of the labor force in the European Union under different scenarios. Without any change in the level of the labor force and zero immigration, it is predicted that the labor force will decrease from 227 million in 2005 to 201 million in 2025 (by 12%) and to 160 million in 2050 (by 29%). Three scenarios, which are presented in this study and which could deal with decreasing labor force due to aging, are the increase of the overall labor force participation in all EU countries to the level currently common in the Scandinavian countries, the increase of the labor force participation of women on the level close to labor force participation of men, and the increase of the retirement by 5 years by 2025 and 10 years by 2050. The author finds that in the absence of the mass migration only a combination of the first and third scenarios (the increase of the overall labor force participation in all EU countries to the level currently common in the Scandinavian countries, and the increase of the retirement by 5 years until 2025 and by 10 years until 2050) will be able to deal with demographic aging while keeping the labor force at a sustainable level.

One of the important factors that have not been considered yet in our discussion about the future development of the labor force in the EU countries is the immigration and emigration of the population. Migration can affect the age structure of the population in many ways. If young people at productive ages immigrate to a country, where the population aging takes place, then the immigration can help to sustain the labor force of the country. However, this fact is influenced by many conditions and is not always necessarily true. It is very difficult to consider migration while estimating the future development of the specific population because migration depends on many unpredictable facts or events in the future. The immigration to the developed countries from developing countries can be caused by many reasons, for example, political and economic conditions or war. There are also significant problems with monitoring the immigration due to the high number of people who immigrate illegally.

If the migration goes in the appropriate direction, it could help countries with labor shortages. In 2003 and 2004, the annual net immigration to the EU countries was about 1,2 million (Eurostat). In 2005, the net migration was 1,7 million (Eurostat). The main destination countries for the immigrants are traditionally Spain, Germany, and the United Kingdom (Eurostat). From the whole number of immigrants, were only about 40% who were employed

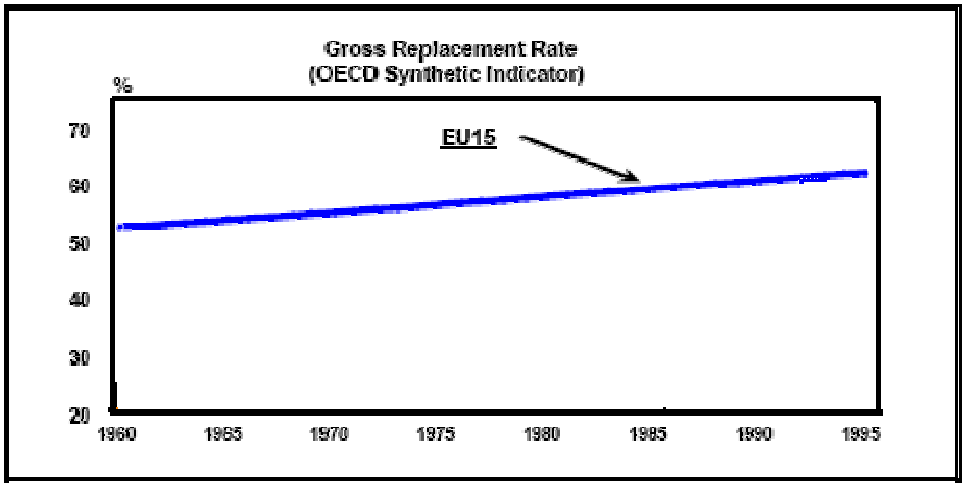
in the destination country (Muenz, 2007). Most of the immigrants do not have necessary skills to join the labor force in the destination country, so it is questionable if they can cover the gap in the labor force that arises by demographic aging. Moreover, according to the projection presented in Muenz (2007), the level of immigration that could replace the lost labor force of the original residents of the EU countries is above the level of immigration to the European countries in recent decades. The needed level of immigration would have to be annually 1,9-2,0 million until 2025 and 2,3 million annually until 2050 (assuming that 70% of immigrants will become employed) (Muenz, 2007).

There is prevailing skepticism that immigration can help to narrow the demographic gap in the EU population that is caused by the population aging (Visco, 2002; Burcin and Kučera, 2003; Muenz, 2007). Also according to the UN, the migration after the Second World War into the developed countries did not have as large an impact on population development as fertility and mortality (United Nations, 2002). This statement further confirms the fact that the countries in the European Union cannot rely on the transfer of the labor supply from developing countries (as North Africa, Middle East or Central Asia) to solve their problems with a decreasing economically active population that must take care of an increasing retired population.

1.C. Generosity of the pension system in the EU

Great increase of the expenditure on the pension benefits since 1960 can be caused by the fact that the governments provided more and more generous benefits to their non-active old-age retirees. This fact can be captured by the development of the gross replacement rate over time. The gross replacement ratio is often used as an indicator for the adequacy of the living standard in retirement. Basically, it expresses the pension entitlements as a share of income during the working life. The ratio thus measures the generosity of the pension system. The development of the OECD synthetic indicator of gross replacement ratio over time is depicted in the figure 11.

Figure 11: The generosity of pension system, 1960-1995, EU 15



Source: Mc Morrow and Roeger, 2002

1.D. The failures in early stages of unfunded pension programmes

Another fact that has contributed to negative development of the established public pension programmes is connected with early stages of the implementation of these programmes. The universal social security was fully introduced in most of the European countries after 1945 (Disney, 1999b). The basic concept of the public unfunded pension programmes states that the pension entitlements should be based on the contributions rather than on the transfers from the general budget (Disney, 1999b). Thus, the early stages of the programmes should be characterized by the accumulation of the fund in order to avoid huge increase in the contributions in the maturity stage of the programmes (Disney, 1999b). Moreover, the maturity of the programmes happens to be in the same time when the baby boom generation reached the pension eligibility age, and thus the aging of population plays significant role in the pension programmes crisis.

Unfortunately, the basic concept of the unfunded public pension programmes mentioned above was rather unfulfilled in all European countries due to several circumstances. Firstly, some of the initial funds lost value due to the doubtful investment decisions (Disney, 1999b). Secondly, the initial accumulated funds were sometimes used as a cheap source of the public credit to finance too generous public spending. Thirdly, the notional link between contributions and pension payments across generations was destroyed by paying the pension benefits to retirees who did not contribute anything or too low to the fund during their active working lives (Disney, 1999b).

1.E. Cutting off the subsequent generations

Another problem that is connected with the installed unfunded public pension scheme rests in non-existence of any credible mechanism that would prevent over-generous public

spending by one generation that passes the public commitment to upcoming generation. This problem of inconsistent behavior in unfunded pension scheme is parallel to some of the public choice puzzles (as budget balanced policy rules) (Disney, 1999b).

The standard analysis of the public pension finance is mainly covered by so called "Aaron-Samuelson" condition that defines the implicit return of the unfunded pension system on the level that guarantees the social optimum (Disney, 1999b). The model introduced by Samuelson in 1958 claims that the 'social contract' is needed in such a way that each generation will pay the pension to the preceding generation with the rate of return equal to the growth of the population (Disney, 1999b). However, to introduce and maintain such 'social contract' through the upcoming generations is impossible. In this sense, the unfunded pension system has the character of the Ponzi game.

Aaron's model is more general and it considers the wage growth as well. The solution of this model states that the rate of return of the unfunded pension programs should be equal to the sum of the population growth and wage growth. Nevertheless, due to the ongoing demographic changes (described in section 1.A) the unfunded public pension systems seem to be inefficient.

1.F. Socioeconomic changes in the European countries

The socioeconomic changes that put forward the need for pension reform in the EU countries can be classified into three different trends of the European societies: the change of the female labor force participation and family structure, the development of new forms of employment, and the wide spread of the life-long education (Holzmann, MacKellar, and Rutkowski, 2003).

The problems with the pension systems in relation to *changing female labor force participation and family structure* stem in several reasons. In all countries with the exception of Denmark and Estonia, there is very deep gap between the level of the pensions of men and women. On average, in the EU, women have pensions more than 15% lower than men (Eurostat). The pension gap exists for several reasons. Firstly, women in labor market usually occupy jobs that have lower earnings. Secondly, women have longer and more frequent career breaks because of childbearing. In addition, women are more likely to work in part time jobs. Thus, the pensions from the second tier that are earnings related are much lower for women than for men. The pensions for women are paid mainly from the first tier that is poverty averting.

If the family structure were traditional, the differences between pensions would not be such a problem. In the traditional family structure, women stayed at home and took care of children, and men were the main breadwinners of the family. In retirement, the roles of women and men were preserved with the support from children. But in many developed countries this traditional family structure is not valid anymore. The labor participation of women is increasing, and the divorce rate is on the very high level (nearly 50% of marriages end by divorce (Holzmann, 2004)). Because of these changes in family structure, there is a need for changes in pension system that should take more into account the career breaks caused by childbearing (as well as taking care of disabled or elderly persons) and should move to the individualization of the pension rights (Holzmann, 2004).

Another socioeconomic trend that evokes the need for pension reform is the development of *nonstandard forms of employment*. The pension systems are usually adopted for full-time work and life-long careers, but the labor market nowadays is different from this traditional model. The labor market tends to be more flexible in integrated EU society, with greater female labor force participation, more temporary jobs, increased reliance on part-time jobs, and greater self-employment (Holzmann, 2004). The former pension system was not equipped for these atypical kinds of job, and so the protection of the workers in older ages was not insured at the appropriate level. In most EU, countries there are accepted many tools for dealing with this problem. Among these tools is extending coverage of the statutory and supplementary pension schemes to the atypical employment, strengthening the link between contributions and benefits, and allowing access to occupational pension schemes for part-time working contracts (European Commission, 2006).

The last important trend in the EU countries having negative impact on the established pension systems is the increasing rate of *life-long learning* that is more and more necessary in the flexible labor market. Separating the life stages in terms of studying, employment, and retirement is not so clear. The pension systems are not well equipped for this change (Holzmann, 2004). The reform of pension caused by this reason should set forward the same direction as was mentioned in analyzing the changing family structure and its consequences.

1.G. Deepening of the European Union integration

According to some authors, the national pension reforms in the EU countries are not sufficient in the world of the ongoing European economic integration (see Holzmann, 2004) and more attention should be paid to the possibility of the pan-European pension reform that would ensure more coordinated pension structure of the EU countries. This should contribute

to the completion of the objective of the common market for goods, services, labor, and capital. Basically, we can find three important impulses for the more coordinated pension reform inside the EU: strict fiscal rules, common European currency, and enhancing the labor market flexibility.

The European Union is the community of the member states that are integrated not only economically but also culturally. The member states have some specific legislation and rules that must be adhered to without exception. One of those very important rules is based on the Maastricht criteria that are very often cited in the integrated process of the new member countries. The important parts of *Maastricht criteria* are rules for fiscal policy that forbid exceeding the fiscal deficit by more than three percent and require that the public debt be below 60 percent of GDP (Fiala and Pitrova, 2003). The aim of this fiscal restriction is to ensure the stability and growth in the EU economies. But with increasing pension expenditures financed from public sources, the fiscal rules to keep low public deficit are impossible. There comes the need for pension reforms that will result in pensions being paid more from private savings than from public budget.

The pension reform in the EU is also wanted due to consequences that come from the common currency. After accepting the *common currency* (Euro), each member state lost its independent monetary policy that could be used to deal with asymmetric shocks that can occur in individual EU countries. The only instruments that are left after the loss of monetary policy are fiscal policy and labor market flexibility. However, fiscal policy is not the best instrument for dealing with asymmetric shocks because of the fiscal criteria mentioned above. Thus, the flexibility of labor markets is the only reasonable way to respond to asymmetric shocks.

There are two ways that the labor market can demonstrate *flexibility*: by flexible wages and by full labor mobility. Unfortunately, both of these mechanisms are more rigid than flexible in the EU. The main reason for rigid labor force mobility is differences in the native languages in the EU countries, but other relevant reasons can include different tax systems and social security systems that cover old age pension systems. The pension systems in the EU are not harmonized enough (Holzmann, MacKellar, and Rutkowski, 2003). Even the coordination of the pension systems in the EU remains behind, and thus it limits labor mobility. The first tier pension scheme should be transferable across the borders according to Regulation 1408/71 on the coordination of the social security schemes (European Commission, 2006). However, in practice, the situation is more complicated. The full transferability of the first tier pension scheme is without problems only with universal

statutory pension scheme that is common in the Czech Republic, Finland, Sweden, and Denmark (European Commission, 2006). A more severe problem that discourages labor mobility stems from the non-transferability of privately funded supplementary pension scheme. This problem is getting worse because the supplementary pension scheme should play a more and more important role in the whole pension system in EU countries.

Chapter 2. Pension Systems

Pension payments are the primary source of income for the majority of people in the retired ages. The need for the pensions arises from the reduced capacity of older people to work and earn their own wages for living. Three main purposes for the pensions are poverty relief, insurance, and consumption smoothing. Nowadays the pension systems are common in nearly all countries over the world to substitute the intergenerational solidarity. In traditional societies or less developed societies, it is usual that the younger generation takes care of older people in their families and ensures their living after they stop working in higher ages. The economic support for the old people in the extended family structure is not common in more developed societies, where the linkages between family members are not so strong. Thus, the pensions in those countries are usually provided, mainly from the public system. However, the basic state pensions are not necessarily the only income for old people. Other income sources for retirees include investment income, occupational pensions, and further earnings in retired age.

The public pension schemes are provided by the national governments to shelter old people from poverty and to sustain living conditions for retired workers. The disadvantages of public pensions are their high costs and a discouragement of incentives to save privately. The first public pension scheme was introduced in Germany in 1889 (Sullivan, 2004). The main purpose for introducing this social insurance scheme was more political than to really help the poorest people in the society (Börsch-Supan and Miegel, 2001). This first pension system was established by the Chancellor Bismarck to reduce the social unrest and to promote the strengthening socialism by the Social Democratic Party. The pensions were paid as disability benefits until the age of 70 and as old pension after that. The level of the pension payments was dependent on the pre-retirement earnings. And thus the first German system did not cover the workers with the lowest earnings and most of the women (Sullivan, 2004). After the first pension system in Germany, other countries started to introduce their public social system for old people as well. Denmark followed Germany in 1891, the United Kingdom in 1908, Australia in 1909, and America in 1935 (Sullivan, 2004).

In developed countries, the size of the pension payments, the way of their financing, and the age, from which the population is eligible to receive the pensions differ considerably, and thus to compare the different pensions systems and their main characteristics is not an easy task. This chapter will describe the main characteristics of the pensions and explain the basic terms.

2.A. Typology of the Pensions systems

The typology of the pension systems is complicated because in the literature exist many approaches that can be used to distinguish individual pension schemes. The classification of the pension systems can be done with respect to the purpose of different parts of the pension scheme (redistributive part or insurance part), with respect to the source of financing (public or private), with respect to the form of pension (defined benefit or defined contribution), and with respect to the financing (funded or pay-as-you-go (PAYG)).

The pension systems in different countries are analyzed carefully by the World Bank, the OECD, the Commission of the European Communities, and other international organizations devoted to social protection or other economic issues. The methodology of comparison began to differ highly across organizations and so became very confusing. In 2005, the OECD developed the taxonomy that can be used for consistent comparison of different pension plans, pension funds, and pension entities among all countries (OECD, 2005). This classification avoids distinguishing the pension system only based on different pillars, which was done previously by the World Bank. Nowadays, the global classification of the OECD is used more widely, and finally it was used by the World Bank in its last WB report dealing with the comparison of the retirement-income system in 53 countries (Whitehouse, 2007).

The typology developed by the OECD is based on the different objectives of particular parts of the pension systems. The classification uses three tiers from which two main tiers are mandatory and the third tier is made by voluntary provisions. Two main mandatory tiers are redistributive and insurance. The redistributive tier is designed to shield the old people from poverty and ensure them an acceptable standard of living. The insurance tier should ensure targeted standard of living that is derived from the pre-retirement earnings. This classification is in accordance with two main purposes of the pension system that are to smooth the consumption over the whole life, and to offer the insurance for people in old ages (Bovenberg, 2002). Because I also find the typology of the OECD to be the most comprehensible and useful for the further discussion about the reform of pension systems, I will present this typology with explanation in the text below.

2.A.1. The First-tier: Redistributive Pensions

The first tier is paid from public provisions for alleviating poverty in old age. Unfortunately, some people with low earnings cannot save enough money for older ages when they will not be able to make their own earnings at work. Thus, there is a need for

compulsory redistribution to provide some minimum income for people with low income. This feature lent the name for the first tier.

The redistribution from the rich to the poor is not the only justified reason for using the first tier in the pension system. There are another two reasons that are in favor to this part of the pension system: “paternalism” and the prevention of free riding (Sullivan, 2004). The first reason for providing the first tier comes from the inability of most people to save an appropriate amount of income for retirement ages. On the one hand, some people would save more money than they actually need for their living in the old ages; on the other hand some people would not save enough money for their life in the retirement. The uncertainty about the length of the individual life also plays an important role. A free-riding problem can occur if people do not pay taxes during their working age, but then in the retired ages they will get the pension payments that are financed by taxes from taxpayers. This problem could happen in the societies that do not allow the old people to live in poverty. Thus, the public pension system that is mandatory requires all people to pay taxes, and then provides the right of all people to some kind of pensions in their retirement.

There are several types of redistributive pensions: the basic pension schemes, the separate targeted pension programs, the minimum pensions within earnings-related plans, and social assistance. Most of the EU countries use a mixture of those types for the redistributive pensions. However, some countries, including Austria, Germany, Italy, Spain, Sweden, Hungary, Latvia, Poland, and the Slovak Republic, have installed only one type of the first tier pensions.

The basic pension scheme

The basic pension scheme is one kind of first tier pension scheme. It can be paid in flat rate (the same amount of money to all pensioners regardless of the length of economic activity) as well as in various rates depending on the length of working years. The size of the basic pensions should not depend on the size of the previous earnings or on other income accessible to pensioners.

The basic pension scheme is common in these EU countries: Denmark, Ireland, Luxemburg, Netherlands, the United Kingdom, the Czech Republic, Estonia, and Lithuania.

The targeted pension scheme

The targeted pension schemes are sensitive to the wealth of retired people. According to the targeted scheme, the poorest pensioners get the highest percentages of pensions and the pensioners with high income get only small percentages pensions. The qualification for the targeted pensions can be determined in three different ways. The first way is based only on

the size of the pension income received by pensioners. The second way is based on the amount of the private savings that belong to pensioners (the targeted pension is decreasing with the increasing amount of savings). The third way is called broader means test, and the targeted pensions are in this case dependent on the pension income and the private savings.

The advantage of the targeted pension scheme stands from the moral ground and the lower cost base. The targeted pension schemes that are favorable to the poorest people at the expense of the richest people can be easily defended on moral and ethic sensitivities towards the people in the largest need. Moreover, if the targeted pension system is introduced appropriately, it should help to the poorest pensioners without imposing an excessive burden on the working population (Sullivan, 2004). The benefits for the public expenses that follow from the targeted pension scheme are unambiguous.

On the other hand, there can be several disadvantages to the targeted pension scheme. Firstly, it can be very costly to provide the means tests. Considerable information must be collected for a means test. Secondly, the targeted pension schemes can produce disincentives to save during the working ages because retired with lower savings can get higher pensions (Sullivan, 2004). Lower savings on the national level can evolve further economic problems.

The targeted pension schemes are common in all former EU countries with exception of Spain, but are not so spread in the new accession countries with the exception of the Czech Republic and Estonia,[2] where the first tier contains the targeted pension as well.

The minimum pension scheme within the earnings-related plans

The minimum pension schemes are paid only to some of the pensioners and so are not universal, as is the targeted pension scheme. The minimum pension schemes are usually earnings-related pension provision. In order to receive benefits from the minimum pension scheme, the individuals must pay some contribution from their earnings.

The minimum earnings-related pension scheme is installed in Belgium, France, Greece, Luxemburg, Portugal, Spain, the United Kingdom, and in all new EU countries with exception of Estonia and Lithuania.

The social assistance

The social assistance programs are usually provided universally to whole populations. Very often, these programs substitute for targeted schemes.

[2] New accession countries are Bulgaria, the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Malta.

The size of the first tier

All of the EU countries have some type or mixture of several types of redistributive pension schemes. But the size of the redistributive tiers differ from country to country. The redistributive pension scheme is usually expressed as a percentage of the average earnings. Table 4 depicts the list of the selected EU countries with the size of pension belonging to different type of the redistributive pension. The last column of the table shows the total first tier benefit to which an eligible full career worker is entitled. In some countries, the retirees are eligible only for one type of payment from the first tier; in other countries, they can be paid from several different types of programs. Because of this fact, the last column is very important for the international comparison. Overall, the largest entitlements of the first tier as a percentage of the average earnings are paid in Luxembourg (46%), Portugal (44%), and Greece (40%). In contrast, the lowest redistribution pensions are furnished in the Czech Republic (12%), Estonia (14%), and Lithuania (17%). Most of the countries have overall entitlement rates between 30% and 40% of the average earnings.

Table 4: The Size of the First Tier (as % average earnings), EU Countries, 2002

	Targeted	Basic	Minimum	Overall entitlement (full-career worker)
Austria	37	n.a.	n.a.	37
Belgium	23	n.a.	38	38
Denmark	17	17	n.a.	34
Finland	21	n.a.	n.a.	21
France	31	n.a.	29	31
Germany	24	n.a.	n.a.	24
Greece	12	n.a.	40	40
Ireland	28	31	n.a.	31
Italy	22	n.a.	n.a.	22
Luxembourg	36	12	46	46
Netherlands	34	34	n.a.	34
Portugal	20	n.a.	44	44
Spain	n.a.	n.a.	33	33
Sweden	34	n.a.	n.a.	34
United Kingdom	26	20	13a	33
Bulgaria	14	n.a.	16	16
Czech Republic	10	8	12	12
Estonia	14	7	n.a.	14
Hungary	n.a.	n.a.	22	22
Latvia	n.a.	n.a.	33	33
Lithuania	n.a.	17	n.a.	17
Poland	24	n.a.	n.a.	24
Slovak Republic	n.a.	n.a.	22	22

Source :OECD, 2005
Note: n.a = not applicable

2.A.2. The Second-tier: Mandatory Insurance

The second tier of the pension system represents the mandatory insurance for retirement ages. This insurance should maintain the living standards in the retirement ages relative to the earnings in the working ages. The second tier thus should serve as the additional income above the poverty-preventing first tier. The second tier is mandatory but can be from public provision as well as from private provision. The public insurance for retirement is advantageous thanks to low risks, low administrative costs, economies of scale, and no need for expensive marketing. The private compulsory savings with commercial pension providers are desirable if the capital market is well developed and properly functioning. The second tier is completely private only in Netherlands. The combination of public and private plans exists in such EU countries as Denmark, Sweden, and in all Eastern European countries with exception of the Czech Republic and the Slovak Republic.

As was the case with the first tier, there are several types of second tier pensions: defined benefit, defined contribution, points, notional accounts, and defined credit.

Defined Benefit

A defined benefit scheme guarantees the specific benefits for retired as reward for their various payments during their working life. The specific amount that is paid in the retirement is defined by a benefit formula. A defined benefit scheme can be either flat rate or earnings related. The flat rate scheme guarantees a fixed amount of pension benefit for each year of paying the insurance. The earnings related scheme defines the size of the pension by the final or average salary of the retiree.

The defined benefit scheme as a second tier is widely spread in the EU countries. It is the most common type of the second tier in the former EU countries.

Defined Contribution

A defined contribution pension provides variable payments based on the defined contribution. The principle is exactly opposite to the defined benefits schemes that provide defined benefit based on the variable contribution. The defined contribution can be either flat rate or determined as a fixed percentage of the earnings. Defined contribution schemes are sometimes called money purchase schemes because the money received in the pension age depends on the total amount contributed, the period over which the contributions are made, the investment returns earned, and available annuity rates (Sullivan, 2004).

Defined contribution plans are not common among EU countries. Denmark uses defined contribution plans in combination with defined benefit schemes for the public provision of the second tier, and defined contribution alone for the private provision of the second tier. Sweden uses defined contribution with the combination of defined benefit scheme only in the private provision. Only these two countries from earlier accessed EU countries have defined contribution schemes in their second tier. In contrast, in the Eastern European countries (with exception of the Czech Republic and the Slovak Republic), defined contribution is common as the private pension insurance.

Points

Different from defined benefit scheme is the point scheme. This scheme is earnings-related. For each year of work, the worker earns the points based on their individual earnings. After the worker becomes a pensioner, the points received during working age are converted into the pension stream.

The points system is used in France, Germany, Estonia, and Slovak Republic as public plans.

Notional Accounts

The name of this system explains the main feature of it. Workers during their working ages pay contributions in an individual notional accounts (the accounts are only in the accounting book). This account provides interest that is only notional as well. After the worker is retired, the accumulated capital with all interest is converted into the stream of pensions. The amount of the pension is calculated by a special formula based on the life expectancy at the time of retirement.

The notional accounts are common as public plans in Italy, Latvia, Poland, and Sweden.

Defined Credits

Defined credits are the basis of the special Swiss second tier private occupational plan. This system is similar to defined contribution scheme but it has more strict rules. The government determines the minimum rate of return and the mandatory annuity rate that must be paid. Switzerland does not belong to the EU countries, but defined credit is another type of second tier plan, and thus it is covered in this analysis.

The size of the second tier

In all EU countries with the exception of Ireland, there is some kind of the earnings-related second tier insurance scheme. Among the different types of the second tier, insurance schemes are earnings-related defined benefit, points or notional accounts. The values of benefits of different insurance schemes for international comparisons are presented in the accrual rate. The accrual rate per year of contribution is the rate at which the worker earns benefit entitlement for each year of coverage (Whitehouse, 2007). The accrual rate is usually expressed as the percentage of the individual earnings, and the pensions are covered only up to the specific size of the earnings (the earning ceiling).

In some countries, the accrual rates are linear. That means that there is a certain rate that is applied to all workers' earnings. But in some countries the accrual rate varies with the individual earnings, with the individual age, and with the number of years of contribution.

The accrual rates are variable in the Czech Republic, Finland, France, Sweden, the United Kingdom, and Portugal. In the United Kingdom, the accrual rate is U-shaped, which means the highest accrual rates are for the lowest earnings and for the highest earnings. The middle earnings have lower accrual rate in the United Kingdom. France and Sweden have similar patterns for the accrual rates that should correct the redistribution spuriousness. In

Portugal and the Czech Republic accrual rates are higher for low earnings and lower for high earnings.

The accrual rates differ according to the length of contribution in Luxembourg and in Spain. The systems in these two countries are very different. In Luxembourg, the accrual rate increases with the period of contributions. In Spain, the highest accrual rates occur in the first years of contribution, and the lowest are in the last years of contributions. Only in Finland do the accrual rates increase with age.

Table 5: The Summary about the Second Tier (Earnings Related), Selected EU Countries, 2002

Countries	Type	Accrual rate (% indiv. earnings)	Countries	Type	Accrual rate (% indiv. earnings)
Austria	DB	1,78	**Spain**	DB	3,00
Belgium	DB	1,50	**Sweden**	n.acs.	1,21
Denmark	DB/DC	n.a.	**United Kingdom**	DB	0,89
Finland	DB	1,50	**Bulgaria**	DB	1,00
France	DB/points	1,75	**Czech Republic**	DB	0,45
Germany	Points	1,00	**Estonia**	Points	0,50
Greece	DB	2,57	**Hungary**	DB	1,22
Ireland	None	n.a.	**Latvia**	n.acs.	0,60
Italy	n.acs.	1,75	**Lithuania**	DB	0,50
Luxembourg	DB	1,85	**Poland**	n.acs.	0,67
Netherlands	DB	1,75	**Slovak Republic**	Points	1,19
Portugal	DB	2,25			

Source: OECD, 2005
Note: n.a = not applicable, n.acs. = notional accounts

The highest accrual rates from average individual earnings are present in Spain (3%), Greece (2,57%), and Portugal (2,25%). The lowest accrual rates are in the former communist countries as in the Czech Republic (0,45%), Lithuania (0,50%), and Estonia (0,50%).

As was mentioned above, in many Eastern European countries, common defined contribution schemes are a component of private insurance plans. The value of the defined contribution rate can be also expressed as a percentage of the individual earnings. On average, the contribution rate is about 6,5% in the Eastern EU countries. The highest contribution rate is in Latvia (10%).

Many high-income EU countries impose ceilings on pensionable earnings, which mean ceilings on the contribution as well as on the pension benefits. Thus, high earners do not have to contribute on their full earnings, and the pensions do not cover their full earnings. To introduce the earnings ceilings for public plans should encourage private savings for high-income workers. The ceilings differ in size among the former EU countries. The highest ceilings are in Italy and Greece (above 300% of average earnings). Relatively low ceilings are in France, Belgium, and Sweden (only about 120 % of average earnings).

2.B. Pension Eligibility Age

The previous chapter described the threat to pensions arising from decreasing labor force participation in the EU countries. One of the main factors to influence labor force participation in older ages is the standard pension eligibility age in the country. The pension eligibility age also has very important effects on the social expenses for pensions, and thus the public finance of the countries.

Table 6 presents the normal, early and effective retirement ages in some of the EU countries. In the earlier accessed EU countries, the normal pension eligibility for men is 65 years. However, we can find some exceptions. For example, in Belgium and France the workers can retire at age 60 with 40 years of contributions; in Greece the workers can retire at age 58 with 35 years of contributions; and in Italy the workers can retire at 57 (56 for manual workers) with 35 years of contributions (OECD, 2006a). In the former communist countries that have entered the EU in recent years, the normal pension eligibility age for men is lower than in more developed EU countries and is between 62 and 63 years, with the exception of Poland, which has the same pension eligibility age as the former EU countries. The normal pension eligibility ages were in the communist countries set at very low levels; but, during the transformation from the beginning of the nineties, the age of eligibility has started to rise.

The normal pension eligibility age for women in all earlier accessed EU countries is the same as for men. The exceptions are Austria, Italy, and the United Kingdom where women are eligible for their pension starting at age 60; and Italy where women can retire at age of 62. Also in Portugal the normal eligibility age of retirement was 60,5 years in 2005 but it is supposed to gradually increase to 65 year until 2015 (European Commission, 2007). Finland and Sweden introduced flexibility into their retirement age so in Finland the normal age of retirement is moving between 63 and 68 years and in Sweden the workers retire in 61 years or older. In the former communist countries, the retirement age is usually lower for women than men (European Commission, 2007). The exceptional eligibility age for women is defined in the Czech Republic where the pension age for women varies with the number of born children to each woman. The lowest possible age for retirement for women in the Czech Republic is 59 years for women with four or more children. This system in the Czech Republic is the inheritance from the communist pro-fertility policy that was created to increase the incentives of women to have more children. It is probable that the pension eligibility age for both men and women is going to increase in all Eastern European countries in the near future.

Table 6: The Normal and Earlier Pension Eligibility Age, Selected EU Countries, 2002

	Normal retirement age		Early retirement age		Effective retirement age	
	Male	Female	Male	Female	Male	Female
Austria	65	60	62	60	59,1	58,1
Belgium	65	65	60	60	59,3	58,4
Denmark	65	65	n.a.	n.a.	64,1	61,4
Finland	63-68	63-68	60	60	60,5	60,1
France	65	62	55	55	58,5	59,2
Germany	65	65	63	60	61,7	60,7
Greece	65	65	57	57	62,4	61,2
Ireland	65	65	n.a.	n.a.	65,2	64,7
Italy	65	60	57	57	60,4	60,9
Luxembourg	65	65	57	57	59,2	61,3
Netherlands	65	65	n.a	n.a.	60,2	60,5
Portugal	60, 5	60, 5	55	55	66,2	65,9
Spain	65	65	60	60	61,1	63,4
Sweden	61 and more	61 and more	61	61	65,5	62,5
United Kingdom	65	60	n.a.	n.a.	63,2	61,4
Bulgaria	63	60	n.a.	n.a.	un..	un..
Czech Republic	63	59–63	60	56–60	61,5	58,4
Estonia	63	59,5	60	56,5	un..	un..
Hungary	62	62	60	57	58,9	57,3
Latvia	62	62	60.	58,5	un.	un.
Lithuania	62.5	60	57,5.	55	un..	un.
Poland	65	60	n.a.	n.a.	61.3	58.0
Slovak Republic	62	62	any age[3]	any age	59,2	55,5

Source: OECD, 2005; European Commission, 2007; OECD, 2007
Note: n.a = not applicable, un. = unknown

The early retirement age represents the possibility for workers to stop working earlier and get lower level of pension provision than is paid after the regular eligibility age. In many countries, the early retirement was introduced in the mid-1970s with the purpose of easing the industrial restructuring process (Brugiavini, 2001). In addition, the early retirement was implemented as a way of making space for younger workers, especially in countries with a high unemployment rate. However, the possibility of earlier retirement can substantially decrease the rate of the working labor force (as happened in the European countries). Therefore, some countries have abolished the possibility of early retirement. Among these countries are the Netherlands, Denmark, France, Ireland, United Kingdom, and Poland. Unfortunately, even in countries with the abolished early retirement the workers, who do not

[3] In addition to 10 years of contributions, the level of pension has to be at least 32% of the average wage in 2005 (European Commission, 2007)

want work in advanced ages, can use other escaping channels from labor market as unemployment benefits or disability benefits (Brugiavini, 2001).

Two last columns of table 6 depicts the average effective retirement age for men and women that is calculated as a weighted average of (net) withdrawals from the labor market at different ages over a 5-year period for workers initially aged 40 and over (OECD, 2007). The average effective retirement age is considered to be a good indicator of retirement behavior. From table 6 we can see that most EU countries have the effective age of retirement below the official retirement age. We can find only three countries whose effective retirement age of men is above their official eligibility age. These are Portugal, Ireland, and Sweden. The situation for women is even worse. Only women from Portugal reach higher effective retirement age than the official one. Contradictory, the average effective retirement age of men for countries like Austria, Belgium, France, Hungary, Luxembourg and the Slovak Republic is below 60 even though the official retirement age is set on the level of 65 years. The lowest effective retirement age of women can be found in Slovakia, Hungary, the Czech Republic, Austria, and Belgium.

Table 7: Average effective age of retirement, men, European countries, 1965-2005

	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00	2000-05
Austria	..	..	..	..	..	..	60,4	59,1
Belgium	63,8	63,5	61,5	60,6	58,5	58,3	58,5	59,3
Czech Republic	..	..	..	..	..	..	61,7	61,5
Denmark	68,3	65,9	65,5	65,9	65,4	62,9	63,4	64,1
Finland	65,9	66,5	65,9	63,0	61,6	60,1	60,2	60,5
France	..	..	..	..	60,0	59,3	58,8	58,5
Germany	..	..	..	..	..	..	61,0	61,7
Greece	67,3	66,5	65,9	65,2	63,7	63,2	63,2	62,4
Hungary	69,3	66,3	65,2	64,0	63,0	62,1	58,3	58,9
Ireland	73,1	70,3	68,2	66,1	64,0	63,2	65,3	65,2
Italy	65,9	63,9	62,2	63,3	62,3	60,5	60,2	60,4
Luxembourg	65,3	61,8	60,8	59,8	60,3	59,3	59,7	59,2
Netherlands	66,6	64,1	63,0	60,9	59,7	61,1	60,6	60,2
Poland	73,6	70,3	68,0	66,5	66,3	63,8	61,4	61,3
Portugal	73,1	71,2	68,7	66,5	65,4	63,3	65,1	66,2
Slovak Republic	..	..	..	..	..	..	59,4	59,2
Spain	69,4	66,8	64,8	63,5	62,9	60,8	61,7	61,1
Sweden	68,0	66,2	65,4	64,3	64,3	62,7	63,8	65,5
United Kingdom	67,7	67,4	66,0	62,8	62,8	62,0	62,4	63,2

Source: OECD estimates based on the results of national labor force surveys, the European Union Labor Force Survey and, for earlier years in some countries, national censuses.

Interesting is also development of the average effective retirement age in the last half of the century. Table 7 presents the average effective retirement ages for men since 1965 in some European countries. Comparing the average retirement ages in 1965-70 with the same variable in 2000-05, it is visible that men withdraw from the labor market earlier nowadays

than they used to in 1960s. Declining trend of the effective retirement age can be seen since 1970s for all countries. However, in the last decade the trend of declining effective retirement age was interrupted by its slight increase in the majority of mentioned EU countries. Same trend of the effective retirement age over the last half of century can be seen also for women, in spite of the fact that the labor force participation rate of women has generally increased since 1960s. This can be seen in table 8.

Table 8: Average effective age of retirement, women, European countries, 1965-2005

	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00	2000-05
Austria	..	..	..	..	..	..	58,9	58,1
Belgium	62,7	63,0	59,0	57,5	56,1	56,4	57,1	58,4
Czech Republic	..	..	..	..	..	..	58,1	58,4
Denmark	66,0	64,8	64,3	63,8	61,9	59,3	59,8	61,4
Finland	62,0	63,3	62,7	62,0	60,8	60,1	59,7	60,1
France	..	..	..	..	60,0	60,0	58,9	59,2
Germany	..	..	..	..	..	..	60,2	60,7
Greece	64,6	64,3	63,0	65,1	60,9	60,8	62,4	61,2
Hungary	67,6	62,7	61,7	59,4	59,0	57,6	55,8	57,3
Ireland	74,6	72,8	70,0	67,5	63,8	64,5	66,0	64,7
Italy	62,1	61,5	61,8	61,8	59,3	57,6	58,8	60,9
Luxembourg	63,2	65,5	64,0	60,9	60,1	58,5	60,3	61,3
Netherlands	66,7	65,1	64,1	61,6	58,8	60,1	58,7	60,5
Poland	72,2	67,7	65,1	63,4	63,3	61,4	59,1	58,0
Portugal	72,2	69,2	67,7	67,0	64,2	62,3	62,4	65,9
Slovak Republic	..	..	..	..	..	..	55,9	55,5
Spain	71,9	72,4	66,6	63,1	64,9	63,0	61,9	63,4
Sweden	66,7	65,2	64,0	63,0	62,6	61,7	62,5	62,5
United Kingdom	65,7	64,6	62,6	60,8	60,7	60,7	60,9	61,4

Source: OECD estimates based on the results of national labor force surveys, the European Union Labor Force Survey and, for earlier years in some countries, national censuses.

The overall approach of the EU in the aging strategies is to increase the working life, decrease the incentives to retire earlier, and facilitate later retirement (European Commission, 2006). Many countries plan to increase the normal retirement age further (for example, Germany plans to increase the normal pension eligibility from 65 to 67 years until 2012). Many EU countries try to reward workers who entered retirement after the official retirement age. For example, in the Czech Republic for each 90 days of working after the official retirement age the accrual rate increases by 1,5%, up to annual increase of 8% (European Commission, 2006). Another way to increase older age working participation is to abolish the early retirement or to punish the early retirees. For example, in Slovakia the pension will decrease by 0,5% for each 30 days that the workers enter retirement before the official retirement age (European Commission, 2006).

To avoid the possible early retirement, the member states should implement the all life learning strategies according to the recommendations of the European Commission (European

Commission, 2006). All life learning strategies should give possibility to change the professional qualification to be able to find a job in the labor market. Another way to increase the economic activity of the older workers is to make the pension system flexible enough to allow the retired people to work. A good example of this occurs in Sweden, where is possible for a retiree to continue working and take a partial wage of 25%, 50%, or 75%. Other countries that have made their pension systems more flexible are Spain, Finland, and Luxemburg (European Commission, 2006).

2.C. Economic Indicators of Pension Entitlements

The *gross replacement rate* at average earnings is probably the most familiar indicator for pension analysis (Whitehouse, 2007). The replacement rate expresses the pension entitlements as a share of the lifetime-average earnings. Thus, it is the best indicator of the insurance role of the pension system because it depicts how the pension systems maintain the living standard after retirement. In other words, the replacement rate is often used as an indicator of generosity of the pension system (Pallacios and Pallares-Miralles, 2000).

The gross replacement rate is 58,2% of average earnings for the EU overall, but there is a huge variation of the gross replacement rates across the EU countries. The highest replacement rate is in Luxembourg, where it exceeds 100% of average earnings. The gross replacement rate exceeds 75% of average earnings in Austria, Greece, Hungary, Italy, and Spain. Pensioners in Estonia, France, Latvia, Lithuania, Netherlands, Poland, Portugal, and Sweden receive more than half of their average earnings. In other member states, the gross replacement rate at average earnings is below 50%. The lowest gross replacement rate is in Ireland (only 30,6%). This fact is explained by the absence of any second tier insurance pension system in Ireland.

Table 9contains the gross replacement rate for low earners (those with earnings 50% below average) and high earners (earnings double the average). The average gross replacement rate in the EU for the low-earning full-career workers is 70,5%. Almost all EU countries have a gross replacement rate for low earnings above 50%. Only the Slovak Republic and Germany have replacement rates for low earnings slightly below 50%. There are two countries with a gross replacement rate for low earnings above 100%: Luxembourg and Portugal. In most countries, the gross replacement rates for low earnings are higher than the gross replacement rate for average earnings. Only in a few countries are these replacement rates on the same level (Austria, Greece, Italy, Poland, and the Slovak Republic).

Table 9: Gross and Net Replacement Rates by Individual Earnings Level for Men, Mandatory Pension Programs, Selected EU Countries, 2002

	Gross replacement rate			Net replacement rate		
	Individual earnings. multiple of average			Individual earnings. multiple of average		
	0.5	*1*	*2*	*0.5*	*1*	*2*
Austria	78,3	78,3	64,3	91,2	93,2	79,3
Belgium	61,6	40,7	26,2	82,7	63,1	42,7
Czech Republic	70,5	44,4	25,4	88,3	58,2	35,3
Denmark	82,4	43,3	23,8	95,6	54,1	35,5
Estonia	58,4	51,6	48,2	59,9	60,9	61,5
Finland	75,9	63,3	63,3	87,3	71,5	123,1
France	84,2	52,9	47,4	98,0	68,8	59,2
Germany	47,3	45,8	37,6	61,7	71,8	67,0
Greece	84,0	84,0	84,0	99,9	99,9	99,9
Hungary	75,4	75,4	75,4	86,6	90,5	92,6
Ireland	61,3	30,6	15,3	63,0	36,6	21,9
Italy	78,8	78,8	78,8	89,3	88,8	89,1
Latvia	63,6	58,2	58,2	89,2	81,8	74,1
Lithuania	69,9	53,4	45,1	81,7	71,3	64,9
Luxembourg	115,5	101,9	95,2	125,0	109,8	104,2
Netherlands	68,7	68,3	68,3	82,5	84,1	83,8
Poland	56,9	56,9	56,9	69,6	69,7	70,5
Portugal	103,1	66,7	65,5	115,9	79,8	86,3
Slovak Republic	48,6	48,6	48,6	58,2	60,2	65,7
Spain	81,2	81,2	76,7	88,7	88,3	83,4
Sweden	87,8	64,8	66,2	90,2	68,2	74,3
United Kingdom	67,4	37,1	22,5	78,4	47,6	29,8
EU average	*70,5*	*58,2*	*51,3*	*82,1*	*70,1*	*66,0*

Source: OECD, 2005

The gross replacement rate for high earnings is on average 51,3% for all EU member states. The replacement rate for high earners is the most generous in Luxembourg, where it reaches 95,2%. The lowest, as could be expected, is in Ireland, which has no earnings related pension scheme. Other countries with replacement rates below 50% are Belgium, the Czech Republic, Denmark, and the United Kingdom. In some countries, the gross replacement rates of high earners and average earners do not differ, as in Finland, Hungary, Italy, Netherlands, the Slovak Republic, and Poland.

The gross replacement rate compares the gross lifetime average earnings with gross pensions, which means that both of these variables are not clean from the taxes and social security contributions. However, among the EU member states, the tax systems and social security contributions vary in large scale, so the gross replacement rates can be misleading. For this reason, the *net replacement rates* are commonly used. The net replacement rate is

calculated as a share of the net pensions relative to the lifetime individual earnings. In many countries, the pensioners are not obliged to pay taxes and social security contributions, and thus the net replacement rates are usually higher than the gross replacement rates. This fact is seen when we compare the EU gross replacement rate for average earnings with the EU net replacement rate for average earnings. This average net rate (70,1%) is about 12% higher than the gross rate (58,2%). The same pattern can be found if we compare the average net and gross replacement rates for low earners (a difference of 11,5%) and high earners (a difference of 15%). The largest differences between the gross and net replacement rate at average earnings are in Germany (26%), Latvia (23,6%), and Belgium (22,4%). In Germany, the large difference is caused by the generous tax treatment of pension income (Whitehouse, 2007). The large difference in Belgium has its reasons the strongly progressive tax system, high direct tax burden, and the relatively low gross replacement rate. The lowest difference between gross and net replacement rate are in Sweden (3,4%), Ireland (6,0%), and Spain (7,1%).

Another economic variable used to describe pension entitlements is *pension wealth.* Pension wealth is discounted stream of pension payments during retirement, weighted by the probability that he will still be alive at the particular age. This indicator takes into account all future pensions to which a retiree is entitled. That means that the pension wealth depends on the amount of payments as well as on the length of the payments, and thus on the retirement age and the life expectancy at the age of retirement. For this indicator, how the pensions are adjusted for inflation or an increase of earnings is also important (OECD, 2005). Table 10 presents the gross and net present value of pension entitlements for some of the EU countries. From the table 10 is clear that the net pension wealth reach higher values than the gross pension wealth for all presented EU countries. The indicators of net pension wealth were highest in Luxembourg, Hungary, Austria, and Greece.

Table 10: Pension wealth, selected EU countries, 2002

Pension wealth: present value of pension entitlement, multiple of economy-wide earnings		
	Worker on average earnings	
	Gross	*Net*
Austria	11,9	14,2
Belgium	7,3	11,3
Czech Rep.	5,8	9,6
Denmark	7,4	7,8
Finland	10,0	11,2
France	9,5	11,7
Germany	8,3	13,0
Greece	12,6	15,0
Hungary	12,2	14,6
Ireland	5,4	6,5
Italy	11,4	12,8
Luxembourg	18,3	19,7
Netherlands	10,3	12,7
Poland	7,9	9,7
Portugal	10,2	12,2
Slovak Rep.	8,0	9,9
Spain	12,2	13,2
Sweden	10,4	10,9
United Kingdom	5,5	7,1

Source: OECD, 2005

Not easily comparable indicator of financing of public pensions is the *contribution rate*. A difficulty in comparison stems from the fact that the coverage of the contribution differs substantially across countries. In some countries (as Belgium, Spain, Ireland Portugal, Slovenia and the United Kingdom) do not exist particular contributions aimed only to pensions but the accumulated contributions finance all together pensions, early retirement, disability benefits or survivor benefits (European Commission, 2007). In many countries, additional financing of pensions is ensured from general tax revenues. An overview of the contribution rates according to their benefit coverage is depicted in table 11.

For the value of pension benefits is very important indexation rule that determines the growth of post-retirement pensions. The pensions are indexed according to price growth or wage growth. The indexation rules are legally binding in all countries except Ireland and Lithuania where the pension benefits are adjusted annually according to budget decision. In most of the EU countries, the pensions are indexed to price growth but some kind of discretionary indexation can occur regarding budget situation (for example in Belgium, Sweden, Finland or the United Kingdom). Also the minimum and earnings related pension can be indexed differently. Earnings related pensions are usually indexed by mixture of wage

growth and price growth. However, Luxemburg and Slovenia are fully indexed to wage growth.

Table 11: Contribution rates according to their benefit coverage, selected EU countries, 2005

	Old age and early retirement (survivors)	Old age and early retirement, disability (survivors)	Broader coverage	Tax financing
Austria		22,8%		2,6% of GDP
Belgium			37,94%	1/3 of total soc. sec. financing
Czech Republic		28%		
Estonia		22%		6% of soc.sec. pensions
Denmark				Fully financed by taxes
Finland		23,9-28,2%		1,7% of GDP
France	16,35%			Means-tested minimum pensions
Germany		19,5%		27,5% of total pension expenditure
Greece		20%		1% of GDP
Hungary	26,5%			2,4% of GDP
Ireland			12,5 – 14,75%	Non-contributory benefits by taxes
Italy		32,7%		Social assistance pensions by taxes
Latvia	20%			6,2% of GDP
Lithuania		26%		Special pensions by general taxes
Luxembourg		24%		1/3 of contrib. from taxes + 2,5%
Netherlands		26,2-33%		
Poland		32,52%		3,8% of GDP
Portugal			34,75%	Means-tested minimum pensions
Slovak Republic		24%		
Spain			28,3%	Means-tested minimum pensions
Sweden	20,2%			Means-tested, disability and survivors pensions
United Kingdom			19,85%	Means-tested pension credits

Source: European Commission, 2007

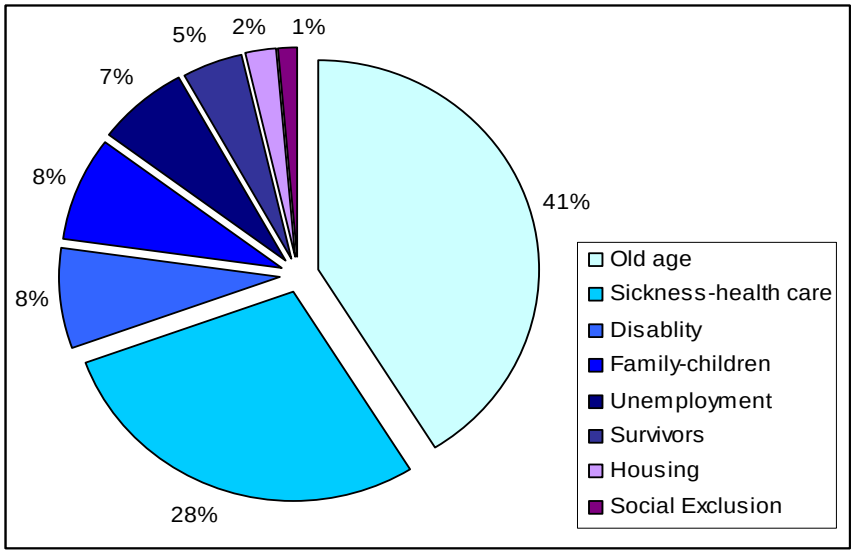
The previous analysis of the economic indicators of pension entitlements is not full-range. Of course, other economic indicators can be used to compare pension systems across countries.

2.D. Expenditures on the Public Pension System

The social systems are well developed in all EU member states. Their main objective should be to protect the poorest in society. The social systems differ across countries as well as the expenditures that are available from public sources for social protection. The social security system should protect people against the risk of unemployment, ill health, parental problems, old age inabilities, disabilities, housing problems, and other exclusion from society. The expenditures for different types of social protection vary among countries, but there are some significant patterns common for all.

Figure 12 shows the division of expenditures in the EU in 2003. The highest share (41%) from total social expenditure is devoted to the protection of old age population. Expenditures on the elderly consist of the normal old age pensions, early retirement pensions, and administrative costs. The second highest share of expenditures (28%) goes to health or sickness protection. Other parts of the social expenditures are depicted on the figure 12.

Figure 12: Expenditure on Social Protection (% share of total benefits), EU-25, 2003



Source: European Communities, 2006

From figure 12, we can see that the expenditures on pensions constitute a big part of total social expenditures. To describe the expenditures on pensions in more detail, we can use another indicator: the public pensions as a share of the Gross Domestic Product (GDP) of the state. Because the aging of the European society will proceed at a greater pace, it is also important to look at the future development of spending on pensions. Because the prediction of future development is very serious for sustainability of public finance, many projections have been made of future spending on pensions. The latest projection for all EU countries was made in 2005 by the Ageing Working Group that was assembled by the European Policy Committee, whose members were assembled from the national experts on this issue

(European Commission, 2006). The commission took into account all accessible macroeconomic indicators and the coming legislative reform of the pension system in many countries. In table 12, are the results from this projection for several EU countries and the EU 25 average.

Pension expenditure as a share of GDP in all 25 EU member states was 10,6% in 2004. Looking at the table in more detail we find out that the expenditures of different EU states varies in great pace. While the lowest public pension expenditures were in 2004 in Ireland (4,7%) and the United Kingdom (6,6%), the highest public pension spending were in Italy (14,2%), Austria (13,4%) or Poland (13,9%). The reasons for low public expenditures in Ireland and the United Kingdom stem from the existence of flat rate pension entitlements and from important role of the occupational pension provision in the whole pension system (Salomäki, 2006). Oppositely, countries with higher public pension expenditure have generally earnings related pension schemes and their pension provisions mostly rely on the social security (Salomäki, 2006).

The public pension as a share of GDP for the whole EU 25 is predicted to increase to 11,9% in 2030 and to 12,8% in 2050. In nearly all countries of the EU, total spending on pensions as a share of GDP is projected to increase until 2050. Only in Austria, Estonia, Latvia, and Poland it is expected that pension expenditures will decrease. The projected decrease in Estonia, Latvia, Lithuania, and Poland stems from the reforms of the pension system that have shifted a large part of their pension entitlements from public pensions to privately funded pensions.

Table 12: Gross Public Pension Expenditures as a Share of GDP, Selected EU Countries, 2004, 2030, 2050

	Public pension as % of GDP			Change		
	2004	2030	2050	2004-30	2030-50	2004-50
Austria	13,4	14	12,2	0,6	-1,7	-1,2
Belgium	10,4	14,7	15,5	4,3	0,8	5,1
Czech Republic	8,5	9,6	14	1,1	4,5	5,6
Denmark	9,5	12,8	12,8	3,3	0	3,3
Estonia	6,7	4,7	4,2	-1,9	-0,5	-2,5
Finland	10,7	14	13,7	3,3	-0,3	3,1
France	12,8	14,3	14,8	1,5	0,5	2
Germany	11,4	12,3	13,1	0,9	0,8	1,7
Hungary	10,4	13,5	17,1	3,1	3,7	6,7
Ireland	4,7	7,9	11,1	3,1	3,2	6,4
Italy	14,2	15	14,7	0,8	-0,4	0,4
Latvia	6,8	5,6	5,6	-1,2	-0,1	-1,2
Lithuania	6,7	7,9	8,6	1,2	0,7	1,8
Luxembourg	10	15	17,4	5	2,4	7,4
Netherlands	7,7	10,7	11,2	2,9	0,6	3,5
Poland	13,9	9,2	8	-4,7	-1,2	-5,9
Portugal	11,1	16	20,8	4,9	4,8	9,7
Slovak Republic	7,2	7,7	9	0,5	1,3	1,8
Spain	8,6	11,8	15,7	3,3	3,9	7,1
Sweden	10,6	11,1	11,2	0,4	0,2	0,6
United Kingdom	6,6	7,9	8,6	1,3	0,7	2
EU 25 average	**10,6**	**11,9**	**12,8**	**1,3**	**0,8**	**2,2**

Source: Economic Policy Committee, 2006

A moderate increase in pension expenditures is anticipated in Italy, Sweden, Germany, France, Finland, Denmark, Slovak Republic, and Lithuania. What is common about these countries is that they all have attempted to reform the pension system. The small increase in pension spending in Sweden and Italy stems from their second tier of the insurance pension scheme. Both of these countries installed the notional accounts, and thus the future pensions will be partly financed by money from accumulated capital on accounts.

In contrast, a major increase in public spending on pensions is projected in Luxembourg, Portugal, Spain, Hungary, and the Czech Republic. In the Czech Republic, the real pension reform is still waiting for its beginning. There was held only parametric reform of the pension system, but the pensions are financed completely on the pay-as-you- go basis that cannot provide any reasonable solution for an aging society.

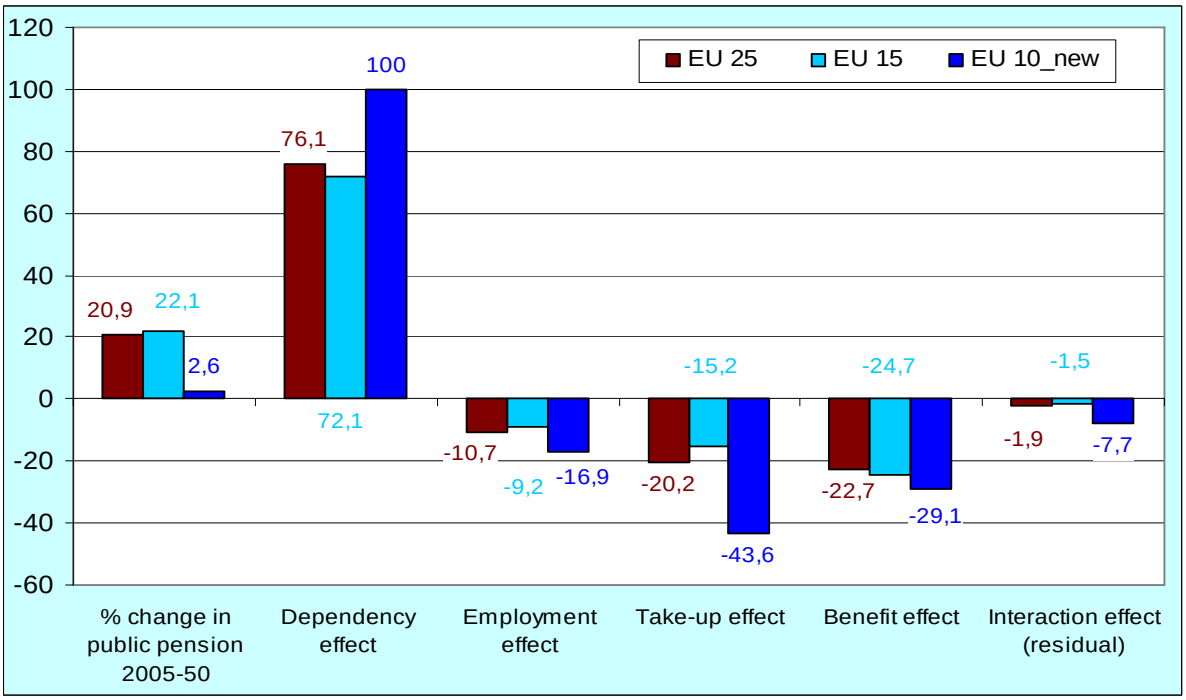
Salomäki (2006) distinguishes four main factors that drive the pension expenditures up. To clarify the decomposition of the increase of the public expenditures we can use following equation:

$$\frac{PensExp}{GDP} = \underbrace{\frac{Pop65+}{Pop(15-64)}}_{\substack{dependency \\ effect}} * \underbrace{\frac{Pop(15-64)}{EmplNo}}_{\substack{employment \\ efect}} * \underbrace{\frac{PensNo}{Pop65+}}_{\substack{pension \\ take-up \\ efect}} * \underbrace{\frac{PensExp/PensNo}{GDP/EmplNo}}_{\substack{benefit \\ efect}}$$

The dependency effect measures the change of the dependency ratio over specific period (2005-2050). The employment effect measures the changes in the share of the population of working age (15-64) relative to the number of the employed. In other words, the employment affect can be interchanged with the inverse employment rate. The take-up effect is in the literature known also as the eligibility effect and it measures changes in the share of pensioners relative to the population older than 65 years. The benefit effect measures the changes in the average pension relative to output per employed person (that is approximation for the average wage). The benefit ratio is not equivalent to the replacement rate because it does not capture the relation between individual earnings and individual retirement. However, the benefit ratio reveals many interesting features. It shows the possible increase in the average pension due to indexation or due to the increase in contribution period as well as it captures the effect of increase in the labor productivity on the increase of the average wage.

The figure 13 shows the percentage change in the total public pension between years 2005 and 2050 decomposed to four various factors for whole EU 25, for the earlier accessed EU countries (EU 15), and for the new members of the EU (EU 10). We can see that the public pension for the whole EU 25 is supposed to increase about 20,9 % until 2050. While the public spending on pension should rise on average only by 2,6% in the new accessed countries, the average increase of the public pension in the earlier accessed EU countries should come to 22,1%. Further, from the figure 13 is clear that the old-age dependency ratio has the highest contribution to the increase of the public pension spending in the EU 15 as well as in the EU 10. If there were no other factors driving the total public pension, then the dependency effect alone would raise the public expenditure on average by 76,1% in the EU 25, by 72,1% in the EU 15, and by 100% in the EU 10_new. Other parts of decomposed effects (employment effect, take-up effect, and benefit effect) are supposed to offset partially the demographic pressure. For the EU 15 seems to be the highest offsetting effect decrease in the benefit ratio and for the EU 10_new is the offsetting effect driven by decline in the take-up ratio.

Figure 13: The contribution of different factors to the total change in the public pension expenditures between 2005 and 2050, EU 25, EU 15, and EU 10_new



Source: Salomaki, 2006

The projected size of different decomposed factors of the public pensions varies from country to country and depends on the current conditions in the labor market, on the future demographic development, on the possible reforms of the labor market or of the pension system. To provide more detailed overview on this, table 13 depicts the list of the decomposed factors contributing to the change in public pension for some of the European Union countries.

As was previously mentioned the aging of population would have the largest negative affect on the public pension spending. The increase of the dependency ratio would double the pension expenditure between years 2005 and 2050 in the Czech Republic, Ireland, Poland, Slovak Republic, and Spain (Salomäki, 2006). From table 13 can be seen that the employment effect has positive impact on the public pension expenditure in all of the listed countries. It means that it is expected the employment rate to increase in all EU countries. However, we can find significant differences in the magnitude of employment rate increase. According to Salomäki (2006), we can expect the largest increase in the countries with currently low employment and high unemployment as are, for example, Poland, Spain, Slovakia or Lithuania.

Table 13: The decomposition of the change in public pension expenditure between 2005 and 2050, EU 25

	% change in public pension 2005-50	Decomposition				
		Dependency effect	Employment effect	Take-up effect	Benefit effect	Interaction effect (residual)
Austria	-7,5	84,5	-10,1	-43,3	-32,2	-6,4
Belgium	49,7	61,6	-8,2	-2,4	-8,1	6,9
Czech Republic	65,9	109,3	-3,6	-36,8	-9,1	6,1
Denmark	33,3	65,1	-3,7	-24,1	-4,6	0,6
Estonia	-41,1	60,3	-7,7	-26,8	-73,1	5,8
Finland	32,0	72,9	-7,7	-25,2	-6,0	-1,9
France	15,4	63,6	-7,0	-12,9	-25,7	-2,7
Germany	17,4	65,8	-10,3	-5,6	-29,6	-2,8
Hungary	60,1	79,4	-10,3	-33,4	16,3	8,1
Ireland	141,9	107,0	-9,9	-20,7	19,5	46,0
Italy	2,8	78,5	-13,8	-21,4	-35,3	-5,1
Latvia	28,5	72,1	-16,0	-27,3	0,1	-0,4
Lithuania	-13,4	62,7	-11,1	-20,6	-40,7	-3,7
Luxembourg	73,7	56,3	-31,1	16,2	16,8	15,6
Netherlands	51,4	71,9	-2,1	-19,3	-4,3	5,1
Poland	-41,7	108,3	-26,7	-54,5	-68,0	-0,8
Portugal	80,3	88,5	-0,9	-3,9	-20,1	16,6
Slovak Republic	20,3	122,0	-19,0	-34,0	-40,6	-8,2
Spain	81,4	105,0	-19,7	-17,5	-1,3	14,9
Sweden	8,5	45,6	-6,2	-2,0	-26,7	-2,2
United Kingdom	28,3	64,2	-1,8	n,a,	n,a,	n,a,
EU 25	**20,9**	**76,1**	**-10,7**	**-20,2**	**-22,7**	**-1,9**

Source: Salomäki, 2006

The take-up ratio is nowadays on the very high level (mainly in the new accessed EU countries) because almost all people over age 65 years are pensioners (Salomäki, 2006). Nevertheless, the projection predicts decline in the take-up ratio in all EU countries cited in table 13. Decline in the take-up ratio can be put in practice by increase of the effective retirement age and by reduction of people who takes pension benefits even before they are statutory eligible for it. The projection predicts decrease in the take-up ratio about 20 persons for the EU 15 (from 144 to 124 pensioners relative to 100 persons with age over 65 years) and about 70 persons for the EU 10_new (from 199 to 125 pensioners relative to 100 persons with age over 65 years) (Salomäki, 2006).

The benefit ratio effect is the most complex decomposed factor. It states the average pension relative to output per worker, and thus it is influenced by many factors as the indexation rules of pensions, the initial level of pensions, by the entitlement rules, the life expectancy adjustment, the timing and the specific form of pension reforms, the labor market

productivity, the composition of pensioners as well as workers (Salomäki, 2006). Generally, we can see from table 12 that the benefit ratio effect reaches negative values nearly for all countries with exception of Ireland, Luxembourg, and Hungary. In these three countries, the benefit ratio effect should increase the public pension spending. The main reason for this negative effect on the public pension comes from the maturation of the pension system (Salomäki, 2006). In contradiction, decline in the public pension expenditure is predicted to be on average 24% in the EU 15 and 30% in the EU 10 between years 2005 and 2050. The relative decrease of the public pension due to the benefit ratio effects most often comes from the change of pension indexation from wage indexation to price indexation (as in Italy, France, or Austria), from the switch of the public pension system partially to the private pension system (as in most of the EU 10), and from linking the pension benefits more tightly with the life expectancy (Sweden, Lithuania, Poland, Italy, Finland and France) (Salomäki, 2006).

The prediction of the development of the public pension spending is really complicated and it depends on many factors. However, it is clear that making the public finance sustainable in light of the coming demographic challenges in the EU member states requires substantial efforts to change the public pension systems into the form that will be acceptable for almost countries, will not leave old people in poverty, and will ensure living standards for pensioners that are as high as possible. The further discussion about pension reform is present in chapter 3.

Chapter 3. Pension reform, possibilities and evaluation

From the discussion in previous chapters is clear that the pension systems are not financially sustainable and the collapse of the public finance can come in several decades. Therefore, this chapter will go over main options how the pension systems can be reformed. However, firstly the introduction of two basic types of financing the pension system with appropriate comparison should serve for better understanding of discussion about possible pension reforms.

3.A. Basic possibilities of financing the pension system and their comparison

It is not easy to make appropriate taxonomy of pension systems and as was highlighted before, there exist many various typologies of pension systems. One way how to sort the pension system is according to the means of financing the pension benefits. Generally, we can differentiate the pension system according to its financing on the PAYG (pay-as-you-go) and funded system. Naturally, we can find other means of financing the pension system but those are derived from PAYG and funded system. It is worthy to add that the way of financing the pension benefits does not determine if the pension systems are privately-managed or publicly-managed. However, mostly holds that the public pension schemes are financed on the PAYG basis and the privately-managed pension schemes are financed by funds (Bezděk, 2000).

3.A.1. PAYG system

The PAYG systems were introduced with the beginning of the formal public pension systems. We can characterize the PAYG system as system where the pension benefits are paid from contribution of current workers and the pension benefits of current workers are expected to be paid by the following generation.

The PAYG systems are based on the intergenerational solidarity and intragenerational solidarity. The intergenerational solidarity shall contribute to social justice if the development of the population is stable and stationary (Bezděk, 2000). However, if the demographic development is not stable then the PAYG can lead to the excess redistribution from young generations to old generations. In the light of population aging, the young generation has to contribute more to the system to sustain the old generation on the suitable living standard. The intragenerational solidarity of the PAYG system means the redistribution of financial assets between the members of the same generation. As was mentioned in the description of the

pension systems, the second tier of the pension systems in the EU countries can be flat rate as well as earnings related. Some of the pension schemes are installed to encourage rather low-earnings workers who must not have enough financial assets to make sufficient savings for their retirement. In this sense the pension systems financed according to PAYG seem to be progressive (redistribute money from rich to poor). On the other hand, those pension systems can appear as regressive at the same time. There exist findings that the correlation between the life expectancy and the level of the life-earnings is positive (for example, Holzmann, 1997) but the PAYG systems do not consider this relationship at all. And thus in this sense, the PAYG systems can prefer the high-income workers to low-income workers.

Disadvantages of the PAYG

The problem connected with the redistribution (either intergenerational or intragenerational) stems from weak link between the contributions and the benefits that is often common in the benefit formula of the PAYG systems. The excessive contributions that must be paid by working age population can have distorted effects on the labor market. The workers can take the contributions as direct tax from their wages, and thus the supply of labor can substantially decrease (Holzmann, 1997). The movement from the official to the shadow labor market can be consequently expected as well. There were made simulations about the effects of the PAYG on the labor market disincentives and their consequences on the economic growth. For example, James (1997) estimates that the payroll taxes on the level of 15% will decrease the official labor supply by 30% in maximum and this will project to decrease of the economic growth about 1% per year.

Another effect of the PAYG system on the labor supply comes from low encouragement of older workers to work longer or even to participate on the labor market until the official retirement age. The formulas for calculating the pension benefits very often do not discourage early retirements. More about this effect was described in the part 2.B of this thesis.

Important characteristic of the pension systems is how they impact the intensity of national savings that contains either the public savings or the private savings. The PAYG systems have negative impact on both types of the savings (Bezděk, 2000). The public savings tends to be in deficits due to the population aging, too generous benefits from PAYG systems (often populistic behavior of politicians), and weak connection of contributions and benefits in the PAYG systems. Interesting is the possible impact of the public PAYG system on the private savings. According to some studies (for example, Mackenzie, Gerson, and Cuevas, 1997) the public PAYG system can drive out the voluntary private savings but not

completely. However, we can find some studies that do not confirm this fact (Bezděk, 2000). The public PAYG system can have positive impact on the private savings in case that the system is not too generous and thus the future retirees save their own finances to forgo a great difference in the living standard between the period when they were working and the retirement period. Similar situation can occur when workers realize that the PAYG system will not be able to fulfill its promise to pay sufficient benefits, and then workers will make their own savings.

Implicit debt

The most burdensome problem of the PAYG system is connected with the financial sustainability of the public pension programs. In the light of population aging, the PAYG systems in present form in many countries do not seem to be sustainable in the long term. Most of the PAYG systems create the implicit debt (Bezděk, 2000). The implicit debt comes from the fact that the pension systems promise higher benefits to future retirees than they are able to really pay. Thus, the implicit debt can be expressed as the difference between the present value of the future contributions to the system and the present value of the future obligation of the system. The implicit debt is usually expressed as percentage of GDP and it is estimated to reach substantial level. In most EU countries, the implicit debt is two or three times greater than the explicit national debt (OECD, 1998).

The PAYG pensions are often compared to government bonds because they promise to pay certain amounts at certain times in the future (Holzmann, Palacios and Zvinien, 2004). However, this comparison is not precise from several reasons. Firstly, the workers have to enter to the system mandatory. It is not up to them if they want to buy the promises or not, the payroll taxes are deducted from their earnings in compulsory public pension system. In contrast to this, the government bonds are traded voluntarily. Secondly, the value of the government bonds is known at least at its nominal yields. However, the value of the PAYG benefits is not known to workers because it depends on the benefit formula that can be changed by government in any time. In this sense, the PAYG benefits are more flexible and the government can reduce the value of pension liabilities any time when the political and social environments provide good background.

The importance of the estimation of the implicit debt comes from several reasons that are or are not connected with pension reform. The reasons, which are not related to the pension reform, are connected with the government policy options and macroeconomic analysis (Holzmann, Palacios and Zvinien, 2004). Knowing the approximate level of the implicit debt of the PAYG pension system is important for determining the intertemporal

budget constraint of the government as well as for determining the decisions about individual consumption and savings. The information about implicit debt is important in the initiating as well as in the assessing of the pension reform. To inform public about the size of the implicit debt can help to convince people about the need of pension reform. If the pension reform takes form of movement from the PAYG system to partially or fully funded pension system then the implicit debt happen to be explicit. This debt is usually financed by government obligation. After this kind of pension reform, it is necessary to evaluate the financial success of the reform that can be done among other by estimating the joint and rolling implicit debt (Holzmann, Palacios and Zvinien, 2004).

After presenting necessary reasons for determining the level of implicit debt we have to confess that the estimation and the comparison of the implicit debt are not straightforward. We can find many estimates of the implicit debt based on different definitions of the implicit debt and different methods of calculation. Moreover, the implicit debt is not connected only with PAYG defined benefit pension scheme but also with guarantees for voluntary and mandatory private pension schemes (Holzmann, Palacios and Zvinien, 2004). The implicit debt of the PAYG unfunded pension system can be in other words called as the stock of the commitments to pension future outlays that can be defined in three basic ways (Holzmann, Palacios and Zvinien, 2004).

1. Accrued-to-date liabilities - These liabilities are defined as the present value of pensions that will be paid in the future based on the accrued rights. The size of the accrued-to-date liabilities depends on the specification of benefits and eligibility criteria of PAYG schemes. Namely, it depends on the assumptions about the real interest rate, real wage growth, inflation rate, and survival probabilities (Holzmann, 1998). However, the information about the size of the accrued-to-date liabilities does not bring any information about the sustainability of the pension system (Holzmann, 1998). This definition of the implicit debt is the best for calculating the explicit debt that will emerge during transformation of the unfunded pension system to funded pension scheme.
2. Projected liabilities of current workers and pensioners net liabilities - They contain both the future contributions of existing members and their new rights under current rules. This type of liabilities assumes that the pension schemes finish with the death of the last member of this system.
3. Open-system net liabilities – They are defined as present value of contributions and pensions of new workers under current conditions. This definition serves

best for determining the inter-temporal budget constraint and can approximate the financial sustainability of the pension scheme.

To sum it up, we can find many estimates and international comparison of the implicit pension debt regarding to applied methodology (for example, Van den Noord and Herd, 1993; Chand and Jaeger, 1996; Frederiksen, 2001). Clearly different estimations vary a lot from each other. For example, Van den Noord and Hard (1993) presented the implicit debt for France on the level of 216% of GDP which is much lower than estimation of the implicit debt from Chand and Jaeger (1996) that reaches for France 265% of GDP (Uebelmesser, 2004). Very interesting contribution brought Holzmann (1998) who showed that the implicit debt could be estimated as multiplication of the pension expenditure by factor 20-30. However, this estimation does not take into account possible factors that have immediate impact on the implicit debt while the impact on the public pension spending can come out only after several periods.

The estimation of the accrued-to-date liabilities for EU 15 together with the likely development was presented by Mc Morrow and Roeger (2002). They estimated an implicit burden of the PAYG system for all EU 15 in 2000 to be on the level of 180% of GDP. Furthermore, they tried to forecast the development of the implicit debt until 2050 under the unchanged conditions. The prediction of the implicit debt in 2050 reaches 280% of GDP. Very interesting results come from their sensitivity analysis of the implicit debt. For example, an increase of the eligibility age to 65 years until 2050 implies decrease in the implicit debt about 23% compared to its level in 2000. The reduction in generosity by 40% caused by the move from the wage indexation to price indexation would decrease the implicit debt by 31% compared to the level of implicit debt in 2000.

To sum it up, all of the estimations, regardless applied methodology, predict the implicit pension debt to be very large in the most of the European countries (Holzmann, Palacios and Zvinien, 2004). This means danger for the public finance and reduction of the success of the systemic pension reform that lean on transformation of the PAYG system to the funded pension system. Possible ways how to cope with the explicit debt incurred from the implicit debt of the PAYG system are listed in chapter 3.B.2

Advantages of PAYG

After summing up all main drawbacks of the PAYG, it is necessary to provide some justification for using the PAYG system as one of the most spread type of pension schemes.

The PAYG system is relatively secure system for retirees from several reasons. Firstly, the PAYG promises seem to be kept or lowered only by acceptable amount in most of

the countries. In this sense, the funds must not be as secure as PAYG promises. The low returns on pension funds occurred in the advanced retirees' age can inevitably harm the pensioners by low and inadequate retirement income (Ferreira do Amaral, 2007). Secondly, the PAYG benefits can better cope with unexpected inflation (Ferreira do Amaral, 2007). The government can intervene on behalf of the pensioners and it can increase (regularly or one-time) the pension benefits considering the price inflation. Thirdly, the PAYG system allows a full pension to be paid immediately (Ferreira do Amaral, 2007).

The basic principle of the PAYG pension scheme is the intergenerational and intragenerational solidarity. Thus, this kind of pension scheme allows pensioners to share in post-retirement economic growth. In addition, the PAYG system is said to ensure greater equality among pensioners rather than funded pension system that can be well-disposed to richer who can more easily choose higher yielding investments in funded system (Ferreira do Amaral, 2007)

3.A.2. FUNDED system

The funded pension system is not based on the intergenerational solidarity. The level of benefits depends only on the individual contributions over the whole working life and on the long term rate of returns of the pension funds (Bezděk, 2000). The individuals pay the contributions that are invested in capital market and after that used for financing the benefits in the retirement ages.

This system is beneficial for many reasons. Firstly, it internalizes the costs connected with the early retirement. The retirement benefits are appropriately lowered according to the specific benefit formula, and thus there does not arise any negative externality connected with early retirement. Secondly, the funded system decreases the risk of an emergence of the shadow economy while it strictly connects the contributions and benefits of the pension system. Therefore, workers do not essentially perceive the contributions to the system as an additional tax. From this point of view, the funded system does not cause any distortions on the labor market. Mainly, it should not discourage workers incentives to work while the system does not demand the excessive taxes.

Considering the consequences of the pension system on the public and private savings is important aspect as was suggested in the discussion about PAYG system. The funded pension system usually arises from the privatization of the pension systems. The privatization of pension system has no consequences on the national savings (Bezděk, 2000). This statement is the result of two occurrences. From the economic theory is known that the

national savings are sum of the public and private savings. After privatization of the pension system the private savings increases due to the mandatory savings in funds. This increase is compensated by the decrease of the public savings that will occur in the form of the transition costs of the privatization of the pension system. The deficits of the old pension systems can be transferred into the public debt. In this case, the privatization of the pension system does not have any consequences on the national savings as a whole. However, if the deficits of the old pension systems are financed by fiscal consolidation, then the national savings can increase significantly (Bezděk, 2000). The fiscal consolidation can be handled by the reduction in expenditures or by the increase in taxes. We can say that the level of national savings depends more on the fiscal consolidation than only on the transformation of pension system from the PAYG to the funded scheme. The other point that is important for the level of saving in the funded pension scheme is the displacement effect of the mandatory pension savings on other voluntary private savings (Bezděk, 2000). If the displacement effect was fully in work then there would be no change in the level of private savings and the only modification would be the change in the structure of the private savings (movement from voluntary private savings to mandatory private savings into the pension funds). However, it is estimated that the displacement effect does not fully occur (Bezděk, 2000).

Disadvantages of FUNDED system

The most often mentioned disadvantage of the funded pension system is the problem with financing the transition costs (Bezděk, 2000). A transition from an unfunded to a funded pension system changes the implicit debt into the explicit debt. After transition to the funded pension system current workers stop paying their contribution to the PAYG system from which the current pension benefits should be paid out. The pension benefits to retirees can not be abolished, and thus the deficits in the PAYG system occur. Moreover, the governments want at least partially compensate the generation of workers who has contributed for the most of their working life into the PAYG system but who are not yet in pension ages. Several details about costs of transition, possible ways of decreasing these costs, and means of paying them are listed in chapter 3.B.2

Even though the funded pension systems are usually managed privately, the government regulation plays still very significant role. The regulatory framework of the privately-managed pension scheme includes the presence of supervision, control authorities, legal basis, administrative rules of management, and rules concerning insolvency (European Commission, 2006). In all EU member states, specific supervision agencies were created to monitor the financial situation of the schemes and to deal with the insolvency of the funds

(European Commission, 2006). The information about private pension schemes is very important for better understanding of current and possible future members. All countries agree that regulation of the privately managed schemes is needed but must be in a balanced way, so as not to be very costly. The regulation framework differs from country to country and we can find two basic approaches (Vittas, 1998). The first one is called draconian approach. This approach should be in power in countries that do not have well-developed capital markets and do not have long experience with the employment pension funds (Vittas, 1998). The second approach is called prudent system. This system is more released in comparison to draconian system and it is supposed to be implemented in countries that are used to employment pension funds and that have developed capital market (Vittas, 1998).

Often criticize feature of the funded pension system are high administrative costs that increase the expenses for the pension contributions. This fact is significant mainly for low-income workers because their contributions make up in absolute value low part of the funds, and thus high fixed administrative costs could discourage those workers to save in funds (Bezděk, 2000). Therefore, in all countries, the policymakers try to find out a way in which the administrative costs could be decreased. For example, in Denmark the low-income workers, whose earnings are below certain limit, do not pay some of the mandatory contributions. In Mexico was introduced financial support to encourage the savings in pension funds (Bezděk, 2000). To avoid high marketing costs some countries limit the number of transition from one fund to another.

Advantages of FUNDED system

According to the OLG model, the transition of the pension systems from PAYG into the funded pension system should support higher economic growth, higher level of investment, and higher increase of the real wages (Bezděk, 2000). Moreover, the privatization of the pension systems can contribute to removal of distortion on the labor market. The positive impact of the transition to the funded pension system was in reality acknowledged by Holzmann (1997) who has showed that the rise of the economic growth in Chile in 1980s and in the first half of the 1990s was caused by the privatization of the pension system.

Furthermore, the evolution and development of the pension funds can have very positive impact on the development of capital market. This statement is based on the fact that canceling of the PAYG system and the foundation of the funds will create new market for financial investments. This was verified, for example, by pension in Chile (Bezděk, 2000).

3.A.3. Comparison of PAYG and FUNDED system

After introducing main features (advantages and disadvantages) of the PAYG and funded pension system, we can continue by comparison of these two pension system from the point of view concerning different kinds of the risks and the internal rate of return.

Internal rate of return

To compare the internal rate of return of an unfunded PAYG and a funded pension scheme we can use the simple two period overlapping generation model (OLG) where we assume labor supply to be completely inelastic (Uebelmesser, 2004). This model is based on the model of Samuelson (1958) and Aaron (1966).

We assume three generation and each generation lives for two period. The first period the young people work, get wages (denoted by *w*) and pay contributions (denoted by τ) that are in the second period transformed to pension benefits (denoted by *b*) and paid back to old people who do not work any more. So we assume that each time period t there exist young generation born in period t (N_t^Y) and one old generation born in period (t-1) (N_{t-1}^O). We assume that everybody dies only at the end of the second period that can be depicted as $N_{t-1}^Y = N_t^O$ {Equation 1.1}. Table 13 depicts the system of three generations that is considered in this model.

Table 14: The flow of generations in the simple OLG model

	Period t-1	Period t	Period t+1	Period t+2
Generation born in period t-1	N_{t-1}^Y	N_t^O		
Generation born in period t		N_t^Y	N_{t+1}^O	
Generation born in period t+1			N_{t+1}^Y	N_{t+2}^O

We assume that everybody wants to consume in both periods of his life so we denote the utility function of individual born in period t as $U_t(c_t^Y, c_{t+1}^O)$. The utilities of other generations are constructed in the same way. The utility function is assumed to be well-behaved (strictly monotone and quasi-concave ordinal utility function).

The budget constraint for first period of individual born in period t can be expressed as following: $c_t^Y + s_t = w_t(1-\tau_t)$ {Equation 1.2}. The left-hand side of this equation denotes the consumption of young individual c_t^Y and his savings s_t at capital market in period t. The

right-hand side of this equation contains the net wage income $w_t(1-\tau_t)$ in period t (wage decreased by the contribution rate).

The budget constraint for the second period of individual born in period t can be expressed as following: $c_{t+1}^O = b_{t+1} + (1+r_t)s_t$ {Equation 1.3}. The left-hand side of this equation contains the consumption c_{t+1}^O made by old individual in period t+1. The right-hand side of this equation expresses the income in period t+1 that consists of the pension benefits b_{t+1} and the saving s_t made in period t that are enriched by the market rate of return r_t form capital market.

Further we will assume that the population growth factor is: $\frac{N_t^Y}{N_t^O} = 1+\eta$, the growth factor of wage is: $\frac{w_{t+1}}{w_t} = 1+\varpi$, the growth factor of contribution is: $\frac{\tau_{t+1}}{\tau_t} = 1+\theta$. The internal rate of return will be denoted as *i* and to determine it we have to explore the funded and unfunded pension system separately based on our assumptions.

a) the internal rate in the PAYG pension scheme

To find out how the internal rate of return is determined in the PAYG scheme we have to realize that within this scheme do not exist any funds and the contributions and benefits must be balance in each period.

Let consider the intergenerational and intragenerational balance in period t. The total contributions in period t are up to the young generation that has N_t^Y individuals. Each individual pays the contribution from his wage $w_t\tau_t$. On the other hand, each old individual gets the pension benefits, thus the total pension benefits at period t are equal to $N_t^O b_t$. The intergenerational balance can be expressed: $N_t^Y w_t\tau_t = N_t^0 b_t$ {Equation 1.4}. From which we can get the pension benefit: $b_t = \frac{N_t^Y}{N_t^0} w_t\tau_t = (1+\eta)w_t\tau_t$ {Equation 1.5}.

To consider the intragenerational balance we have to equalize individual contributions in period t increased by the internal rate of return on the one side and the individual benefits that will be paid in the period t+1 on the other side. The intragenerational balance can be caught as: $w_t\tau_t(1+i_t) = b_{t+1}$ {Equation 1.6}. When we plug the Equation 1.5 into 1.6, we get:

$1+i_{t+1} = \frac{b_{t+1}}{\tau_t w_t} = \frac{\tau_{t+1}}{\tau_t}\frac{w_{t+1}}{w_t}(1+\eta)$ {Equation 1.7}.

Using the growth factor of wage and contribution we can further rewrite the Equation 1.7 as:

$$1+i_{t+1}=\frac{b_{t+1}}{\tau_t w_t}=(1+\theta)(1+\varpi)(1+\eta) \qquad \{\text{Equation 1.8}\}$$

This equation shows that the internal rate of return go up with increase of the population, increase of the wage and also with increase of the contribution rate. However, if we think about long time the continuous increase of the contribution rate is not possible and sustainable, so we can consider the contribution rate to be constant ($\theta=0$) (Uebelmesser, 2004). Assuming this the equation 1.8 changes to: $1+i_{t+1}=(1+\varpi)(1+\eta)=1+\eta+\varpi+\mu\omega$. Because the multiple of the growth rate of population and growth rate of wage is very small, it can be neglected. Thus, the internal rate of return of the funded pension scheme is approximately:

$$i\approx\eta+\varpi \qquad \{\text{Equation 1.9}\}$$

The equation 1.9 is so called Aaron's rule.

b) the internal rate in the funded pension scheme

As was mentioned earlier the funded pension scheme is not based on the intergenerational solidarity, and thus the individual contributions to the system in period t will bring the pension benefits increased by the market rate of return in period t+1. The balance can be expressed:

$$N_t^Y w_t \tau_t (1+r_{t+1})=N_{t+1}^0 b_{t+1} \qquad \{\text{Equation 1.10}\}$$

The left side of this equation shows the total contributions of the young generation in period t that were invested into funds, and thus they bring the returns on the level of the market rate of return. The right side of the equation presents the total benefits in period t+1 for the same generation that has contributed in period t. As was said in our assumptions nobody dies before the end of the second period, therefore $N_t^Y=N_{t+1}^O$. Plugging this into Equation 1.10, we get:

$$b_{t+1}=\frac{N_t^Y}{N_{t+1}^0}w_t\tau_t(1+r_{t+1})=w_t\tau_t(1+r_{t+1}) \quad \{\text{Equation 1.11}\}$$

From this we can easily see that the internal rate of return of the funded pension scheme is equal to the market rate of return. However to be precise we can express this fact as in previous case. The individual contributions should be equal to individual benefits: $w_t\tau_t(1+i_{t+1}^F)=b_{t+1}$. Plugging the Equation 1.11 into this we get:

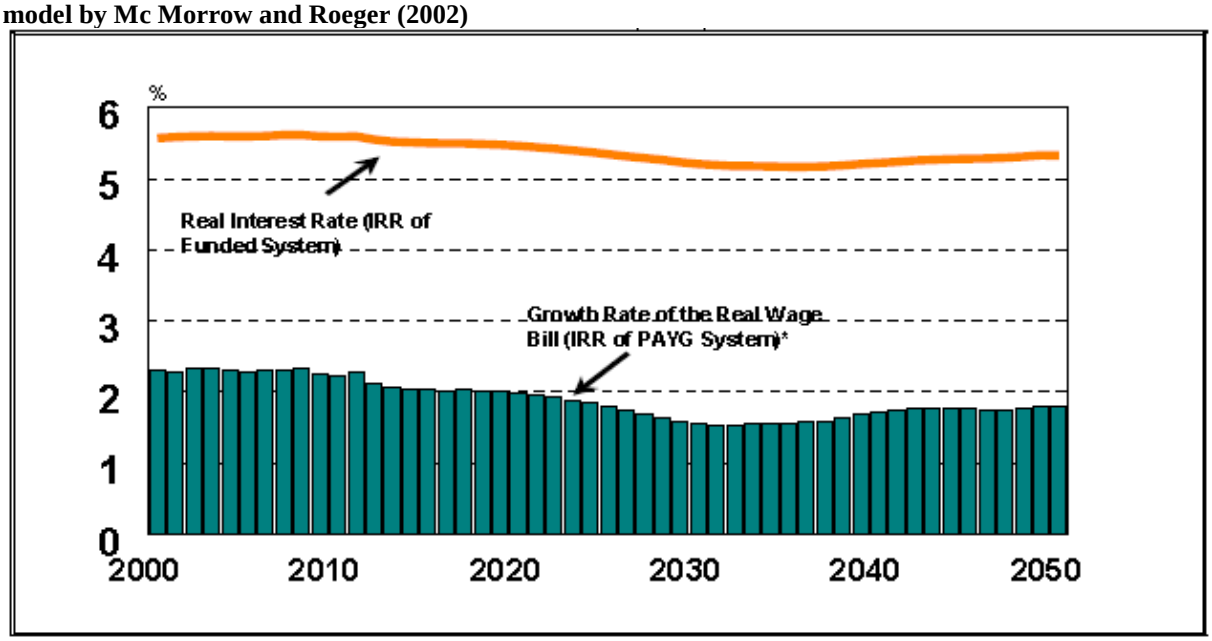
$$(1+i_{t+1}^{F}) = \frac{b_{t+1}}{w_t \tau_t} = \frac{w_t \tau_t (1+r_{t+1})}{w_t \tau_t} = 1 + r_{t+1} \Rightarrow i_{t+1}^{F} = r_{t+1} \qquad \{\text{Equation 1.12}\}$$

c) the comparison of the internal rate of return of the PAYG system and the funded pension system

After specifying the internal rate of return of an unfunded and funded pension system we can determine which from these two systems is more efficient. We need to compare the growth factor of wage plus the growth factor of population (the internal rate of return of the PAYG system) with the market rate of return (the internal rate of return of the funded pension system). The growth factor of wage is very often approximated by the consumption growth. If the internal rate of return of the PAYG system is higher than the internal rate of return of the funded pension system, then the PAYG system is more efficient. However, from the empirical studies follows that once the economy stabilizes then the market rate of return is typically higher than the internal rate of return of the unfunded pension system (Uebelmesser, 2004).

Interesting forecast of the development of the internal rate of return of PAYG and funded pension systems over next 50 years for the EU countries was made by Mc Morrow and Roeger (2002). Their model approximates the internal rate of return of the PAYG pension system by the real wage bill (taxable base) and it expects the average annual growth of wage bill to be equal to 2% between 2000 and 2050. This average growth of wage bill takes into account the aging of population that will cause an increase of capital per worker that will consequently lead to higher labor productivity and to higher real wages (Mc Morrow and Roeger, 2002). To predict the development of the real interest rate, that approximates the internal rate of return of the funded pension scheme, is not so easy because the aging of the population has an ambiguous on capital sensitivity (Mc Morrow and Roeger, 2002). However, the model predicts that the effect of the population aging on the real interest rate should not be very significant (the real interest rate is predicted to decline by only 0,25% between 200 and 2050) because the population aging is driven more by the extension of the life expectancy than by decline of the fertility rate. The forecast of the internal rate of return of PAYG and funded pension system, which follows from the model by Mc Morrow and Roeger (2002), are depicted in figure 14. It is clear that even though the internal rate of return of the funded pension system is predicted to slightly decrease, it will be still about 3%to 3,5% higher than the internal rate of return of the PAYG pension system.

Figure 14: The forecast of the internal rate of return of PAYG and funded pension system, EU countries, model by Mc Morrow and Roeger (2002)



Source: Mc Morrow and Roeger, 2002

Possible risks

Börsch–Supan (1997) distinguishes five different types of risks that are connected with the financing mechanism of PAYG and funded pension system. As was mentioned earlier, both systems are connected with the *demographic risk* (mainly with population aging). The financial sustainability of most PAYG systems is threatened by population aging. The funded pension system is also vulnerable. Decrease in the workforce will cause relative increase in capital (in relation to number of workers) and this can yield to decrease of the rate of return to capital (Bezděk, 2000). However, generally it is considered that the PAYG systems are more vulnerable to demographic risks than funded systems.

The *political risk* means the possibility of change in the pension benefits due to the political decision (Bezděk, 2000). The pension benefits provided by either the PAYG or the funded pension system can be influenced by political power. The danger related to funded pension system stems from the possibility of misusage of the financial resources to other purposes than to pension benefits. The political risk in the PAYG pension system lies in the legislative change in rules for retirement age or pension benefits. If the funds are under strict regulatory framework, then the danger of political risk decreases. From this point of view, the PAYG pension system is more threatened by political risk.

The funded pension system is fully exposed to various risks connected with *capital markets*. Among these risks belong, for example, the risk of fluctuation of the rates of return, the risk of high transaction costs or the risk coming with the inflation of funds that are

nominally expressed. At this point we have to admit that the inflation also has negative impact on the PAYG liabilities. Another risk, that can influence the funded pension system, is related to the possible movement of the exchange rates when the assets from funds are invested internationally. Nevertheless, the international investments work positively because they can spread the capital risks. The risk connected with the capital market is important for analysis of relative rates of return (the absolute rate of return from funds reduced in appropriate way by the capital risks).

The funded pension system can be connected with moral hazard. In this case, the *moral hazard* occurs as market failure of pension annuities. The insurance companies provide annuities based on the estimation of the average life expectancy because they can not predict specific life expectancy for each person. However, some of the individuals can influence their mortality rates by their life style. So people who eat healthy or make enough sport activities can likely live longer. This can bring the problem for insurance companies which can not disclose the specific characteristics of anyone. It can happen that the savings from pension funds (in the form of annuities) are exhausted before death of the retiree which means lost for the insurance company. Contradictory, individuals with lower than average life expectancy do not want to participate on saving for future pension annuities that are based on the average life expectancy because this would mean lower rate of return for them (Bezděk, 2000).

As can be seen, both system of financing of pension system are subject to different kinds of risks that are not completely correlated (Bezděk, 2000). This fact yields to a belief that the ideal pension system should be multi-pillar consisting from the public PAYG pension pillar as well as from the private funded pension pillar (see chapter 3.B.

3.B. The possibilities of the pension reforms

After presenting the reasons for needs of the pension reform in the European Union countries and presenting the main features of two basic possibilities of the pension system, we can go further and introduce the main possibilities how the current pension systems can be reformed. We can find lots of taxonomy of the pension reforms but for our purpose, best serves the taxonomy by Disney (1999b). This taxonomy distinguishes the pension reforms to four categories according to the fact if they preserve an unfunded base or if the emphasize the transition to the funded private component (Disney, 1999b). This section will present the main characteristics of these four categories of the pension reforms, another suggestion for reforms, and it will try to answer the question if an optimal pension reform exists.

3.B.1. Parametric reforms

The name of this reform suggests that the key point of this reform lies on the change of parameters of the unfunded pension system. To understand the characteristics of the parametric pension reform it is useful to define when the PAYG pension system is in equilibrium (Petrides and Dangerfield, 2003):

$$cwL = pB \qquad \{\text{Equation 2.1}\}$$

where: c is the contribution rate

w is the average wage per worker

L is the number of workers

p is the average pension per pensioner

B is the number of pensioner

The equation 2.1 does not bring any surprise. It just says that the pension system is in the equilibrium when the inflows to the system (the total contribution of a whole working population) equals to total outflows from the system (the total pension benefits paid to all pensioners). This equation can be transformed to:

$$c = \frac{B}{L}\frac{p}{w} \qquad \{\text{Equation 2.2}\}$$

Thus the contribution rate of the unfunded pension system equals to multiplication of the inverse support ratio ($\frac{B}{L}$) and the average replacement rate ($\frac{p}{w}$). This equation shows that the contribution rate can be written as a function of few parameters. It follows that if we want to decrease the contribution rate we have several possibilities:

a) Reduce the number of pensioners (B) – In the light of population aging, it is not easy to hold the number of pensioners on the stable level or even decrease it. However, there exists several ways how this could be executed. The first option that comes along is the raise of the official retirement age. This option should insure that the pension benefits would be paid only to people who are too old to work. However, as was mentioned in chapter two the increase of the retirement age can discriminate lower-income workers who have usually lower life expectancy than the average life expectancy is. Moreover, the increase of the eligibility age for pensions is not politically favorable. The other options include an increase of years of the active working life or providing the means testing to change the threshold for the pension eligibility (Schwarz, 2006).

b) Increase the number of workers (L) – Different policies that would close the channels to early retirement or disability benefits can be put in power with aim to increase the number of workers in the population.

c) Decrease the replacement rate ($\frac{p}{w}$) – To decrease the replacement rate means either reducing the generosity of the pension system (decrease pension benefits) or raising the wage bill from which the contributions are taken away. The generosity of the pension system can by lowered, for example, by seldom indexation of the pension benefits to the price growth instead of the indexation to the wage growth (Schwarz, 2006). To index the pensions to wage growth is not available for most of the countries because it would be very costly for the public finance. Another way of decreasing the generosity of pension system is cutting the official minimum pension (Schwarz, 2006). This option is because the older people do not have such a high expenses as people in working age because the retirees usually do not have to pay taxes or do not have so many family members to support (Schwarz, 2006). On the other hand, the public pension system should not let the pensioners in the poverty.

To sum it up, the parametric pension reform is based on the increase of the retirement age or on the reduction of the generosity of the unfunded pension system or on the combination of both. The forecast from Mc Morrow and Roeger (2002) tries to predict how the change in generosity, the increase of the retirement age or reforms of the labor market impacts the economic growth, the budgetary sustainability and the distributional fairness in the EU 15 countries between years 2000 and 2050. However, before presenting their findings attached to parametric pension reform it is necessary to introduce the assumptions of their model together with the outcomes of the model for the baseline scenario. The baseline model shows the impact of aging on the economic growth, budgetary sustainability and the distributional fairness between working population and retirees. The model uses the Eurostat projection from 2000 that was prepared for the Economic Policy Committee (EPC). It assumes the participation rate of labor force to stay until 2050 on the level from 2000, the retirement age to move around 60 years, and the net replacement ratio to be constant over whole period on the level of 74%. Using these assumptions the model brings the following outcomes of the population aging for the EU 15 (compared to situation when no aging is common in the EU 15):

- The level of GDP per capita should decrease about 19% until 2050.

- The public pension expenditure as share of GDP are supposed to increase about 7 percentage points (from 10,5% to 17,6%)
- The contribution rate as a share of wage has to increase about 9 percentage points (from 16,1% to 26,9%) to meet the pension obligations.
- The aging of population should have the same impact on the change of the consumption of working population and pensioners (the consumption decrease by 19,6 and by 19,5 respectively.)

After presenting the impacts of the population aging on the economic growth, budgetary sustainability and the income fairness the authors try to predict similar outcomes but with the assumption that some kind of parametric reform is present. The successful parametric reform should get back the PAYG system into the equilibrium that means the contributions rate, the implicit debt and the public pension expenditure should keep stable over the watched period (2000-2050) (Mc Morrow and Roeger, 2002). How different kinds of parametric reforms change the evolution of tracked economic variables is depicted in table 15.

Table 15: The impact of the parametric reforms on the economic growth, budgetary sustainability and income fairness, Mc Morrow and Roeger (2002)

Change of parameters	GDP per capita	Public pension expenditure (as % of GDP)	Social security contribution (as % of wages)	Consumption of the working age population	Consumption of pensioners
	all variables show the difference from the baseline forecast in 2050				
Partial shift from wage to price indexation	2,1	- 2,7	- 4,2	6,4	- 7,4
Increase in the retirement age (from 60 to 65 years)	13,1	- 4,2	- 6,4	10,8	16,3
Combination of parametric reforms[4]	26,5	- 7,0	- 10,7	28,3	13,6

Source: Mc Morrow and Roeger (2002)

We can see that the partial shift from the wage to the price indexation would mean slight decrease in the public pension expenditure and in the social security contributions compared to the baseline scenario. On the other hand, this kind of reform would deteriorate the level of the consumption of pensioners, and thus it seems to be little bit income unfair.

The second type of the parametric pension reform presented in the paper stems from increasing the retirement age from 60 years to 65 years. This reform would mean significant

[4] The combination of parametric reform means increase of the effective retirement age from 60 years to 65 years, decrease in the generosity of the pension system (fall in net replacement rate to 58%) together with labor market reforms that yields to increase of the labor force participation rate by 4% and decrease of the structural unemployment rate by 2% (Mc Morrow and Roeger, 2002).

improvement for the economic growth as well as for the budgetary sustainability. Nevertheless, it does not stabilize the passivity ratio, which expresses the proportion of number of years in work and the number of years in retirement, because the life expectancy is predicted to increase much more (Mc Morrow and Roeger, 2002).

The combination of different parametric reform could bring the PAYG system back to equilibrium. It ensures the social security contribution rate to stay on the level from 2000, and thus it offset the negative impacts of population aging. From the view of the income fairness, this reform would mean greater improvement in the consumption of the working age population than improvement in the consumption of pensioners (Mc Morrow and Roeger, 2002).

The main arguments against the parametric reforms are based on the political inability or unwillingness to impose the unfavorable unpopular provisions as an increase of the retirement age or decrease in generosity of the pension system. Moreover, the increase of the retirement age does not alone ensure higher labor force participation rate since the labor market contains the other places to escape from active work as disability benefits or unemployment benefits.

3.B.2. Systemic reform –transition to full funded system

A shift from an unfunded pension system to a funded system is another possibility of the pension reform that is called the systemic pension reform. The transition to the funded pension system certainly includes some type of the private component, and therefore it can be called as privatization (Disney, 1999b). This reform strategy is sometimes called as market-based reform because it typically involves the movement to the market-driven investments (Holzman and Hinz, 2005). The systemic reform usually includes the conversion of defined benefit arrangements to defined contribution arrangements (Holzman and Hinz, 2005). The unfunded component of the pension system is totally abolished or it is decreased to the level that is just able to alleviate poverty. Tools alleviating poverty, under this pension reform, can be in form of a social assistance, a minimum pension, or a minimum rate of return guarantees in the new funded system (Holzman and Hinz, 2005).

The full privatization of the pension system took place firstly in Chile in 1980 from where it spread to other Latin American countries as Bolivia, El Salvador, Mexico, and Peru in 1990s (Holzman and Hinz, 2005). The inspiration from this kind of pension reform took over Australia, Hon Kong, and the United Kingdom (Disney, 1999b).

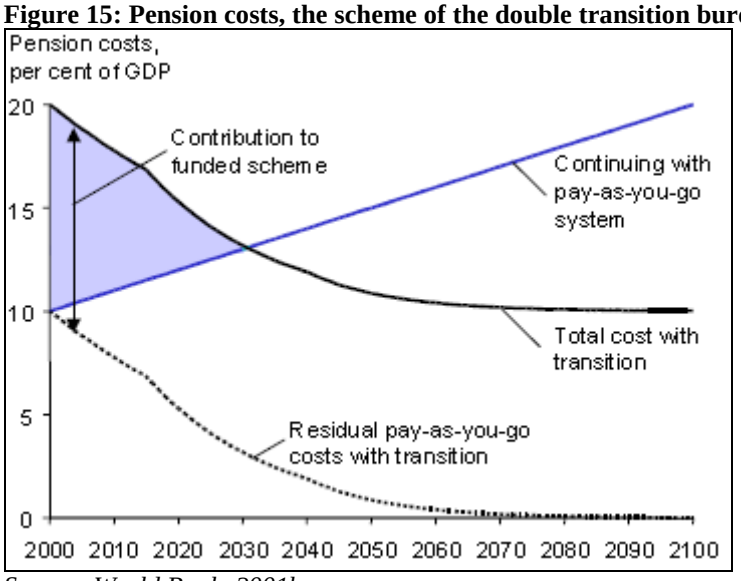
The attractions of the systemic pension reform were more or less presented in chapter 3.A.2 that devoted to the main characteristics of he funded pension system. To sum it up, the advantages of the full funded system are an internalization of the costs connected to the early retirement, transparency (the explicit connection of the pension benefits to the contributions and the capital market performance), a rise of labor incentives (erasing of the labor supply distortions that are related with the income taxes in funded pension scheme), an increase of the national savings, and a positive impact on the development of the capital market (Bezděk, 2000; Disney, 1999b; Holzman and Hinz, 2005). Moreover, as was shown in chapter 3.A.3 the market rate of return exceeds the long-term wage growth that is the internal rate of return of the unfunded pension system.

After listing attractions of the pension reform based on the transformation of the PAYG system to funded pension system, the drawbacks of this reform must follow. The funded pension system explicitly abolishes the redistribution within generations even though the low-income workers do not have to be able to save enough for their retirement. However, this problem is usually solved by establishing the safety net for retirees most exposed to the poverty risk as was mentioned in the beginning of this chapter. Further disadvantages of this reform were presented in chapter 3.A.2 that points out a need of complex regulatory framework connected with funds, high administrative costs, presence of the investment risks, and the problem of transition to the funded pension system.

Transition to funded pension system

From above mentioned disadvantages, the major problem of this pension reform that must be overcome to enjoy all crucial benefits connected with funded system is a transition problem that is based on the transformation of the implicit debt of the PAYG system to the explicit debt. The shift from the unfunded pension system to fully funded pension system induces the transition double burden (World Bank, 2001b). The transition burden got the attribute double because the current worker would pay twice – the contributions into their funds and the contributions for current retirees who get the pension benefits from the PAYG system. The size of the double transition burden is depicted in Figure 15 as shaded triangle. The size of the double transition burden matches the assumptions that the contributions to the PAYG system will increase by 10% of GDP until 2010 (due to the aging of population), the residual costs of the PAYG declines slowly, and the contributions paid to the funded pension scheme are constant at 10% of GDP. The total cost under the transition consists of the residual costs of the PAYG system and the contribution to funds.

Figure 15: Pension costs, the scheme of the double transition burden



Source: World Bank, 2001b

As was mentioned in chapter 3.A.1 the implicit debt of the EU countries is very large (according to the estimation by Mc Morrow and Roeger (2002) it reached 180% of GDP in 2000), and therefore ways how to decrease the transition burden are important to discover. We can find several methods that can be used in order to decrease the implicit debt, there are listed several of them:

- **Speed of transition**

Speed of transition from an unfunded to a funded pension system can very significantly affect the cost of transition. Speed of transition can be taken into account from two aspects (World Bank, 2001b).

The first aspect includes the rate of coverage or new funded pension scheme. From this point of view, the most radical option of the transition is to transform all PAYG liabilities including the commitments of existing pensioners into the funds. This would mean creation of huge explicit debt at once. On the other hand, the minimal option would mean that only new labor force can join new funded pension system. All current workers and pensioners would stay in the old PAYG system and the systemic reform ends by death of the last person eligible for PAYG pensions. In reality, most often the reform stands between these two extreme options. The government determines the cut-off age from which the younger individuals join new funded pension system whereas the older individuals stay in the PAYG system (Holzmann, 1998).

The second aspect of speed of transition is the can be gradual increase of contributions. Initially the rate of contributions is very small and then the rate increases. The advantage of this approach is a spread of the costs of transition into longer periods because it

allows larger revenue flow to meet existing PAYG liabilities (World Bank, 2001b). On the other side, phasing contributions in has several disadvantages. For instance, small contributions together with administrative cost cause that only small part of contributions finally gets to the individual accounts or the government can change its promises on increasing the contributions that would reduce the component of the funded pension (World Bank, 2001b).

- **Size of the funded pension scheme relative to the new unfunded pension scheme**

As was mentioned, even though the pension reform includes the full transformation to the funded pension scheme, the social safety net for pensioners in crucial needs should not be totally erased. The cost of transition can be decrease by prevailing broader first pillar of pension system that will provide defined benefit earnings related pensions to all retirees (World Bank, 2001b). However, the size of the transition burden does not diminish absolutely but the implicit debt from the PAYG system will only move for further generations.

- **Parametric reform before the transition**

The changes of parameters as increase of the retirement age or decrease in generosity of pension system can substantially bring down the transition burden. Mc Morrow and Roeger (2002) presented the impact of the parametric reform on the implicit debt, among others. Their results were presented in chapter 3.A.1 of this thesis. Similar impact as parametric reforms has a change in the real interest rate. Decline in the real interest rate increases the total PAYG liabilities because it decreases the internal rate of return of the funded system.

- **Allowing a government to share in any extra returns earned by the funded scheme**

This reduction in the transition burden can occur only if the market rate of return is higher than wage growth. The government can use the extra returns from the funded system in two ways: government can reduce accrued rights in the old PAYG for persons joined the funded system or government can use some contributions from funded system to pay for existing PAYG promises (Holzmann, 1998).

Even though the transition burden can be lowered, it can not be totally reset. Therefore the government must implement some kind of policy to pay for the transition. Basically, we can find two main ways how to meet the explicit debt derived from the implicit debt: the budgetary financing or debt financing (Holzmann, 1998). The budgetary financing of the transition burden is put in power either by increase of taxation or by cutting the public spending. This can induce distortions in economy (World Bank, 2001b). As another way of

financing the implicit debt, the government can issue governments' bonds or the government can balance the PAYG liabilities with other governments' assets (for example, government can use the revenues from privatization) (Holzmann, 1998). Using debt financing reduces debt for current workers and it helps to keep the taxes stable so it does not evoke any distortion in economy. Moreover, the debt is brought forward to the future generation which gains from the transition so this method of paying the debt seems to fair (World Bank, 2001b). On the other hand, issuing governments' bonds can have negative impact on the financial markets because it gives rise to higher interest rates that reflects a risk from increased public debt. In addition to this, it can hold back a development of financial markets and improvements in capital allocation.

After presenting main features of the systematic reform that counts on establishment of full funded pension system, there must be left space for prediction how this kind of reform would influence the GDP growth and the development of consumption. The model by Mc Morrow and Roeger (2002), which was described in chapter 3.B.1, also has focused on the possibility of shift to full funded pension system in EU 15. It assumes that the funded system is set up as defined benefit system guaranteeing the same net replacement rate to pensioners as was before the reform (74%). The PAYG system is assumed to be abolished in 200 and the transition burden is fully taken into account. Due to the enormous size of the burden, the model assumes the minimal option of the transition speed (the transition burden dies out with the death of last worker who was under the PAYG system). The contribution rates would be about 12% (as percentage form wage) higher than under the PAYG system. Despite of significant transition costs, the transition to funded system will encourage inconsiderable GDP growth per capita about 5,1 percentage points higher than in the baseline scenario. Also the consumption of the working age population is assumed to increase by 3,9 percentage points and the consumption of pensioners about 6,6 percentage points compared to basic scenario.

3.B.3. Transition to partial funded system

The partial transition to the funded pension system is based on the preservation of the PAYG system to some instance as well as introducing the funded pillar to certain level (for example, only certain people can choose to contribute into the funded pension scheme). We can find two basic types of partial privatization (Disney, 1999b). Firstly, **the cohort-based option** means that only new cohorts entering to labor market must (or can) join the funded

pension system. Secondly, **the choice based approach** was put in power in the United Kingdom to allow workers make a choice between staying in the unfunded component of the pension program and starting to contribute to the personal pension accounts (Disney, 1999b).

The main advantage of this pension reform lies in the spread of the transition costs into longer period. Moreover, keeping the funded and the unfunded component of the pension system insures that the overall risk connected with the pension system is lower because the specific kinds of risk related to funded and unfunded pension system are not correlated with each other (Bezděk, 2000).

A problem connected with this type of reform stems from large within-generation variations in funded returns due to difference in transaction costs or difference in contributions to the unfunded scheme (Disney, 1999b). For example, if the transition to the funded pension scheme is voluntary then it can happen that only rich people enter this scheme and poor people stay in unfunded pension scheme. This evoke standard adverse selection problem and it also perish the possibility of intergenerational redistribution (Disney, 1999b).

Paper by Mc Morrow and Roeger (2002) presented above also tries to predict consequences of the partial shift to the funded system in EU 15. They consider the partial shift in the range of 25% to the funded pension system together with a significant reform of PAYG system that ensures the stabilization of transition burden through labor market reform combined with decrease in generosity of PAYG system. The results show that this kind of reform offsets the negative impact of aging on the GDP per capita growth, it also has positive effect on contribution rates (decrease of contributions to the public PAYG system by 3,1% of wage until 2050 compared to 2000 level and contributions to the funded private system are predicted to be around 3% of wage in 2050), and it increases the consumption of workers as well as of pensioners.

3.B.4. Notional Defined-Contribution pension system

Notional defined contribution plans knowing also as **notional accounts** keep the unfunded pension system as major financing strategy but create strict link between contributions and benefits for each generation (Disney, 1999a). This pension system mimics a funded system in sense that it creates so-called notional accounts where individuals accumulate their contributions. A value of pension depends on the size of contributions and on the rate of return of the notional accounts that is determined by special formula that takes into accounts the current and prospective demographic and productivity changes. The rate of return of notional accounts does not depend on investment returns in financial markets but it

is set by government and it is linked to the real growth of wage bill (the growth of real contribution base) (Disney, 1999a). In this sense, the notional rate of return is another form of Aaron-Samuelson condition (Disney, 1999b). The accounts are called "notional" because they constitute a series of individual claims on the future public budget (World Bank, 2001a).

The first proponent of similar reform as notional accounts was Buchanan who suggested reforming the social security system in the USA in a way of compulsory purchases of social security bonds that will be revalued each year by rate of return depending on the growth of GNP (Disney, 1999a). Other roots of the notional accounts can be find out in the reform of social security system in France in 1945 (pension depends on accumulation of personal points) or in the United Kingdom in 1988 (individual retirement savings accounts) (Disney, 1999a). Reforms based on foundation of notional accounts were implemented in Sweden (introduced in 1994 but implemented in 1998), Latvia (1995/1996), Poland (proposed in 1995 but implemented in 1999), and Italy (1995) (Disney, 1999a).

Advocators of the notional defined contribution system emphasize very often an "*actuarial fairness*" of the system. The actuarial fairness means that life annuity should equal to the ratio of the lifetime contribution to the remaining life expectancy (Simonovits, 2004). The notional accounts are said to be fair because the benefits of two individuals who entered the system in different times are proportional to the time and amount they have paid (Disney, 1999a). To understand how the notional account system is fair in contrast with traditional defined benefit system it is favorable to compare benefit formula of both systems (see Table 16).

Table 16: Benefit formula of notional account and defined benefit system

	Notional accounts	**Traditional defined benfit**
Benefit formula	$b = g\sum_{t=0}^{R} w_t \frac{I_R}{I_t} c$	$b = \sum_{t=0}^{R} a w_t \frac{I_R}{I_t}$
Notations	b = pension value w_t = the wage rate at time t I = the appropriate revaluation index (as wage bill) c = the contribution rate R = age of retirement	
	g =the pre-set conversion factor (G-value) by which the notional accumulation is converted into the pensions	a = accrual rate of defined benefit unfunded pension system

Source: Disney, 1999a

As can be seen pension benefits in the notional accounts are defined as a sum of earnings revalued by notional rate of return (index that ensures that the marginal return on contributions in terms of increased pension is invariant to timing) multiplied by the contribution rate. This sum is multiplied by so-called g-value that serves as a conversion

factor of contribution at time of retirement. A benefit formula for a defined benefit PAYG system is defined as sum of earnings revalued by index (index takes into account changes in the cost of living) multiplied by an accrual factor (World Bank, 2001a).

It can be noticed that the benefit formulas equalize if the indexes for revaluation are same and if the accrual rate is equal to the multiplication of g-value and the contribution rate. However, several differences between these formulas can be found. Firstly, earnings in notional benefit formula are counted on the lifetime basis. In contrast, defined benefit system usually do not use the lifetime average earnings for determining the pension benefits but only earnings from several years (for example earnings from last ten years of work) (World Bank, 2001a). This can discourage the intentions of partial work or it can open the space for misreporting of the final earnings. Secondly, the accrual rates in defined benefit systems usually do not equally weight contributions from different years in contrast to notional accounts where the contributions are indifferent of years.

The notional accounts are not *actuarially neutral* because they are not fully separated form redistribution (World Bank, 2001a). Firstly, under the condition that the annuity rates do not take into accounts factors affecting longevity (as sex or occupation) the notional accounts redistribute from people who live shorter to people who live longer. Secondly, the notional defined contribution systems usually give credits also for years of inactivity (for unemployment or maternity life).

Another important aspect of the pension system is an *intergenerational fairness* that is defined by many means depending on point of view. For example, according to the utilitarian perspective the intergenerational fairness means that the marginal utilities of consumption are equal across generations (Disney, 1999a). Another example, the Aaron-Samuelson condition says that the rate of return on an unfunded pension system should be the sum of labor force growth and productivity growth (Disney, 1999b). Redistribution between generations inside the notional accounts depends on g-value, notional rate of return and the indexation method of pension. All of these variables can be influenced and changed by political authorities. So similarly to the defined benefit PAYG system the notional accounts are subjected to political risks and do not ensure intergenerational fairness.

As was mentioned previously one of the main motivation of the pension reform in the light of population aging should be *fiscal sustainability*. Palmer (2000) stressed that the notional accounts assist the fiscal sustainability in long run regardless of demographic changes and economics shocks because the contribution rate is held fixed. On the other hand, we can find also opinions arguing that the notional defined contribution system does not

automatically ensure fiscal sustainability of the pension system (Simonovits, 2004 or Disney, 1999a). One of the main arguments, which contribute to the conviction that notional accounts enhance the fiscal sustainability, is the equipment of the notional accounts with two automatic stabilizers. First of them is installed in g-value that can adjust increase in longevity but is not able to handle decrease in fertility. Unfortunately, if the negative demographic development is long run then the notional accounts cannot absorb it (Disney, 1999a). The second stabilizer is the choice of notional rate of return, which can be a growth of wage bill, growth of earnings or growth in GDP (World Bank, 2001a). However, if the volatility of wage bill growth is large then there arises a need of construction some kind of fund that keeps the contribution rate stable (Disney, 1999a). Nevertheless, establishing the fund means incomplete link of annuity and revaluation to the real wage bill growth.

The notional accounts are said to be *transparent* (Disney, 1999a). In contrary to defined benefit system, the notional accounts do not promise overgenerous benefits but link the benefits to contributions in clear way. As was mentioned previously, the contributions to the notional accounts are perceived by workers as savings rather than taxes so they do not discourage to work. Nevertheless, the notional accounts are as unfunded defined contribution system subjected to decisions of politicians so the credibility of the notional accounts can be diminished.

To sum it up, the notional accounts (if properly implemented) can bring favorable results in pension system from several points of view. As was mentioned, significant parametric reforms of unfunded pension system are usually politically unfeasible. Nevertheless, well-introduced and explained notional account system can be easier to implement. Also by linking benefits to contributions, the notional accounts can destroy disincentives to work. However, from above analysis is clear that the fiscal sustainability can not be maintained just by introducing notional accounts. Moreover, the political risks are not driven out from this system. Furthermore, empirical comparisons of notional rate of return and rate of return of funded pension system seem to be in favor to funds (World Bank, 2001a). This is supported by dynamic efficiency of economy.

3.B.5. Other reform proposals

As was presented in the beginning of this section, we can find many various taxonomies of pension reforms. To have complete overview of the pension reform possibilities I would like to add several other reform strategies that seem to be important.

Holzmann and Hinz (2005) mention a **public prefunding** of defined benefit or defined contribution system as reform strategy that was implemented to sum extend in several developed economies (as Canada, Ireland, New Zealand, and the United States) and in some former British colonies in Africa and Asia. The main feature of prefunding is its centralization in one government-administrated fund. The centralization of funding in one public fund rather than allowing several privately managed funds brings advantage of decrease in administrative costs and improvement in risk pooling (Holzmann and Hinz, 2005). In addition, this kind of reform should decrease explicit debt. A key problem with the prefunding is to which extend the political bodies can intervene and decide about the investment from the fund. An opinion, that access to the fund should be denied to government, seems to be rational.

Schwarz (2006) points out **administrative reforms** that should focus on unifying multiple systems within a country, improving benefit service, improving record keeping, aggregating contribution collection with tax collection, and strengthening rules for eligibility for disability benefits. All of these tools are supposed to improve fiscal situation of countries as well as decrease uncertainty for all income groups. This kind of reform would not be sufficient alone but it should accompanied some another kind of reform mentioned in above taxonomy.

3.B.6. An "ideal" pension reform?

From analysis of several pension reform possibilities is clear that all of the reforms have their advantages and drawbacks. It is impossible to make some kind of chart of pension reforms according to their characteristics. A choice of the reform strategies depends on each country's original pension system (relation of mandatory and voluntary pension component, social security scheme together with family support, and coverage of the pension benefits in relation to poverty among retirees), reform needs of country, and on the specific characteristics of country (macroeconomic situation, demographic development, institutional background, and financial market development) (Holzmann and Hinz, 2005). Even though we can not say which pension reform is generally the best one, we can list goals which should be reached by decent pension system after reform.

The World Bank suggested very useful criteria of pension systems that should be reached (Holzmann, 2004). These criteria are two kinds: primary and secondary goals. The primary goals of pension system are affordability, adequacy, sustainability, and robustness. These goals should be reached together with implementation of the optimal welfare-improving scheme appropriate fro each country. The *adequacy* of the pension scheme ensures

sufficient benefits for all members in population with purpose to prevent pensioners from poverty and to smooth the consumption during whole life. The *affordability* of pension system means that the pensions are in capacity of individual as well as whole society without having harsh fiscal consequences. The *sustainability* of pension system guarantees that pension benefits will be paid according to promises for long period under realistic assumptions. The *robust* pension system ensures that the pension system can overcome various economic and demographic shocks. Another feasible feature is the *equitability* of pension system that provides the income redistribution from lifetime rich to lifetime poor in consistency with the social preferences.

Secondary criteria evaluate the contributions of pension system to the economic growth and stability. These criteria concerns improvements in labor market efficiency, changes in level of savings, and development of financial markets. These criteria takes into account future prospects of economic development and are important for fulfilling promises of specific pension system.

Concluding that there is no ideal universal pension reform suitable for all countries, the World Bank advocates reform that leads to multi-pillar pension system (Holzmann and Hinz, 2005). The multi-pillar system should be flexible enough to accommodate the specifics of each country. Moreover, implementing several components of pension system should ensure more security against demographic, political, and economic risk. Furthermore, various pillars of pension system cover various target groups in the population.

The World Bank suggests the combination of following five basic pillars (Holzmann and Hinz, 2005):

- The “zero pillar” should be noncontributory pillar. It should substitute social pensions or a general social assistance to ensure the minimum protection to all elderly. The main task of the zero pillar is a protection against poverty or liquidity constraints (Holzmann and Hinz, 2005).
- The “first pillar” should be contributory one. The level of contributions should be linked to previous earnings, and thus it should replace some part of the pre-retirement income. This pillar is usually financed on the PAYG basis, and thus it prevent from the risk at capital market, life expectancy uncertainties or individuals myopia. However, it is not cleaned up from the demographic and political risk (Holzmann and Hinz, 2005).
- The “second pillar” should stand for the mandatory individual savings account that relates benefits with contributions and capital returns. This pillar is favorable for

private savings, financial market development, and suppression of individual myopia and political risks. Unfortunately, this pillar is subject to risks related to financial markets (as market volatility or high transaction costs) (Holzmann and Hinz, 2005).

- In contrast to all previous pillars, the "third pillar" should be voluntary and flexible. It can take various forms (defined benefit or defined contribution, individual or occupational savings). The flexibility of this system brings the greatest advantage and disadvantage at once. It is advantageous because it compensate the rigidity of other pillars. On the other hand, disadvantages stem from high financial risks (Holzmann and Hinz, 2005).
- The last pillar is the non-financial pillar that includes family support or other formal social programs.

If we take the concept of multi-pillar system more loosely, we can find it in most of the countries because most countries have some kind of social assistance for people in needs as well as some kind of individual or occupational saving scheme for part of population. As was mentioned the multi-pillar systems differ in focus on the main groups in society as well as in type of funding and use of mandating. The World Bank also suggests that a reform of pension system in developed countries depends on inherited pension system rather than on capacity issues (Holzmann and Hinz, 2005). In other words, even if the capacity issues for reform are sufficient, the political bodies can decide not to move to funded (partial or full) pension component if the implicit debt from previous pension system is too high. This can be called as path dependency of pension reform.

With a view on the European Union countries, we can find many variants or proposals of optimal pension reform. For example, study by Mc Morrow and Roeger (2002) define the optimal pension reform for EU 15 as two-stage path. The first stage includes stabilization of the PAYG system (reducing generosity of the system, increasing the retirement age, imposing labor market reforms enhancing better incentives to work) together with partial shift to funding. The second stage means progressive 100% shift to funded system that includes both private and public pillars. The public pillar should replace the old PAYG system and should be compulsory and defined benefit. The private pillar should be voluntary and defined contribution. According to the paper, this kind of pension reform should maximize growth rates and should ensure financial sustainability.

Chapter 4. Pension reforms in the EU countries

After presenting theoretical possibilities of pension reforms, we can move to the practical implementation of these reforms in particular European Union countries. Firstly, I present the approach of the European Union towards the pension reforms. Then the analysis of pension systems and reforms follows that brings the comparative typology of pension systems and relates pension reforms to different types of pension structures.

4.A. European Union approach towards the pension reform

The European Union was established mainly to develop economic cooperation among the European countries, but after several decades, cooperation was extended also to the sphere of social policy. The main issues in this sphere were the rights for employees, the problem of unemployment, averting poverty, social inclusion of the disabled, and an adequate standard of living for the poor and elderly. In 1989, was approved the European Charter of Social Rights of Employees, which provided several basic principles. Among them are the guarantees of a minimum standard of living for older persons (Fiala and Pitrova, 2003). This was the first document that stated the common principle for social policy. To accept common legislation in the sphere of social policy was always complicated because each member state has its own idea and practice in this field. Thus, the principles concerning social policy are mainly in the form of the EU recommendations and not in the form of common European legislation that must be followed without compromises. In spite of this fact, the EU can still play an important role in coordination of the social systems.

The European Union as an economic community highlights the economic development of its member states and makes all efforts to keep the economic growth at the highest possible rate. Clearly, high public spending on social security can jeopardize the necessary finance for investment. The European Union takes into account the population aging and the danger of high public debts, and thus it adopts necessary tools to help its member states in their efforts of reforming the pension systems in the best possible way. The European Union does not consider one pattern of pension reform to be the best for all member states because it realizes the historical, political, economic, and cultural differences across the countries (European Commission, 2006). However, the EU recognizes specific objectives of the pension systems that should be introduced by the pension reform in all EU member states. Among these objectives are universal access, adequacy, adaptability, and financial viability.

The Stockholm European Council outlined a three-pronged strategy that fights against the budgetary implication of aging (European Commission, 2006).It says that the EU

countries should reduce public debt at a faster pace (European Commission, 2006). Further, the EU countries should accept appropriate reform of labor markets that increase the labor force participation of men and women (European Commission, 2006). Finally, the pension reforms should ensure the sustainable public finance and intergenerational balance (European Commission, 2006).

The Laeken European Council in 2001 concluded that the member states should enhance cooperation on the issues related to the pension reforms and formally endorsed the common objectives of pension systems mentioned above (European Commission, 2006). At this time, the European Council adopted the so-called "open method of coordination". This method ordered all member states to share the material status, reform approach, and the progress of reform with each other (Holzmann, Orenstein and Rutkowski, 2003). This approach has many advantages not only in exchanging ideas about the reform approach but also in evoking pressure on countries that lag in reform attempts. Each member state is obliged to write and publish a National Strategy Report about the existing pension system and national pension reform. After that, the European Commission and Council published the Joint Report on sustainable and adequate pensions based on different National Strategy Reports (European Commission, 2006). The Joint Report is comprehensive and pursues different national approaches to increase knowledge about this topic. On the other hand, the Joint Report does not place enforcement.

The first National Strategy Reports were published in 2002, and the first Joint Report on adequate and sustainable pensions was introduced in 2003. Clearly, this first report did not cover the former communist countries that accessed the European Union on May 1, 2003.

After publishing the Joint Report in 2003, the European Council called on member states to ensure the implementation of further reform and, in 2005, proposed the second round of the National Strategy Report. The open method coordination on social protection was approved by the revision of the Lisbon strategy in 2005 that further suggested publishing reports about pension reform, social inclusion and healthcare issues annually from 2006. The European Council and Commission published the second Joint Report in 2006.

Some economists (for example, see Holzmann, MacKellar, and Rutkowski, 2003) argue that the method of open coordination was originally formed to prevent the discussion about one pan-European pension reform that would weaken national authorities and against which stands strong political opposition. It seems that this goal of the open method of coordination is being achieved; on the other hand, the method is criticized for its slowness and

its weakness to order the needed comprehensive reform in some member states (Holzmann, MacKellar, and Rutkowski, 2003).

4.B. Comparison of pension reforms and pension systems in EU countries

Since the variability of pension systems together with different social, economic and political conditions of each country is very high, the appropriate and comprehensible comparison of pension reform in EU countries reveals to be complicated. Very likely, a type of pension reform depends on the current and previous structure of pension system. So choice of pension reform tends to be path dependent. To explore links between pension reforms and various characteristics of pension system, we analyze how strategies of pension reforms vary with the pension structures and other pension system characteristics. Moreover, our analysis reveals the comparative typology of pension system and reforms in most of the EU countries.

Presented model is based on the paper by Soede and Vrooman (2008) which was a part of project on Adequacy of Old Age Income Maintenance in European Union (AIM). This paper brings an empirical typology of various pension systems in 19 EU countries, the USA, Canada, Australia and Norway. Moreover, it tries to verify whether this typology of pension systems corresponds to standard typology of welfare regimes (divided to liberal, corporatist and social-democratic welfare regimes) introduced by Esping –Anderson in (1990). Soede and Vrooman used in their paper the categorical principal component analysis (CatPCA) that produce principal component analysis on the optimally transformed data (produced in SPSS). This method can handle various types of data (nominal, ordinal or interval) as well as it can cope with number of variables exceeding the number of observations. Generally, the principal component analysis is a multivariate method whose main task is to reduce dimensionality of the data set (Johnson, 1998).[5]

The model performed in Soede and Vrooman (2008) relies on 34 qualitative and quantitative characteristics of mandatory parts of pension systems that under the described

[5] For better understanding of performed analysis, it is necessary to introduce what we mean by dimensionality of the data set. Let us assume that a data set is described by *p* variables, which means that a dimensionality of data set is *p*. In this sense, by each dimension we mean one specific variable. However, we can ask a question: "If we plot data on p-dimensional space, will they take all *p* dimensions?" If they do not take all p dimensions then we can say that the actual dimension of the data set is lower than p and the original variables can be replaced by smaller number of underlying variables without loosing any information about the data set. This is exactly what the principal component analysis make with data sets. It tries to discover true dimensionality of data sets and replace the original variables by smaller number of new variables that are called principal components (Johnson, 1998). The principal components are formed in decreasing order of importance in a way to be uncorrelated with each other (Johnson, 1998). The importance of a principal component depends on how much of variability in a data set the specific principal component is able to explain. Therefore, the first principal component accounts for as much of the variability in the data set as possible and each succeeding component accounts for as much of the remaining variability as is possible (Johnson, 1998).

statistical method divide countries into four clusters. Two main demarcation lines for clusters are the average pension level and the ratio of private and public scheme in mandatory pension system.

A comparison of analysis performed by Soede and Vrooman (2008) with analysis performed in this thesis can be found at the end of section 4.B.1

4.B.1. Specification of analysis

To explore relationship among pension system variables and to find reasonable typology of pension system in several EU countries, I decided to perform the principal component analysis of qualitative data (PRINQUAL). The PRINQUAL is based on the work of Kruskal and Shepard (1974); Young, Takane, and de Leeuw (1978); Young (1981); and Winsberg and Ramsay (1983) (SAS Institute, 1999). It obtains linear and nonlinear transformations of variables by using the method of alternating least squares in order to optimize properties of transformed variables' covariance or correlation matrix (SAS Institute, 1999). This multivariate analysis technique combines optimal scaling with principal component analysis. Like the principal component analysis, the main task of this technique is also to determine true dimensionality of the dataset in order to improve interpretability of data. The original variables are reduced to a limited number of uncorrelated dimensions by searching for linear combinations of variables which minimizes the unexplained error in the data (Soede and Vrooman, 2008).

In contrast to standard principal component analysis, the principal component analysis of qualitative data is suitable to perform special analysis of fitting a principal component model to nominal and ordinal variables. Moreover, it is able to summarize mixed quantitative and qualitative data and detect nonlinear relationships. In addition, this analysis allows a number of variables to exceed a number of observations.

We can distinguish three methods of the principal component analysis of qualitative data that are maximum total variance (MTV), minimum generalized variance (MGV), and maximum average correlation (MAC) (SAS Institute, 1999). All of these three methods attempt to transform data in order to decrease dimensionality of a data set. The maximum total variance method is based on the principal component analysis and it maximizes the variances accounted for by a few linear combinations (SAS Institute, 1999). The minimum generalized variance method decreases dimensionality of data by minimizing general variance of variables. The maximum average correlation method maximizes the average correlation of the variables with the dimensions. For our analysis, I have chosen the maximum total variance

method because it is closer to standard principal component analysis and thus the interpretation of results is easier.

The main outcome of PRINQUAL iterations is new scaling of each variable that is based on original variable and it satisfies transformation standardization constraints (fixed mean and variance) together with other constraints (as linear constraints, weak order constraints, category constraints, and smoothness constraints). We can distinguish several optimal scaling levels. To perform our analysis I have used B-spline optimal scaling that preservers the grouping of objects in categories.

Performed analysis

To perform the principal component analysis for qualitative data I have used SAS program that provide the PRINQUAL procedure. As was mentioned above, I decided to choose the maximum total variance method with a cubic polynomial transformation (standard transformation belonging to B-spline optimal transformation) and with two principal components. I decided to use only two first principal components because it revealed to be sufficient for explaining substantial amount of variability in our data. The output of PROC PRINQUAL displays the iteration history, transformed variables, components, correlations, and component structure information. To find groups of countries with similar pension system characteristics is useful to plot the EU countries into the biplot generated by the first two components.

To find out according to which variables are individual clusters of countries situated, it is useful to perform so called preference mapping.[6] The preference map contains observations (as a points) and vectors from the origin that substitutes specific variables. These vectors show how various observations differ on specific attribute (SAS Institute, 1999). On other words, the direction of vector says how individual observations are related to specific variables.

Data used in performed analysis

I have collected qualitative and quantitative data for 23 EU countries (Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden, and the United Kingdom). Data describing the main characteristics of pension system includes 48 variables that can be sorted to 5 different

[6] In SAS, the preference mapping can be created by performing the TRANSREG procedure that fits the univariate regression models for different types of variables. The preference map contains vectors beginning in the origin and ending in the point defined by an attribute's regression coefficients.

groups: demographic variables, variables describing retirement age and labor participation of older workers, variables describing the structure of pension system, variables describing generosity of pension system, and variables describing pension reforms.

All collected data are listed in Annex 1 and the explanation of specific variables together with sources is in Annex 3. I tried to find data from similar year (2005-2006) but some of the data are also from different years. Annex 3 contains also date for each pension characteristic. One of the problems connected with data collection comes from several crucial past changes of pension systems in most of the countries because pension reforms do not happen in one moment but they are gradual. So, it is common that some aspects of both pension systems (old and new) can coexist together at one time; therefore reasonable characteristics that truly describes the reality can be difficult to find.

Before carrying out the analysis, all characteristics have to be classified into categories. I tried to set up categories meaningfully and naturally but, of course, categories are more or less subjective and they could be set up in different manner if somebody else created them. The explanation of how categories were created is listed in Annex 3. Annex 2 contains a data set of these categorical variables.

Differences between performed analysis and analysis in Soede and Vrooman (2008)

Both analyses, our analysis and analysis performed in Soede and Vrooman (2008), are based on the principal component analysis of categorical data. However, they distinguish from each other by applying different methods of transforming a set of data in order to decrease dimensionality in data. Analysis by Soede and Vrooman (2008) was performed by SPSS program that provide CatPCA procedure. To reduce dimensionality of the data, this procedure maximizes the average correlation of the variables with the dimensions (MAC method). Whereas, our analysis was performed in SAS where a method of principal component analysis of qualitative data can be set more specifically. To reduce dimensionality of our data, we have used method that maximizes a variance accounted for by a few linear combinations (MTV method). This method is similar to classical principal component analysis. In addition, the variables were scaled differently. The analysis by Soede and Vrooman (2008) scaled variables at ordinal level while our variables were scaled at spline ordinal level. From this comparison, we can see that the principal of both analyses is same with several distinctions.

The main difference between these two analyses is in chosen data sets. In comparison with analysis in Soede and Vrooman (2008), three new EU member states (Estonia, Latvia, and Lithuania) were added and four non-EU countries (the USA, Australia, Canada, and

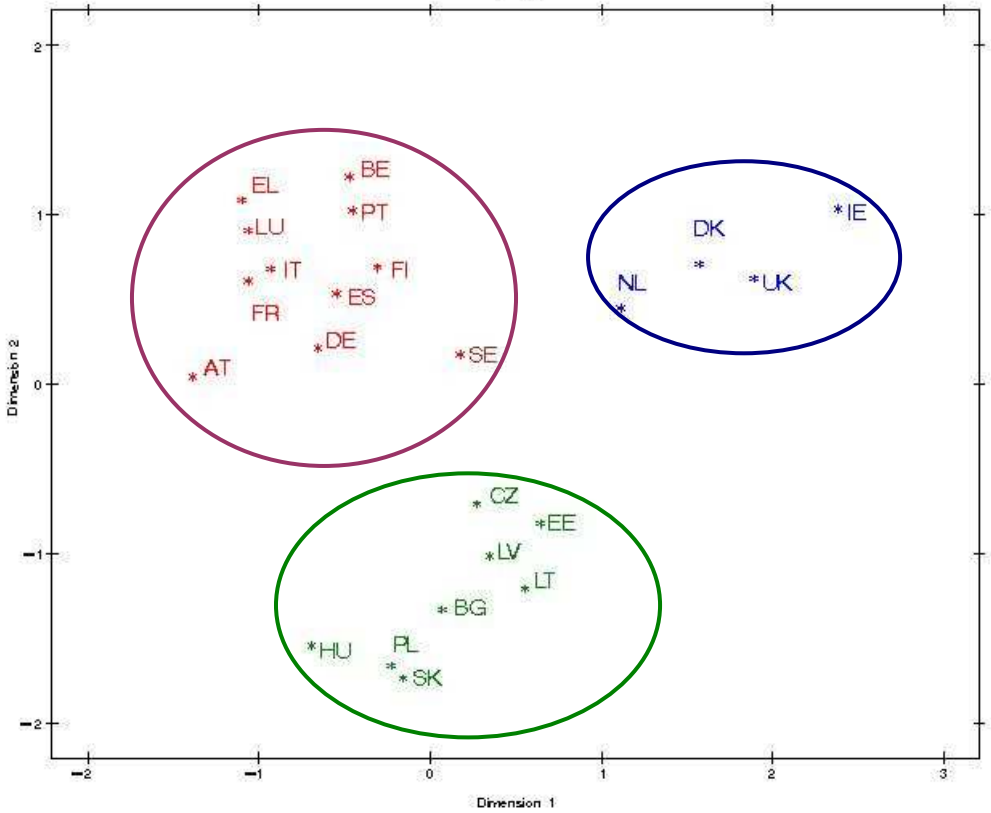
Norway) were omitted to our analysis. Performing analysis including more new member states should contribute to better understanding of path dependency of pension reform strategies. Moreover, our analysis was performed on larger number of pension system characteristics and pension reform characteristics (we used 48 variables while Soede and Vrooman (2008) use only 34 variables). Including more variables into analysis can contribute to more precise results of clustering and to easier description of differences among clusters.

4.B.2. Results of analysis

Firstly, the PRINQUAL procedure with methods described above was performed. The iteration history of this procedure is listed in Annex 4. The iteration history indicates that by performing the principal component analysis of qualitative data using our categorical data set the proportion of variance in data increased (from an initial 0.39 to 0.46) that is beneficial for decreasing dimensionality of data in order to interpret variability in them.

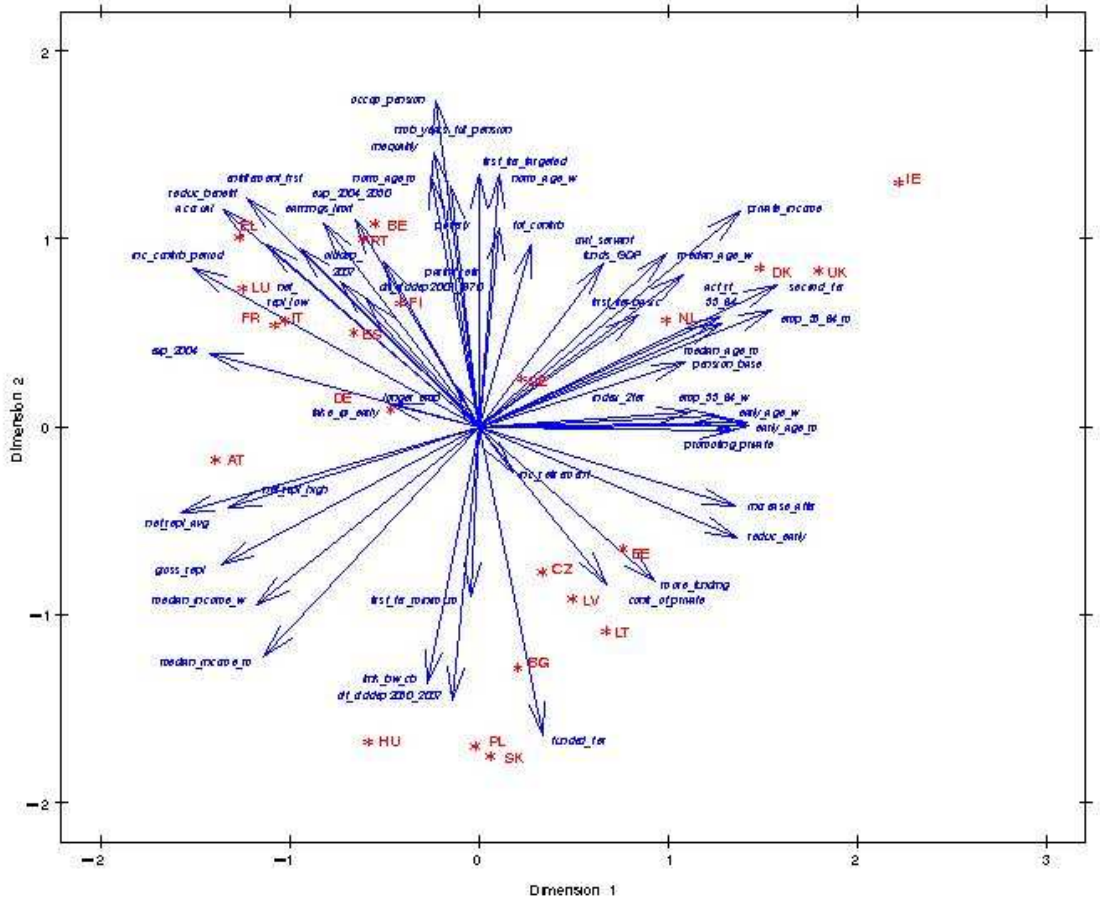
To find out the structure of transformed data, I decided to run the standard principal component analysis on transformed data. Part of output from this procedure is also in Annex 4. It shows that the first principal component accounts for nearly 25% of total variation in our data set (data set of categorical characteristics describing pension system and pension reform). The second principal component accounts for about 21% of total variation in our data set. Even though the first two principal components explains together less than 50% of total variance in data, only these two components will be considered to be important for explaining the structure of data. This stems from low explaining capability of other principal components (third component accounts for only 7% of total variance in data). A plot of the first two principal components with scaling of countries is located in Annex 4 (Annex figure 1). From the figure is clear that the first two components divide selected EU countries into three groups according to their pension system characteristics (red, green and blue). A biplot of the first two components obtained from PRINQUAL procedure shows very similar results of clustering (Figure 16) (the interpretation of the first and the second dimensions of this biplot is below).

Figure 16: Plot of first and second component from PRINQUAL procedure, SAS program



To understand how this biplot was constructed, it is useful to present initial biplot that contains EU countries (as points) and pension system's characteristics (as vectors) together (see Figure 17). Coordinates of points are determined by the principal component scores of different EU countries. The position of countries in this figure show positive or negative correlation of them with the first and second principal component. Countries with similar pension characteristics are allocated close to each other. The pension characteristics' vectors start from the origin and go through a point whose coordinates are the coefficients of the pension variable on the first two principal components. The absolute length of vectors is arbitrary but the relative length of vectors indicates fit (SAS Institute, 1999). The squared length of vectors indicate a proportion of explained total variation in data by specific pension characteristic (it means that longer vectors represent more important pension characteristics in assessing similarity and differences of pension systems in EU countries).

Figure 17: Biplot made with PRINQUAL procedure, SAS program (explanation of abbreviation of variables is in Annex 3)



To understand how clusters were created and how clusters are situated in the biplot, it is necessary to try to interpret the first two principal components (dimensions of the plot). From the biplot and our data set, it can be seen that the first dimension relates to the generosity of pension system as well as to the eligibility of early retirement.[7] The red cluster of 11 EU countries (Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Portugal, Spain and Sweden) can be characterized by relative generous pension system (in sense of relative median income ratio, average replacement rate, accrual rate or entitlement from first pension tier) and relatively easy access to early retirement or other ways of escaping from labor market (in sense of enabling early retirement or relatively low employment of older workers – except Finland and Sweden). In contrast, the blue cluster involving four EU countries (the United Kingdom, Ireland, the Netherlands, and Denmark) can be characterized with relatively low generosity in pension benefits and relatively high employment of older people. The green cluster including explicitly new EU member states (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, and the Slovak Republic) could not be

[7] This fact can be concluded by observing that vectors representing variables describing pension generosity and variables describing the eligibility of early retirement are related more with the first dimension.

characterized unambiguously according to the first dimension (because some countries are positively correlated with the first dimension whereas some countries are negatively correlated with the first dimension). For example, Hungary has one of the most generous pension systems from all EU countries. However, countries like Estonia or Latvia does not seem to be overgenerous in pension benefits. The ambiguity occurs also in situation of employment of older workers. Some countries already abolished early retirement schemes (as Poland or Bulgaria) but on the other hand, labor force participation of older workers is on very low level in most of the new EU member states.

Explaining the origin of the second principal component reveals to be even more difficult. The second dimension of the plot mostly relates to the extension of private pension schemes.[8] All countries in blue cluster have occupational private scheme, high income from private fund (as a percentage from total pension income), or large relative size of pension funds. Countries in red cluster are also characterized by presence of occupational private scheme. In contrast, countries in green cluster do not have well developed schemes of private pensions (low relative income from private pension). However, we can expect change in this point because several countries (like Poland, Estonia, Latvia, Lithuania or Hungary) established compulsory private funded tier inside their mandatory pension schemes.

To examine the typology of pension systems and reforms in the EU countries in more detailed it is worthy to perform preference mapping for each group of pension variables.

Mapping of demographic characteristics

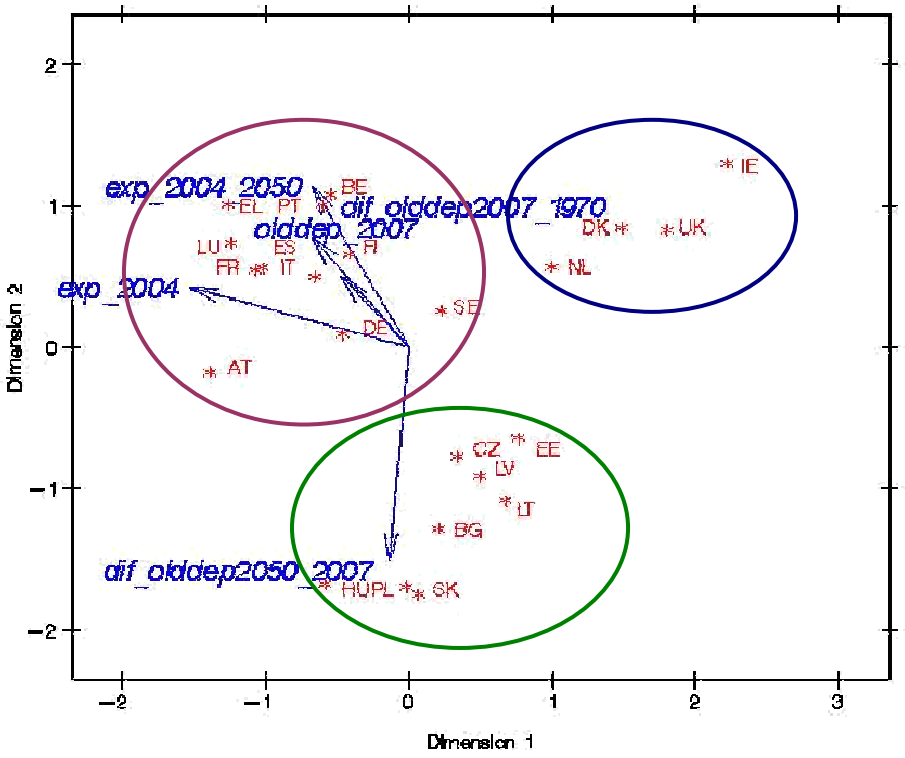
As was mentioned in the beginning of this thesis, aging of population brings serious problems in sustainability of pension system. To portray a magnitude of population aging in different EU countries five characteristics were chosen: old age dependency ratio in 2007, old age dependency ratio in 2007 in percentages of old age dependency ratio in 1970, old age dependency ratio in 2050 in percentages of old age dependency ratio in 2007, gross public pension expenditures as a share of GDP, and change in public pension expenditure between 2004 and 2050.

Figure 18 presents the initial biplot (figure 16) together with vectors representing demographic characteristics (see Annex 1). It shows that countries with more generous pension system (red cluster) have relatively "older population" which means that the old age dependency ratio in 2007 was over 25% in most of the EU countries (for example 30,2% in

[8] Similarly to the first dimension, this fact can be concluded by observing that vectors representing variables describing development of private pension schemes are related more with the second dimension.

Italy or 29,9% in Germany). Moreover, this cluster can be characterized by high increase of old age dependency ratio between 1970 and 2007 (increase about 80% in Finland and Italy). An expected increase of the old dependency ratio between 2007 and 2050 is predicted to be substantial in most of the EU countries. However, this increase is expected to cause lower problems in countries with less generous pension system and expanded private pension scheme. Clearly, the public pension expenditures in 2004 generated more than 10% of GDP in nearly all EU countries from red cluster (see data set in Annex 1).

Figure 18: Map of demographic characterisitcs (explanation of abbreviation of variables is in Annex 3)



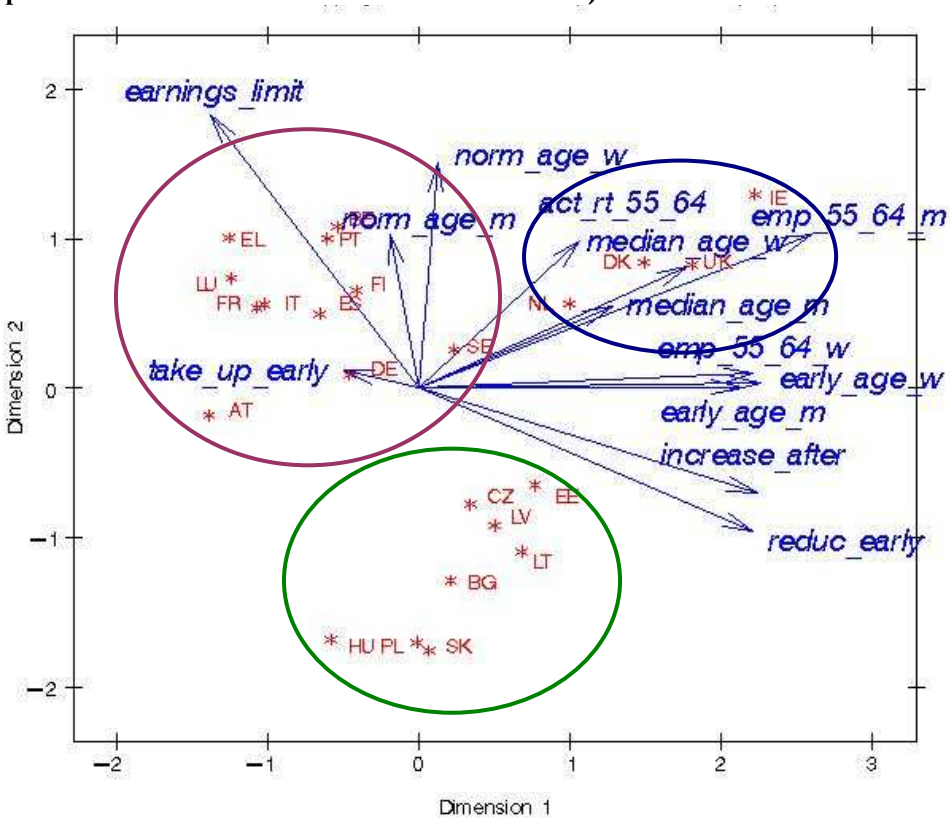
Mapping of retirement age and labor participation of older worker

One way how difficulties connected with population aging could be overcome is substantial increase in labor force participation of older workers. To describe the situation of labor force participation of older workers several characteristics (13) were chosen (including the eligibility of retirement - early, normal, or median; activity rates of older workers; policy tools to increase activity rates of older workers). These variables are very powerful in clustering.

Figure 19 shows the initial biplot (figure 16) together with vectors representing variables describing retirement age and labor participation of older worker (see Annex 1). It is clear that the blue cluster of EU countries is distinguished by high employment rate of men in age group 55-64 (more than 60%), relatively high employment rate of women in age group

55-64 (52,4% in Denmark and 48,9% in the United Kingdom), relatively high median age of retirement for both sexes. From this point of view, Sweden tends to be part of the blue cluster because the labor force participation rate of older workers is there on the highest level among all EU countries. To other European countries with high employment rate of older men and women belong Estonia, Latvia and Lithuania (about 60% of men old 55-64 years were employed in 2007). On the other hand, the lowest employment of older men and women can be found in Belgium, France and Luxembourg (from red cluster), Poland, Hungary, and Slovakia (from green cluster).

Figure 19: Map of variables describing retirement age and labor participation of older worker (explanation of abbreviation of variables is in Annex 3)



Another outstanding feature of blue cluster in sense of retirement age is relative abolishing of the early retirement. This cannot be said about any country from red cluster and only two countries from green cluster introduced this abolishment (namely, Poland and Bulgaria). Very remarkable common characteristic of green cluster (in comparison with both other clusters) is lower normal retirement age for men (usually 63 years). The normal retirement age of men and women is on similar level in red and blue cluster (with several exceptions as Portugal, Finland and Sweden).

Regarding policy tools, encouraging participation of older workers in labor market clusters cannot be sharply distinguished. It means that we cannot say which tool is significant

for which cluster. Reduction of pension benefits for workers who retire earlier than at official retirement age is moving from 0,5% per year to 8% per year in red cluster, from 3,6% per year to 8% per year in green cluster, and clearly it is not in power in countries that have abolished early retirement. Increase of pension benefits for workers who retire later than official retirement age varies also a lot in red cluster (moving from 2% per year in Belgium to nearly 10% per year in Portugal). In green cluster, the pension benefits can increase by 6% per year or more if retirement takes place after normal retirement age. This instrument of special bonuses for retirees, who became inactive after official retirement age, was not installed in three countries – Bulgaria, Netherlands, and Denmark. Countries with notional defined contribution systems (Sweden, Latvia, Italy, and Poland) reduce and increase pension benefits under actuarially fair rules.

Mapping of pension structure

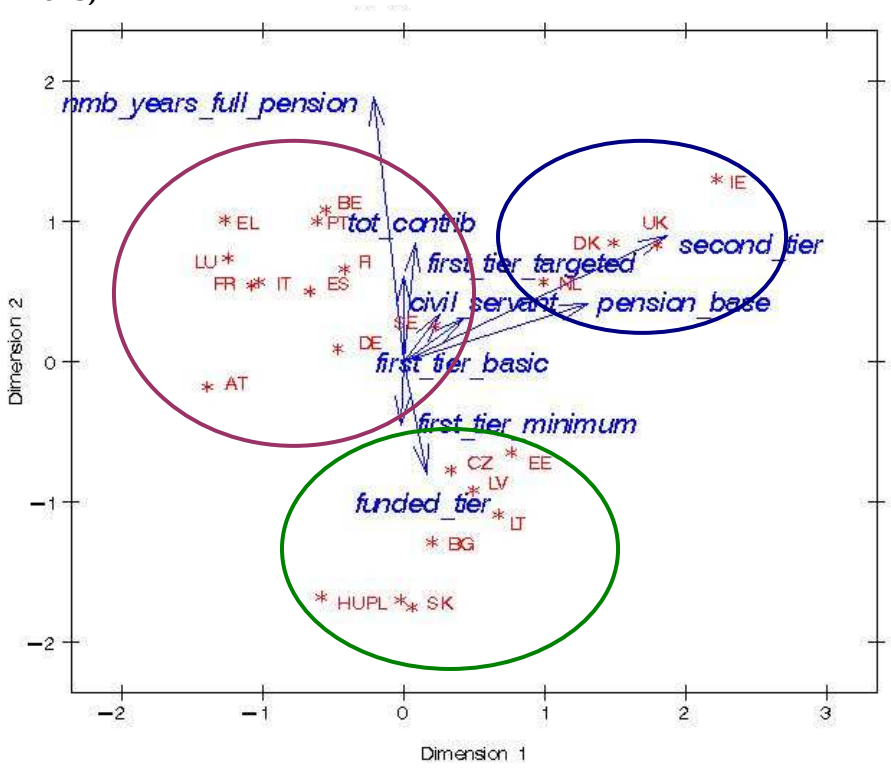
To describe the pension structure in EU countries, several characteristics were chosen (including type of the first pension tier, type of the second pension tier, presence of a funded tier within a mandatory pension scheme, presence of special scheme for civil servants, number of years needed for full pension, total pension contribution, and four variables describing an expansion of private pension scheme). These variables are listed in figure 20 that was constructed from initial biplot (figure 16) by adding vectors representing variables describing pension structure (see Annex 1).

As was presented in chapter 2.A.1, the first tier of pension schemes in the EU countries can be targeted, basic, minimum or some combination of these three schemes. Several countries regardless of cluster color have combined first tier which makes the comparative typology more difficult. However, the blue cluster is characterized by combination of basic (benefits do not depend on previous wage rate) and targeted first tier (with exception of the United Kingdom that also has the minimum first tier). In red cluster outweigh the targeted first tier (tier sensitive to the wealth of retired people) and in the green cluster outweigh the minimum first tier (not universal tier).

A flat type of second tier fully distinguishes the blue tier from the rest of countries. The presence of the funded tier inside the mandatory pension scheme is clearly associated with green cluster (most of countries have recently introduced this structural change of their pension system). Number of years for full pension is highly correlated with the second dimension. Generally, workers from countries belonging to red and blue cluster must work for 40 or more years to become qualified for full pension benefits. While workers from countries

in green cluster do not have determined number of worked years for full pension or have much smaller number of years than 40 years.

Figure 20: Map of variables describing pension structure (explanation of abbreviation of variables is in Annex 3)



Mapping of expansion of private pensions

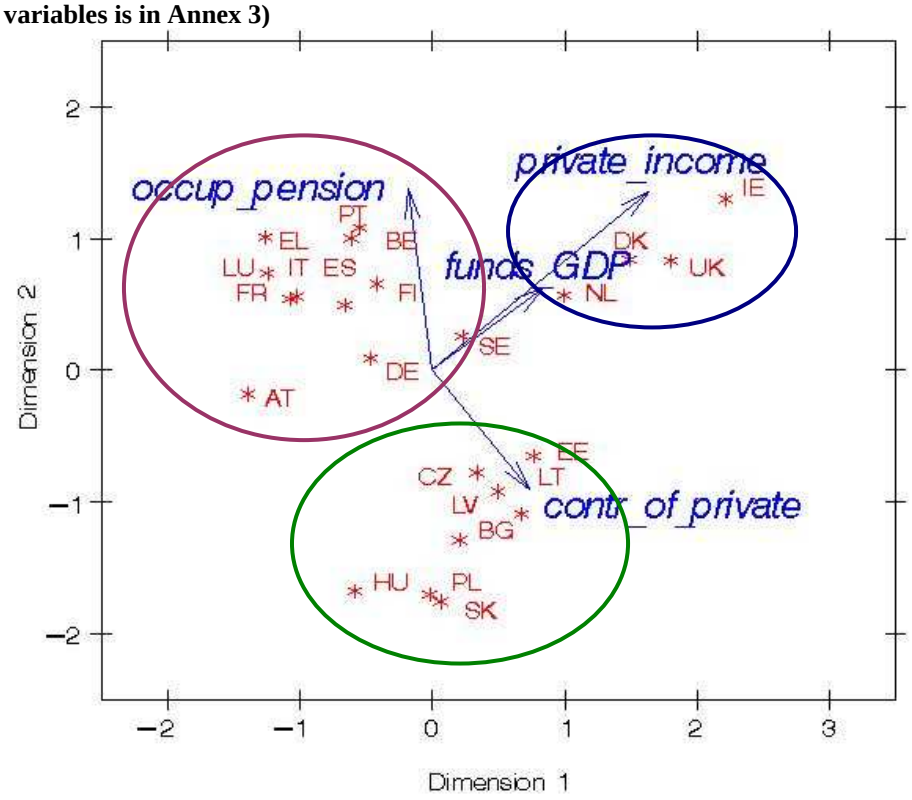
As was mentioned previously, the second dimension of biplot accrued from the PRINQUAL procedure seems to be correlated with expansion of private pension scheme (occupational or personal private). This can be also seen on figure 21 that was formed from original biplot (figure 16) by drawing vectors representing variables describing an expansion of private pensions (see Annex 1) Mainly, the blue cluster can be characterized by relatively large expansion of private pension scheme. Income from private fund relative to total pension income is highest in countries in blue cluster where it reaches more than 20%. Also the size of pension funds relative to GDP was substantial in all countries from blue cluster (for example 124,9% in Denmark, 70,1% in the United Kingdom, and 52,8% in Ireland). The occupational pension scheme is mandatory or well developed in countries from blue cluster. The percentage of workers contributing to private or occupational private pension funds reaches 95% in Denmark and 90% in the Netherlands.

The occupational pension scheme is also common in countries belonging to red cluster but it is substantial only in Finland, France, and Sweden. The income from private funds relative to total pension income is between 5% and 20% only in Belgium, Germany, Portugal,

and Sweden. In other countries from red cluster, it is less than 5%. The size of pension funds relative to GDP is less than 10% in most of the EU countries from red cluster (only in Finland it reaches 66%).

Countries from green cluster are similar in introduction of a funded tier recently, and therefore, their private pension scheme is not so developed nowadays. However, in future it is expected that the importance of private pension scheme will increase mainly in countries which introduced the pension funds to their mandatory pension schemes (European Commission, 2006). The percentage of workers who contribute to private pension funds (occupational pension schemes were not introduced) is relatively high in this cluster (the average is about 52%).

Figure 21: Map of variables describing the expansion of private pension (explanation of abbreviation of variables is in Annex 3)

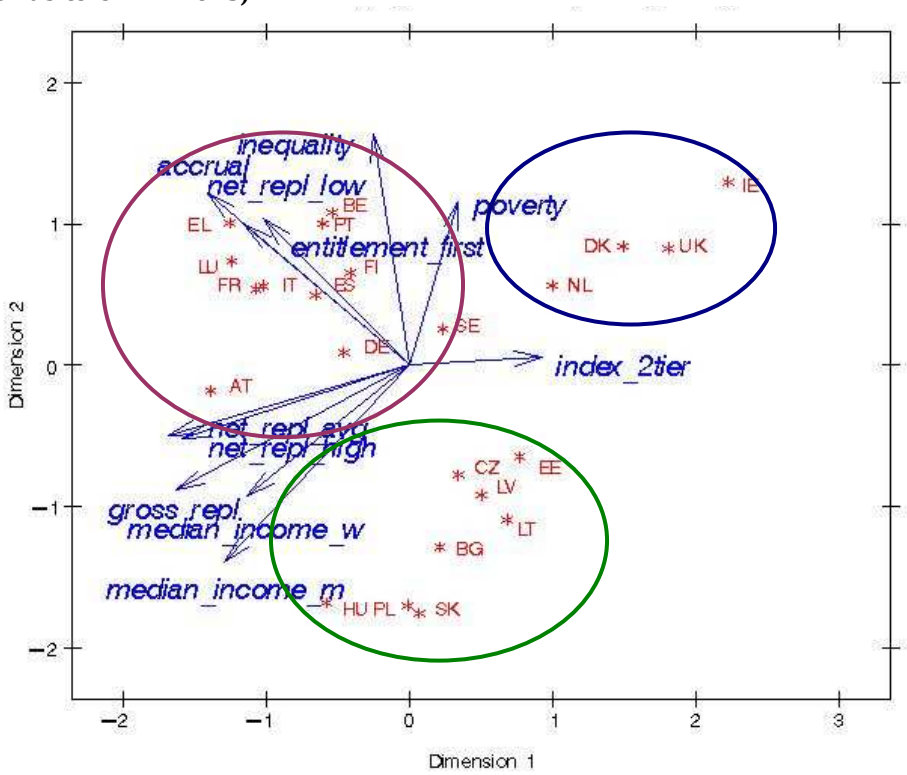


Mapping of pension generosity

As was mentioned earlier, the first dimension is highly correlated with generosity of pension system. Among characteristics describing generosity of pension system was included 11 variables as gross and net replacement rate, indicator of poverty among pensioners, indexation of the second tier pension scheme, entitlement from the first tier of pension system, accrual rate, median income ratio, and inequality of income distribution among older people. Vectors representing all of these variables were added to initial biplot (figure 16) to create figure 22.

The red cluster is characterized by relatively generous pension system. The median gross replacement rate of this cluster reaches 66,7% and the median replacement rate for average earner is nearly 80%. Both of these characteristics are the highest in Luxemburg (more than 100%) and the lowest in Belgium (about 40%). Comparing the median net replacement rates for average earners and for low earners we can find that the overall difference is about 10% in favor to low earners but some countries have nearly same net replacement rates for both (as Austria, Greece, Italy, Spain). The median overall entitlement from the first tier as percentage of average earnings is 34% (lowest in Italy and highest in Luxembourg). Also the accrual rates seem to be on relatively high level (median is 1,8%). The indexation of the second tier is heterogeneous in the red cluster (5 countries index according to mix of price and wage increase, 5 countries according to growth of prices, and 1 country according to growth of earnings). The median income ratios of men and women are also related to the first dimension of biplot (on average it reaches 0,87 for men and 0,82 for women in red cluster).

Figure 22: Map of variables describing generosity of pension system (explanation of abbreviation of variables is in Annex 3)



Countries in blue cluster reach similar level of overall entitlement from the first tier and median inequality rate among older people as countries in the red clusters. However, all other variables are on average lower which refers to lower generosity of pension systems. Worthy to notice is a large difference between the median net replacement rate for high

earners and net replacement rate for lower earners who accounts for 40%. It shows that people with higher earnings attain less favorable replacement rates. Comparing the characteristics describing generosity of pension system, it can be easily found that the Netherlands is the most generous from all countries in the blue cluster (see Annex 1).

Regarding the generosity of pension systems, green cluster is less homogenous than red cluster. Some of countries have rather generous pension system (as Hungary) whereas other countries do not seem to be extremely generous (as Estonia). This cluster is interesting by having the lowest median of poverty rate among older people (only 13%). The median net replacement rate for average earners is 70.5%. The net replacement rates for low earners and average earners are very similar in all countries except the Czech Republic where people with low earnings have significantly higher net replacement rate than average earners.

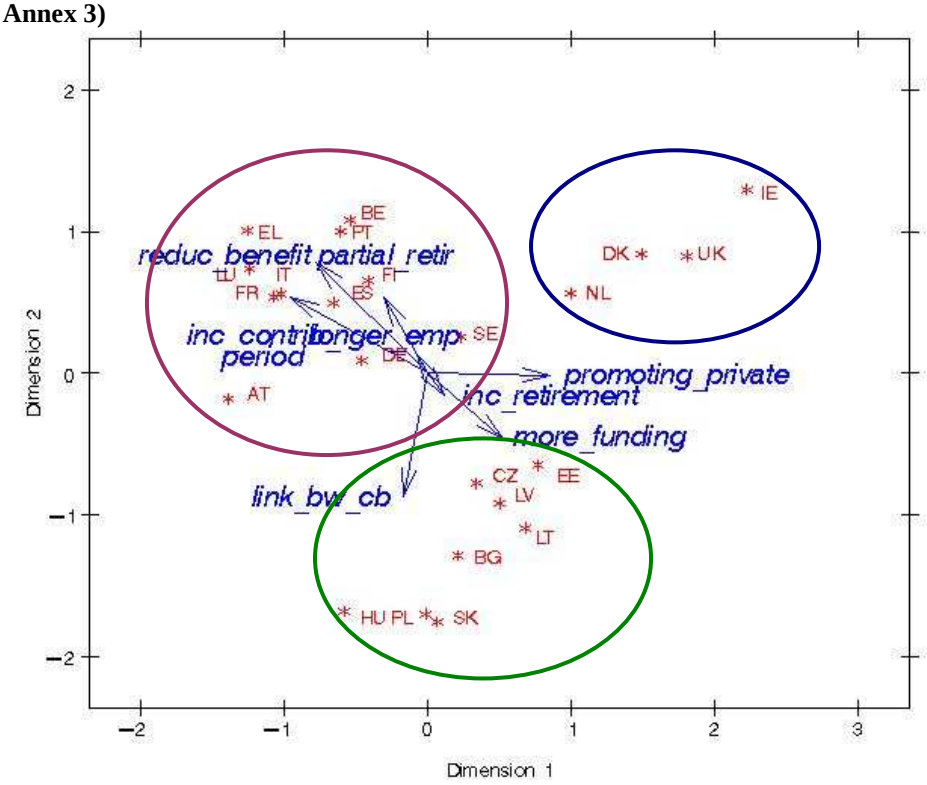
Mapping of pension reforms

To find relations between pension reforms and typology of pension systems, several characteristics describing recent steps of pension reforms were selected. Among them belong the reduction of pension benefits (implemented for example by change of indexation of pension benefits or by decrease of accrual rates), the increase of contribution period, implementing stricter link between contributions and benefits, promoting private pension scheme, promoting more funding, increasing the retirement age, introducing partial retirement, and promoting longer working life.

From figure 23, which was constructed from initial biplot (figure 16) by adding vectors representing characteristics about pension reform, can be seen that types of pension reform as promoting of private pension and pension funds are negatively correlated with generosity of pension systems (red cluster). On the other hand, pension reform tools as increase of contribution period, reduction of pension benefits, and promoting of longer working life are positively correlated with pension wealth (red cluster). The number of contributory years to be eligible for the full pension was increased in France (2003), Austria (2002), and Portugal (from 10 to 15 years) (European Commission, 2006). Belgium and Germany adjusted the revaluation coefficient of the pension benefits (Soede and Vrooman, 2008). In 2003-2005, Finland adjusted the pension benefits for the increasing life expectancy (European Commission, 2006). Promoting of longer working life and thus increasing the employment rate of older workers took various forms (for example, bonuses for later retirement, reductions for early retirement, or introducing partial retirement). For example, Finland and Sweden introduced flexibility in retirement. Several countries implemented

partial retirement (including Belgium, Finland, France, Germany, Luxembourg, Spain, and Sweden). Moreover, most of countries start to provide subsidies or reduction in social contributions to boost incentives of employers to employ older workers (Austria, Belgium, Finland, Germany, Greece, Portugal, Spain, and Sweden). Also the minimum pension guarantees were extensively reformed in the last five years to ensure better social protection and decrease poverty risk of older workers. For example, the rapid increase of the minimum pension guarantees took place in Spain, Portugal, and Belgium (European Commission, 2006).

Figure 23: Map of variables describing pension reforms (explanation of abbreviation of variables is in Annex 3)



Countries from blue cluster can be characterized mainly by pension reforms that aim at strengthening private pension schemes. However, most of countries from this cluster, namely the United Kingdom, Ireland and Denmark, focused also on adequacy of pension system by introducing new minimum benefits or increasing the minimum pension guarantees (European Commission, 2006). In spite of the fact that employment rates of older workers are in these countries on higher level than the EU average employment rate of older workers, they further attempt to increase the employment and the labor productivity. For example, the Netherlands adopted the reduction of long-term unemployment benefits, the United Kingdom try to restrict disability schemes to not enable people that do not deserve the disability benefits to receive them, Denmark adopted several measures to improve health care for

workers, and Ireland's sustainability strategy is devoted to increasing the labor productivity of low-earnings workers (European Commission, 2006).

Most of countries in green cluster tried to improve a link between pension benefits and contributions. An introduction of notional accounts in Latvia and Poland is the best example of this. An introduction of a funded tier into the pension system took place in all countries from green cluster. However, an extension of this tier varies from country to country. In Bulgarian, Poland, Hungary, Estonia, Latvia, and Slovakia was established a funded tier into a statutory scheme that is mandatory (European Commission, 2006). However, in the Czech Republic is the membership in private pension funds voluntary (European Commission, 2006). Poland makes the biggest efforts in increasing the employment rates of older workers by implementing the highest retirement age from all countries in this cluster. Moreover, Poland abolished the early retirement.

Conclusion

The ongoing demographic trends, low labor force participation of older workers, drawbacks in original pension systems, deepening economic integration and the socioeconomic changes of European societies lead to the need for substantial pension reform in all EU member states. Some EU countries have established comprehensive pension reform, and some have started to put greater effort into establishing more adequate pension systems, but some are just in the beginning of making first steps toward the substantial changes in their pension systems.

All countries in the EU have as a priority providing sustainable and adequate pension provisions today and in the future. To create sustainable long-term pension reform, the reform strategies should reach high political and social consensus. To prevent potential conflicts, a broad-based inclusive approach to a pension reform where all relevant players are included in planning the reform. This fact is highly accepted in all EU countries and has led to the constitution of special expert committees involving social partners, ministries, scientists, and other specialized institutions (European Commission, 2006). Also, clear information about pension entitlements must be disseminated to the whole population, so that people can plan the appropriate level of personal savings and make other long-term personal decisions concerning retirement. Reliable information contributes to the transparency of the pension system and strengthens the confidence in long-term sustainable pension systems.

Most of the EU countries have public pension system based on PAYG financing mechanism. This mechanism is based on the intergenerational and intragenerational redistribution and it seems to be suitable if the population development is stable and stationary. However, in case of population aging the PAYG system evokes an implicit debt that is predicted to reach significant value in most of the EU countries. Moreover, the PAYG system does not provide strict link between contributions and benefits, it can discourage labor incentives, and it can drive out private savings. To sum it up, most likely the public pensions based on PAYG financing mechanism seems to be unsustainable because the promises to future pensioners would jeopardize the public finance by excessively increasing public debt.

To overcome these problems, several countries decided to introduce (partially or fully) funds. The funded pension schemes provide pension benefits based on the lifetime contributions and the internal rate of returns. This financing mechanism should increase in investments, boost an economic growth, contribute to development of capital markets, and spread incentives to work. Moreover, the internal rate of return of the funded scheme is

predicted to be higher than internal rate of return of PAYG system under the assumption of positive economic development. Nevertheless, foundation of a funded scheme brings several severe problems. Firstly, transition costs connected to transformation of PAYG scheme to funded system are very high and coping with them is difficult task for policymakers. In addition, administrative costs related to funded schemes are on high level. Comparing several kinds of risks connected with PAYG system and funded system show that a system that will be composed from both of these financing mechanisms will be best in lowering the overall risk.

A typology of pension reforms, which is based on preserving the unfunded base or highlighting the transition to funded tier, presents four reform strategies: a parametric reform, a systematic reform consisting transition to full funded pension system, a reform based on transition to partial funded pension system, and a notional defined contribution system. None of these pension reform strategies is ideal for all countries. A pension reform strategy for specific country should be chosen with respect to country's original pension system, specific pension reform needs, and socioeconomic conditions of the country. In spite of the fact that there is no universal pension reform that would install an "ideal" pension system, a new pension system after reform should enhance characteristics like affordability, adequacy, sustainability, robustness, and equitability. The World Bank approach advocates pension system that compound five pillars: noncontributory zero pillar, contributory first pillar related to previous earnings, mandatory individual savings account as second pillar, voluntary third pillar, and non-financial forth pillar. From my point of view, this approach seems to be reasonable and efficient.

However, in reality the pension reform efforts of the EU countries are of various kinds, but generally, we can see an effort to increase the importance of the privately managed pension schemes to the prejudice of the public pension schemes. The privately managed pension schemes should increase the savings of each state and decrease the pressure on the public finance, and thus have positive effects on the economic growth, competitiveness and productivity of each member state. Another target that is common for all EU pension reform is the increase of the labor force participation among the entire population. High employment means a high contribution rate into the social security system, from which are later paid benefits in retirement and other social assistance allowances. The Joint Report on Social Protection and Social Inclusion, published in 2006 by the Commission of European Communities, points out that the group 55-64 years of age could contribute highly to an increase in labor force participation. A high percentage from this age group is currently

economically inactive, and if they became employed it would substantially improve adequacy and financial sustainability of the social security system. Many countries are considering restrictions to early retirement pension systems and raising the pension eligibility age. In addition, some EU countries are trying to adopt measures that would allow pensioners to work during the retirement years and make the system more flexible.

In spite of the efforts to make the pension system more sustainable, the EU countries want to ensure that older people will not be placed into the risk of poverty. Thus, all EU countries' pension reforms keep some kind of minimum guarantees for retirees that have not accrued sufficient pension entitlements in their own right. These minimum guarantees should be introduced in a way to help the poorest but should not discourage the working incentives.

To describe the pension systems and pension reforms in more detailed the principal component analysis of qualitative data was carried out using maximum total variance method with a cubic polynomial transformation. To perform this analysis 48 variables describing a demographic background, a retirement age and labor participation of older workers, a structure of pension system, generosity of pension system, and pension reform strategies for 23 EU countries were collected. The analysis sorted selected EU countries according to the first two principal components into three groups: red cluster, blue cluster, and green cluster.

The red cluster contains eleven countries (Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Portugal, Spain and Sweden) and its main feature is relatively high generosity of pension systems that means high median income ratios for men and women, high gross and net replacement rates, and relatively high accrual rates. The population of the red cluster can be characterized as relatively older population with dependency ratio over 25% and substantial increase of it between years 2007 and 2050. The public expenditure of countries in this cluster were usually more than 10% of GDP in 2004 but their increase until 2050 is not homogenous and it is dependent on implemented reform. The red cluster is also defined by easy excess to early retirement and relatively low employment rates of older workers. The first tier of pension system is generally sensitive to the wealth of retired people (targeted first tier) and retirees to be eligible for full retirement benefits must work 40 years or more. In all countries, occupational pension schemes are common but it is usually less developed. This fact can be seen also in the size of pension funds relative to GDP that is usually less than 10%. The most common reform strategies for the red cluster were increasing contribution period, reducing of pension benefits, and promoting of longer working life. The pension reform efforts are less aimed at promoting private pensions.

The blue cluster includes four countries (the United Kingdom, Ireland, the Netherlands, and Denmark) that can be on average characterized by relatively low generosity of pension systems, high employment rates of older workers, and well-developed private pension schemes. All countries in this cluster have high income from private funds relative to total pension income (more than 20%), substantial size of pension funds, and mandatory or well-developed occupational pension schemes. To low public expenditure in countries from blue cluster contribute higher than average employment rates of men in age group 55-64 years and high median age of retirement for men and women. The second tier of pension systems of blue cluster is flat rate. For countries belonging to this cluster is distinguishing that people with higher earnings attain less favorable replacement rates compared to people with low earnings (large difference in replacement rates of these two groups). Pension reform strategies in countries from blue cluster are targeted at enhancing the private pension schemes, further increasing of employment rates, but also at promoting adequacy of pension schemes.

The green cluster consists of eight new EU member states (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, and the Slovak Republic) that are not as homogenous as previous two clusters (in sense of generosity of pension system or labor force participation rates of older workers). Some of countries have rather generous pension system (as Hungary) whereas other countries do not (as Estonia). However, the poverty rate of older people in this cluster is the lowest on average. Common feature of countries from green cluster is lower retirement age of men and women in comparison with the rest of EU countries. The employment rates of older workers are on high level in Estonia, Latvia, and Lithuania. On the other hand, the employment rates of older workers are on very low level in Poland, Hungary, and Slovakia. Two countries from this cluster (Bulgaria and Poland) abolished the early retirement. Usual first tier in green cluster is a minimum tier that is not universal. One of the most common characteristics of pension schemes in green cluster is introduction of compulsory private funded tier inside their mandatory pension schemes (all countries from this cluster except the Czech Republic). This should enhance development of private pension schemes that is currently on low level. Other pension reform strategies include strengthening links between benefits and contributions (for example, introduction of notional accounts in Latvia and Poland).

To sum it up, we can find some common pension reform strategies in countries belonging to specific clusters. Most obvious is this fact in the red cluster and in the blue cluster. The main reform strategies of countries belonging to red cluster is lowering the

pension benefits and increasing the contribution periods. On the other hand, promoting of private pension schemes is characteristic reform strategy for countries in blue cluster.

Another interesting finding from our analysis is that pension reform strategies as promoting of private pension and pension funds are negatively correlated with generosity of pension systems (red cluster) and pension reform strategies as increase of contribution period and reduction of pension benefits are positively correlated with generosity of pension systems. Therefore, we can say that countries with more generous pension systems implement different pension reforms than countries with lower generosity of pension systems.

As was mentioned before, the performed comparative typology of pension systems and reforms sorted 23 EU countries into three clusters. It is notable that one of these three clusters contains only new EU member states. This fact shows that these countries have similar pension systems' characteristics as lower retirement age or foundation of mandatory private funded tier into their statutory pension schemes.

However, the results from the analysis do not show strict relationships among structural reforms and fiscal problems arising from severe population aging. The largest increase of pension expenditure is predicted in the Czech Republic, Greece, Hungary, Luxembourg, Portugal, and Spain. However, most of these countries have not imposed structural reforms yet to avoid such a high increase in public pension expenditures. From this point of view, it seems that structural pension reforms are not driven by problems arising from population aging. Therefore, the explanation why the structural reforms are implemented in some countries and in some not must be hidden somewhere else. More likely, a driven force of structural pension reforms is connected with political will and a way how pension systems are reforming is most likely path dependent. This also brings explanation why the EU does not advocate particular types of pension reform in their member countries. Each country is unique in its economy, social policy, history, and culture. However, the EU tries to keep track of different pension reforms by requiring each country to publish the National Report on its progress on the pension reform. An exchange of knowledge and examples of good practice among member states can lead to the best working pension systems in the EU countries, which will help in promoting economic growth and further cooperation in this community.

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ANNEX

ANNEX 1 – Raw data in analysis

ANNEX 2 – Categorical data in analysis

ANNEX 3 – Explanation of creating categories

ANNEX 4 – Output from SAS

ANNEX 1 - Raw data in analysis

Annex table 1: Raw data describing demographic characteristic

Country	Abbreviation	olddep_2007	dif_olddep2007_1970	dif_olddep2050_2007	exp_2004	exp_2004_2050
Austria	AT	25	110,1	201,7	13,4	-1,2
Belgium	BE	25,9	122,2	169,4	10,4	5,1
Bulgaria	BG	24,9	177,9	222,7	9,1	-1,2
Czech Republic	CZ	20,2	112,8	204,5	8,5	5,6
Denmark	DK	23,2	122,8	243,2	9,5	3,3
Estonia	EE	25,1	141,8	188,0	6,7	-2,5
Finland	FI	24,8	182,4	162,9	10,7	3,1
France	FR	24,9	113,2	228,9	12,8	2,0
Germany	DE	29,9	139,7	196,3	11,4	1,7
Greece	EL	27,6	160,5	161,9	12,2	12,4
Hungary	HU	23,2	136,5	255,3	10,4	6,7
Ireland	IE	16,2	83,9	232,4	4,7	6,4
Italy	IT	30,2	180,8	169,5	14,2	0,4
Latvia	LV	24,8	137,8	206,2	6,8	-1,2
Lithuania	LT	22,7	142,8	166,6	6,7	1,8
Luxembourg	LU	20,7	108,4	245,6	10,0	7,4
Netherlands	NL	21,5	132,7	212,1	7,7	3,5
Poland	PL	19	150,8	254,3	13,9	-5,9
Portugal	PT	25,6	171,8	217,5	11,1	9,7
Slovak Republic	SK	16,5	114,6	327,3	7,2	1,8
Spain	ES	24,2	159,2	229,2	8,6	7,1
Sweden	SE	26,4	127,5	176,6	10,6	0,6
United Kingdom	UK	24,1	117,6	173,9	6,6	2,0

Annex table 2: Raw data describing retirement age and labor participation of older workers, part 1

Country	normal_age_men	normal_age_women	early_age_men	early_age_women	median_age_men	median_age_women
Austria	65	60	62	60	59,6	56,4
Belgium	65	65	60	60	60,9	56,8
Bulgaria	63	60	66	66	60,9	57,6
Czech Republic	63	59–63	60	56–60	61,0	57,2
Denmark	65	65	66	66	62,2	60,1
Estonia	63	59,5	60	56,5	65,0	61,4
Finland	63-68	63-68	60	60	61,5	60,7
France	65	62	55	55	58,8	58,3
Germany	65	65	63	60	61,6	59,9
Greece	65	65	57	57	61,7	58,4
Hungary	62	62	60	57	58,4	57,2
Ireland	65	65	66	66	64,4	61,5
Italy	65	60	57	57	58,4	57,2
Latvia	62	62	60	58,5	61,6	60,3
Lithuania	62,5	60	57,5	55	63,4	59,8
Luxembourg	65	65	57	57	57,7	58,7
Netherlands	65	65	66	66	60,5	59,3
Poland	65	60	66	66	57,0	55,2
Portugal	60,5	60,5	55	55	64,2	61,4
Slovak Republic	62	62	any age	any age	60,2	55,5
Spain	65	65	60	60	62,6	59,5
Sweden	61 and more	61 and more	61	61	63,9	63,3
United Kingdom	65	60	66	66	63,8	60,3

Annex table 3: Raw data describing retirement age and labor participation of older workers, part 2

Country	take_up_early	act_rt_55_64	emp_55_64_m	emp_55_64_w	reduc_early	increase_after	earnings_limit
Austria	low	39,8	49,8	28	4,2	4,2	no after 65
Belgium	high	35,9	42,9	26	none	2	yes
Bulgaria	medium	45,7	51,8	34,5	n,a,	none	no
Czech Republic	low	48,2	59,6	33,5	3,6	6	no after 63
Denmark	medium	60,8	64,9	52,4	9	7	no
Estonia	medium	62,2	59,4	60,5	4,8	10,8	no afte 63
Finland	high	58,8	55,1	55	7,2	4,5	no
France	medium	40,4	40,5	36,2	0,5	3	yes
Germany	low	57,5	59,7	43,6	3,6	6	no after 65
Greece	high	43,9	59,1	26,9	4,5	3	yes
Hungary	high	34,5	41,7	26,2	6	6	no
Ireland	low	55,2	67,9	39,6	n,a,	none	yes
Italy	medium	34,6	45,1	23	actuarial reduction	actuarial increase	yes
Latvia	low	60,3	64,6	52,4	actuarial reduction	actuarial increase	no
Lithuania	high	55,6	60,8	47,9	4,8	8	no
Luxembourg	high	32,7	35,6	28,6	none	7	yes
Netherlands	high	52,8	61,5	40,1	n,a,	none	no
Poland	high	31,8	41,4	19,4	n,a,	actuarial increase	no after 65
Portugal	low	54,4	58,6	44	4,5	10	no
Slovak Republic	medium	38,8	52,5	21,2	6	6	no
Spain	low	47,4	60	30	8	2	yes
Sweden	high	72,8	72,9	67	actuarial reduction	actuarial increase	no
United Kingdom	medium	59,3	66,3	48,9	n,a,	10,4	no

Annex table 4: Raw data describing structure of pension system, part 1

Country	pension_base	first_tier	second_tier	funded_tier	contr_of_private	private_income
Austria	best 15	targeted	DB	0	45	new
Belgium	lifetime average	targeted	DB	0	45	5-20%
Bulgaria	final 15	targeted + minimum	DB	1	54	new
Czech Republic	30 years	targeted + minimum+ basic	DB	0	40	new
Denmark	flat	targeted + basic	flat	0	95	more than 20%
Estonia	points from whole career	targeted + basic	points	1	83	new
Finland	Final 10 years	targeted	DB	0	17	less 5
France	Best 20 years	targeted+basic	DB + points	0	18	less 5
Germany	points from whole career	targeted	points	0	83	5-20%
Greece	Final 5 years	targeted+basic	DB	0	nearly 0	new
Hungary	lifetime average	minimum	DB	1	60	new
Ireland	lifetime average	targeted+basic	flat	0	52	more than 20%
Italy	lifetime average (notional accounts)	targeted	nacs	0	10	new
Latvia	lifetime average (notional accounts)	minimum	nacs	1	48	new
Lithuania	lifetime average	basic	DB	1	62	new
Luxembourg	lifetime average	targeted + minimum+ basic	DB	0	25	less 5
Netherlands	Lifetime average	targeted + basic	flat	0	90	more than 20%
Poland	lifetime average (notional accounts)	minimum	nacs	1	49	new
Portugal	Best 10 out of final 15 years	targeted + minimum	DB	0	5,5	5-20%
Slovak Republic	points from whole career	minimum	points	1	27	new
Spain	final 15 years	minimum	DB	0	54	less 5
Sweden	lifetime average (notional accounts)	targeted	nacs	1	90	5-20%
United Kingdom	lifetime average	targeted + minimum+ basic	flat	0	50	more than 20%

Annex table 5: Raw data describing structure of pension system, part 2

Country	funds_GDP	occup_pension	civil_servant	nmb_years_full_pension	tot_contrib
Austria	4,7	1	0	45	22,8
Belgium	4,2	1	1	45	37,9
Bulgaria	less than 5	0	0	37	26,5
Czech Republic	4,1	0	0	25	28
Denmark	33,6	2	0	40	13,6
Estonia	less than 5	0	0	15	22
Finland	66,1	2	0	no max	26,1
France	5,8	2	0	40	26,15
Germany	3,9	1	0	no max	23,5
Greece	0,6	1	0	15	20
Hungary	8,5	0	0	38	33,5
Ireland	52,8	2	1	40	30
Italy	2,8	1	0	40	39,6
Latvia	0,4	0	0	no max	27
Lithuania	less than 5	0	0	30	26
Luxembourg	4,6	1	0	40	24
Netherlands	124,9	2	0	50	21,5
Poland	8,7	0	0	no max	29,7
Portugal	12,9	1	0	40	34,75
Slovak Republic	0,6	0	0	no max	28,75
Spain	9,1	1	1	35	28,3
Sweden	14,5	2	0	no max	30,9
United Kingdom	70,1	2	1	no max	36,9

Annex table 6: Raw data describing generosity of pension system, part 1

Country	gross_repl	net_repl_low	net_repl_avg	net_repl_high	poverty	index_2tier
Austria	78,3	91,2	93,2	79,3	16	prices
Belgium	40,7	82,7	63,1	42,7	23	hybrid
Bulgaria	49,7	67,1	75,2	52,9	18	hybrid
Czech Republic	44,4	88,3	58,2	35,3	6	earnings
Denmark	43,3	95,6	54,1	35,5	17	earnings
Estonia	51,6	59,9	60,9	61,5	25	hybrid
Finland	63,3	87,3	71,5	123,1	22	hybrid
France	52,9	98,0	68,8	59,2	16	prices
Germany	45,8	61,7	71,8	67,0	13	hybrid
Greece	84,0	99,9	99,9	99,9	26	hybrid
Hungary	75,4	86,6	90,5	92,6	9	hybrid
Ireland	30,6	63,0	36,6	21,9	27	different
Italy	78,8	89,3	88,8	89,1	22	prices
Latvia	58,2	89,2	81,8	74,1	30	hybrid
Lithuania	53,4	81,7	71,3	64,9	22	different
Luxembourg	101,9	125,0	109,8	104,2	8	earnings
Netherlands	68,3	82,5	84,1	83,8	6	hybrid
Poland	56,9	69,6	69,7	70,5	8	prices
Portugal	66,7	115,9	79,8	86,3	26	hybrid
Slovak Republic	48,6	58,2	60,2	65,7	8	hybrid
Spain	81,2	88,7	88,3	83,4	31	prices
Sweden	64,8	90,2	68,2	74,3	12	prices
United Kingdom	37,1	78,4	47,6	29,8	28	hybrid

Annex table 7: Raw data describing generosity of pension system, part 2

Country	entitlement_first	accrual	median_income_m	median_income_w	inequality
Austria	37	1,78	1,02	0,91	3,9
Belgium	38	1,5	0,74	0,73	3
Bulgaria	16	1	0,97	0,84	3,6
Czech Republic	12	0,45	0,85	0,81	2,3
Denmark	34	n,a,	0,72	0,70	2,5
Estonia	14	0,5	0,76	0,70	3,3
Finland	21	1,5	0,81	0,71	3
France	31	1,75	0,93	0,88	4,5
Germany	24	1	0,96	0,91	3,5
Greece	40	2,57	0,83	0,78	5
Hungary	22	1,22	1,07	0,97	2,6
Ireland	31	1,25	0,66	0,65	3,4
Italy	22	1,75	0,87	0,84	4,5
Latvia	33	0,6	0,77	0,73	3,9
Lithuania	17	0,5	0,90	0,75	3,5
Luxembourg	46	1,85	0,95	0,99	3,1
Netherlands	34	1,75	0,88	0,88	3,3
Poland	24	0,67	1,20	1,02	3,6
Portugal	44	2,25	0,77	0,76	5,7
Slovak Republic	22	1,19	0,90	0,82	2,5
Spain	33	3	0,77	0,76	4,4
Sweden	34	1,21	0,87	0,76	2,6
United Kingdom	33	0,89	0,75	0,72	4,2

Annex table 8: Raw data describing pension reforms

Country	inc_retirement	longer_emp	partial_retir	reduc_benefit	inc_contrib_period	promoting_private	more_funding	link_bw_cb
Austria	1	1	0	1	1	0	1	1
Belgium	1	1	1	1	1	1	1	0
Bulgaria	1	0	0	0	1	0	1	1
Czech Republic	1	0	0	0	0	0	1	0
Denmark	1	0	1	0	0	1	1	0
Estonia	0	1	0	0	0	1	1	1
Finland	0	1	1	1	1	0	1	1
France	0	1	1	1	1	0	0	1
Germany	1	1	1	1	1	1	1	1
Greece	1	0	0	1	1	0	0	0
Hungary	0	0	0	0	0	0	1	1
Ireland	0	0	0	0	0	1	1	0
Italy	0	1	0	1	1	0	1	0
Latvia	1	1	0	0	0	1	1	1
Lithuania	1	0	0	0	0	0	1	1
Luxembourg	0	0	1	1	1	0	0	0
Netherlands	0	1	0	0	0	1	1	0
Poland	0	1	0	0	0	1	1	1
Portugal	0	0	0	1	1	0	0	0
Slovak Republic	1	0	0	0	0	1	1	1
Spain	1	0	1	1	1	0	0	0
Sweden	1	1	1	0	0	1	0	1
United Kingdom	1	1	0	1	0	1	1	0

ANNEX 2 - Categorical data in analysis

Annex table 9: Categorical data describing demographic characteristic

Country	Abbreviation	olddep_2007	dif_olddep2007_1970	dif_olddep2050_2007	exp_2004	exp_2004_2050
Austria	AT	2	1	2	4	1
Belgium	BE	3	2	1	3	3
Bulgaria	BG	2	4	3	2	1
Czech Republic	CZ	2	1	2	2	3
Denmark	DK	2	2	3	2	3
Estonia	EE	3	3	2	1	1
Finland	FI	2	4	1	3	3
France	FR	2	1	3	4	2
Germany	DE	3	2	2	3	2
Greece	EL	3	4	1	3	4
Hungary	HU	2	2	4	3	3
Ireland	IE	1	1	3	1	3
Italy	IT	3	4	1	4	2
Latvia	LV	2	2	2	1	1
Lithuania	LT	2	3	1	1	2
Luxembourg	LU	2	1	3	2	4
Netherlands	NL	2	2	2	2	3
Poland	PL	1	3	4	4	1
Portugal	PT	3	4	2	3	4
Slovak Republic	SK	1	1	4	1	2
Spain	ES	2	3	3	2	4
Sweden	SE	3	2	1	3	2
United Kingdom	UK	2	1	1	1	2

Annex table 10: Categorical data describing retirement age and labor participation of older workers, part 1

Country	normal_age_men	normal_age_w	early_age_men	early_age_w	median_age_men	median_age_w
Austria	2	1	3	2	1	1
Belgium	2	3	2	2	2	1
Bulgaria	1	1	4	4	2	1
Czech Republic	1	2	2	1	2	1
Denmark	2	3	4	4	3	3
Estonia	1	1	2	1	3	3
Finland	3	3	2	2	2	3
France	2	2	1	1	1	2
Germany	2	3	3	2	2	2
Greece	2	3	1	1	2	2
Hungary	1	2	2	1	1	1
Ireland	2	3	4	4	3	3
Italy	2	1	1	1	1	1
Latvia	1	2	2	1	2	3
Lithuania	1	1	1	1	3	2
Luxembourg	2	3	1	1	1	2
Netherlands	2	3	4	4	2	2
Poland	2	1	4	4	1	1
Portugal	1	1	1	1	3	3
Slovak Republic	1	2	1	1	2	1
Spain	2	3	2	2	3	2
Sweden	3	3	3	3	3	3
United Kingdom	2	1	4	4	3	3

Annex table 11: Categorical data describing retirement age and labor participation of older workers, part 2

Country	act_rt_55_64	emp_55_64_m	emp_55_64_w	reduc_early	increase_after	earnings_limit	take_up_early
Austria	1	2	2	2	2	3	1
Belgium	1	1	2	1	2	4	3
Bulgaria	2	2	3	5	1	1	2
Czech Republic	2	3	3	2	3	2	1
Denmark	4	4	5	3	3	1	2
Estonia	4	3	5	3	4	2	2
Finland	3	3	5	3	2	1	3
France	2	1	3	2	2	4	2
Germany	3	3	4	2	3	3	1
Greece	2	3	2	2	2	4	3
Hungary	1	1	2	3	3	1	3
Ireland	3	5	3	5	1	4	1
Italy	1	2	1	4	5	4	2
Latvia	4	4	5	4	5	1	1
Lithuania	3	4	4	3	4	1	3
Luxembourg	1	1	2	1	3	4	3
Netherlands	3	4	4	5	1	1	3
Poland	1	1	1	5	5	3	3
Portugal	3	3	4	2	4	1	1
Slovak Republic	1	2	1	3	3	1	2
Spain	2	3	2	3	2	4	1
Sweden	4	5	5	4	5	1	3
United Kingdom	3	5	4	5	4	1	2

Annex table 12: Categorical data describing structure of pension system, part 1

Country	pension_base	first_tier_targeted	first_tier_minimum	first_tier_basic	second_tier	funded_tier	contr_of_private
Austria	1	2	1	1	1	1	2
Belgium	2	2	1	1	1	1	2
Bulgaria	1	2	2	1	1	2	3
Czech Republic	1	2	2	2	1	1	2
Denmark	5	2	1	2	2	2	4
Estonia	4	2	1	2	3	2	4
Finland	1	2	1	1	1	1	1
France	1	2	1	2	1	1	1
Germany	4	2	1	1	3	1	4
Greece	1	2	1	2	1	1	4
Hungary	2	1	2	1	1	2	3
Ireland	2	2	1	2	2	1	3
Italy	3	2	1	1	4	1	1
Latvia	3	1	2	1	4	2	2
Lithuania	2	1	1	2	1	2	3
Luxembourg	2	2	2	2	1	1	2
Netherlands	2	2	1	2	2	2	4
Poland	3	1	2	1	4	2	2
Portugal	1	2	2	1	1	1	1
Slovak Republic	4	1	2	1	3	2	2
Spain	1	1	2	1	1	1	3
Sweden	3	2	1	1	4	2	4
United Kingdom	2	2	2	2	2	1	2

Annex table 13: Categorical data describing structure of pension system, part 2

Country	private_income	funds_GDP	occup_pension	civil_servant	nmb_years_full_pension	tot_contrib
Austria	1	1	2	1	5	1
Belgium	3	1	2	2	5	3
Bulgaria	1	1	1	1	3	2
Czech Republic	1	1	1	1	2	2
Denmark	4	2	3	1	4	1
Estonia	1	1	1	1	2	1
Finland	2	3	3	1	1	2
France	2	2	3	1	4	2
Germany	3	1	2	1	1	1
Greece	1	1	2	1	2	1
Hungary	1	2	1	1	3	3
Ireland	4	3	3	2	4	3
Italy	1	1	2	1	4	3
Latvia	1	1	2	1	1	2
Lithuania	1	1	1	1	3	2
Luxembourg	2	1	2	1	4	1
Netherlands	4	3	3	1	5	1
Poland	1	2	1	1	1	2
Portugal	3	2	2	1	4	3
Slovak Republic	1	1	1	1	1	2
Spain	2	2	2	2	3	2
Sweden	3	2	3	1	1	3
United Kingdom	4	3	3	2	1	3

Annex table 14: Categorical data describing generosity of pension system, part 1

Country	gross_repl	net_repl_low	net_repl_avg	net_repl_high	poverty	index_2tier
Austria	4	4	4	3	2	3
Belgium	1	3	2	1	3	2
Bulgaria	2	2	2	2	2	2
Czech Republic	1	3	1	1	1	1
Denmark	1	4	1	1	2	1
Estonia	2	1	2	2	4	2
Finland	3	3	2	5	3	2
France	2	4	2	2	2	3
Germany	2	2	2	2	2	2
Greece	4	4	4	4	4	2
Hungary	4	3	4	4	1	2
Ireland	1	2	1	1	4	4
Italy	4	3	3	3	3	3
Latvia	2	3	3	2	4	2
Lithuania	2	3	2	2	3	4
Luxembourg	5	5	5	5	1	1
Netherlands	3	3	3	3	1	2
Poland	2	2	2	2	1	3
Portugal	3	5	2	3	4	2
Slovak Republic	2	1	2	2	1	2
Spain	4	3	3	3	4	3
Sweden	3	4	2	2	2	3
United Kingdom	1	2	1	1	4	2

Annex table 15: Categorical data describing generosity of pension system, part 2

Country	entitlement_first	accrual	median_income_m	median_income_w	inequality
Austria	4	3	5	4	3
Belgium	4	3	2	2	2
Bulgaria	1	2	4	3	3
Czech Republic	1	1	3	3	1
Denmark	3	1	2	2	1
Estonia	1	1	2	2	2
Finland	2	3	3	2	2
France	3	3	4	3	4
Germany	2	2	4	4	3
Greece	4	4	3	2	4
Hungary	2	2	5	4	1
Ireland	3	2	1	1	2
Italy	2	3	3	3	4
Latvia	3	1	2	2	3
Lithuania	1	1	4	2	3
Luxembourg	4	3	4	4	2
Netherlands	3	3	3	3	2
Poland	2	1	5	5	3
Portugal	4	4	2	2	4
Slovak Republic	2	2	4	3	1
Spain	3	4	2	2	4
Sweden	3	2	3	2	1
United Kingdom	3	1	2	2	4

Annex table 16: Categorical data describing pension reforms

Country	inc_retirement	longer_emp	partial_retir	reduc_benefit	inc_contrib_period	promoting_private	more_funding	link_bw_cb
Austria	2	2	1	2	2	1	2	2
Belgium	2	2	2	2	2	2	2	1
Bulgaria	2	1	1	1	2	1	2	2
Czech Republic	2	1	1	1	1	1	2	1
Denmark	2	1	2	1	1	2	2	1
Estonia	1	2	1	1	1	2	2	2
Finland	1	2	2	2	2	1	2	2
France	1	2	2	2	2	1	1	2
Germany	2	2	2	2	2	2	2	2
Greece	2	1	1	2	2	1	1	1
Hungary	1	1	1	1	1	1	2	2
Ireland	1	1	1	1	1	2	2	1
Italy	1	2	1	2	2	1	2	1
Latvia	2	2	1	1	1	2	2	2
Lithuania	2	1	1	1	1	1	2	2
Luxembourg	1	1	2	2	2	1	1	1
Netherlands	1	2	1	1	1	2	2	1
Poland	1	2	1	1	1	2	2	2
Portugal	1	1	1	2	2		1	1
Slovak Republic	2	1	1	1	1	2	2	2
Spain	2	1	2	2	2	1	1	1
Sweden	2	2	2	1	1	2	1	2
United Kingdom	2	2	1	2	1	2	2	1

ANNEX 3 - Explanation of creating categories

Annex table 17: Demographic variables

Variable	Definition of categories	Explanation and source of variable
olddep_2007	1'<20, '2'=between 20 and 25, '3'>25	Old dependency ratio 1st variant (population 65 and over to population 15 to64 years) (in %) Eurostat
dif_olddep 2007_1970	1'<120, '2'= between 120 and 140, '3'=between 140 and 160, '4'>160	Old age dependency ratio in 2007 in percentages of old age dependency ratio in 1970, Eurostat
dif_oldep 2007-2050	1'<180, '2'= between 180 and 220, '3'=between 220 and 250, '4'>250	Old age dependency ratio in 2050 in percentages of old age dependency ratio in 2007, Eurostat
public_expenditure_2004	1'<7,5, '2'= between 7,5 and 10, '3'=between 10 and 12,5, '4'>12,5	Gross Public Pension Expenditures as a Share of GDP, Economic Policy Committee (2006)
change_expenditure_2004-2030	1'<0, '2'= between 0 and 2, '3'=between 2 and 4, '4'>4	Change in public pension expenditure between 2004 and 2030, Economic Policy Committee (2006)
change_expenditure_2030-2050	1'<0, '2'= between 0 and 2, '3'=between 2 and 4, '4'>4	Change in public pension expenditure between 2030 and 2050, Economic Policy Committee (2006)
change_expenditure_2004-2050	1'<0, '2'= between 0 and 3, '3'=between 3 and 7, '4'>7	Change in public pension expenditure between 2004 and 2050, Economic Policy Committee (2006)

Annex table 18: Variables describing retirement age and labor participation of older workers

Variable	Definition of categories	Explanation and source of variable
normal_age_men	1'<65, '2'=65, '3' = more than 65 or flexible retirement age	Standard retirement age of men in 2005, European Commission 2007
normal_age_women	1'<62, '2'= between 62 and 64, '3' = 65 and more	Standard retirement age of women in 2005, European Commission 2007
early_age_men	1'<60, '2' = 60, '3' = 60 and more, '4' = not applicable	Early retirement age of men in 2005, European Commission 2007
early_age_women	1'<60, '2' = 60, '3' = 60 and more, '4' = not applicable	Early retirement age of women in 2005, European Commission 2007
median_age_men	1'<60, '2'= between 60 and 62, '3' >62	Median retirement age of men in 2005, Eurostat
median_age_women	1'<58, '2'= between 58 and 60, '3' = 60 and more	Median retirement age of women in 2005, Eurostat
take_up	1'=low (less than 10%), '2'= medium (between 10% to 20%), '3' = high (more than 20%)	Take up of early retirement as a share of population 55-64 years, Social Protection Committee (2008a)
act_rt_55_64_2007	1'<40, '2'= between 40 and 50, '3'=between 50 and 60, '4'>60	Activity rates of people 55-64 years old in 2007 (in %), Eurostat
emp_rt_55_64_m	1'<45, '2'= between 45 and 55, '3'=between 55 and 60, '4' = between 60 and 65, '5'>65	Employment rate of men 55-64 years old in 2007 (in %), Eurostat
emp_rt_55_64_w	1'<25, '2'= between 25 and 30, '3'=between 30 and 40, '4' = between 40 and 50, '5'>50	Employment rate of women 55-64 years old in 2007 (in %), Eurostat
reduce_early	1'=none, '2'= less than 4,6, '3'= 4,6 and more, '4' = actuarial reduction, '5' = not applicable	Reduction from the normal old-age pension if early retirement (in % per year), European Commission (2007)
increase_after	1'=none, '2'= less than 5, '3'= between 5 and 8, '4' = 8 and more, '5' = actuarial increase	Increased pension accrual after the normal retirement age in 2005, European Commission (2007)
earnings_limit	1'=yes, '2'= no after 63 years, '3'= no after 65 years, '4' = no	Limit of earnings if working after retirement, Social Protection Committee (2007)

Annex table 19: Variables describing structure of pension system

Variable	Definition of categories	Explanation and source of variable
pension_base	1'= several years from working life, '2' = lifetime average, '3' = lifetime average (notional accounts), '4' = points from whole career, '5' = flat	Pension base in 2005, European Commission (2007)
first_tier_targeted	1' = no, '2' = yes	Type of first pension tier, OECD (2005)
first_tier_minimum	1' = no, '2' = yes	Type of first pension tier, OECD (2005)
first_tier_basic	1' = no, '2' = yes	Type of first pension tier, OECD (2005)
second_tier	1'= DB, '2' = flat, '3' = points, '4' = notional accounts	Type of second pension tier, OECD (2005)
funded_tier	1' = no, '2' = yes	Presence of funded tier in statutory scheme, Social protection committee (2008b)
contr_of_private	1'<20, '2'= between 20 and 50, '3'=between 50 and 80, '4' > 80	Percentage of workers contributing to private or occupational private pension funds, Economic Policy Committee (2006)
private_income	1' = countries who accepted private funds recently, '2' = less than 5% of pension income, '3' = between 5% and 20% of pension income, '4' = more than 20% of income	Income from private fund as a percentage from total pension income, Economic Policy Committee (2006)
funds_GDP	1'<5, '2' = between 5 and 50, '3' > 50	The size of pension funds relative to GDP in 2005 , OECD (2006b)
occup_pension	1' = none, '2'= moderate, '3' = spread or mandatory	Presence of occupational pension scheme, European Communities (2002) and European Commission (2007)
civil_servant	1' = no, '2' = yes	Special schemes for civil servants, European Commission (2007)
nmb_years_full_pension	1'=no max, '2'= 25 years and less, '3'= between 30 and 40 years, '4' = 40 years, '5' = more than 40 years	Number of years needed for full pension, European Commission (2007)
tot_contrib	1' < 25, '2'= between 25 and 30, '3' = 30 and more	Total pension/social security contribution (as % of gross wage), Social protection committee (2008b) and European Commission (2007)

Annex table 20: Variables describing generosity of pension system

Variable	Definition of categories	Explanation and source of variable
gross_repl	1'<45, '2'= between 45 and 60, '3'=between 60 and 75, '4'=between 75 and 100, '5' > 100	Gross replacement rate, OECD (2005)
net_repl_low	1'<60, '2'= between 60 and 80, '3'=between 80 and 90, '4'=between 90 and 100, '5' > 100	Net replacement rate for low earners, OECD (2005) and the Social Protection Committee (SPC) (2006)
net_repl_avg	1'<60, '2'= between 60 and 80, '3'=between 80 and 90, '4'=between 90 and 100, '5' > 100	Net replacement rate for average earners, OECD (2005) and the Social Protection Committee (SPC) (2006)
net_repl_high	1'<50, '2'= between 50 and 75, '3'=between 75 and 90, '4'=between 90 and 100, '5' > 102	Net replacement rate for high earners, OECD (2005) and the Social Protection Committee (SPC) (2006)
poverty	1'<10, '2'= between 10 and 20, '3'=between 20 and 25, '4' > 25	Poverty ratio of people 65+ (ceiling at 60% of the median) in 2006, Eurostat
index_2tier	1' = earnings, '2'= hybrid, '3' = prices, '4' = different	Indexation of the second tier, European Commission (2007)
entitlement_first	1' < 20, '2'= between 20 and 30, '3' = between 30 and 35, '4' = 35 and more	Overall entitlement from first tier (full-career worker) (as % of average earnings), OECD (2005)
accrual	1' < 1, '2'= between 1 and 1,5, '3' = between 1,5 and 2, '4' = 2 and more	Accrual rate of pension (as % of individual earnings), OECD (2005) and European Commission (2007)
median_income_m	1' < 0,7, '2'= between 0,7 and 0,8, '3'= between 0,8 and 0,9, '4' = between 0,9 and 1, '5' = more than 1	Relative median income ratio (65+) for men in 2005, Eurostat
median_income_w	1' < 0,7, '2'= between 0,7 and 0,8, '3'= between 0,8 and 0,9, '4' = between 0,9 and 1, '5' = more than 2	Relative median income ratio (65+) for women in 2005, Eurostat
inequality	1'<3, '2' = between 3 and 3,5, '3' = between 3,5 and 4, '4' = more than 4	Inequality of income distribution S80/S20 income quintile share ratio for people older 65 years in 2005, Eurostat

Annex table 21: Variables describing pension reforms

Variable	Definition of categories	Explanation and source of variable
inc_retirement	1' = no, '2' = yes	Increasing retirement age, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
longer_emp	1' = no, '2' = yes	Promoting longer employment, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
partial_retir	1' = no, '2' = yes	Partial retirement, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
reduc_benefit	1' = no, '2' = yes	Reduction benefits, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
inc_contrib_period	1' = no, '2' = yes	Raise in contribution period, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
promoting_private	1' = no, '2' = yes	Promoting private scheme, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
more_funding	1' = no, '2' = yes	More funded schemes, European Commission (2007), European Commission (2006), International Social Security Agency (2004)
link_bw_cb	1' = no, '2' = yes	Stricter link between contributions and benefits, European Commission (2007), European Commission (2006), International Social Security Agency (2004)

ANNEX 4 – Output from SAS

Annex table 22: Output from PROC PRINQUAL, SAS program

PRINQUAL MTV Algorithm Iteration History					
Iteration Number	Average Change	Maximum Change	Proportion of Variance	Criterion Change	Note
1	0.24145	2.04563	0.38547		
2	0.06532	0.82608	0.44464	0.05917	
3	0.03616	0.44413	0.45276	0.00812	
4	0.02640	0.28370	0.45614	0.00338	
5	0.01984	0.26003	0.45793	0.00179	
6	0.01479	0.21060	0.45897	0.00104	
7	0.01137	0.17334	0.45958	0.00061	
8	0.00894	0.16098	0.45996	0.00038	
9	0.00720	0.13989	0.46020	0.00025	
10	0.00595	0.12140	0.46038	0.00017	
11	0.00503	0.10465	0.46051	0.00013	
12	0.00434	0.08829	0.46061	0.00010	
13	0.00380	0.07359	0.46068	0.00008	
14	0.00337	0.06101	0.46075	0.00006	
15	0.00304	0.05056	0.46080	0.00005	
16	0.00277	0.04731	0.46085	0.00005	
17	0.00257	0.04896	0.46089	0.00004	
18	0.00243	0.05035	0.46093	0.00004	
19	0.00235	0.05142	0.46097	0.00004	
20	0.00230	0.05207	0.46101	0.00004	
21	0.00227	0.05221	0.46105	0.00004	
22	0.00228	0.05178	0.46109	0.00004	
23	0.00229	0.05205	0.46114	0.00005	
24	0.00232	0.05434	0.46119	0.00005	
25	0.00237	0.05759	0.46124	0.00005	
26	0.00245	0.06177	0.46129	0.00005	
27	0.00254	0.06557	0.46135	0.00006	
28	0.00262	0.06891	0.46141	0.00006	
29	0.00270	0.07176	0.46147	0.00006	
30	0.00278	0.07408	0.46153	0.00006	Not Converged

WARNING: Failed to converge, however criterion change is less than 0.0001.

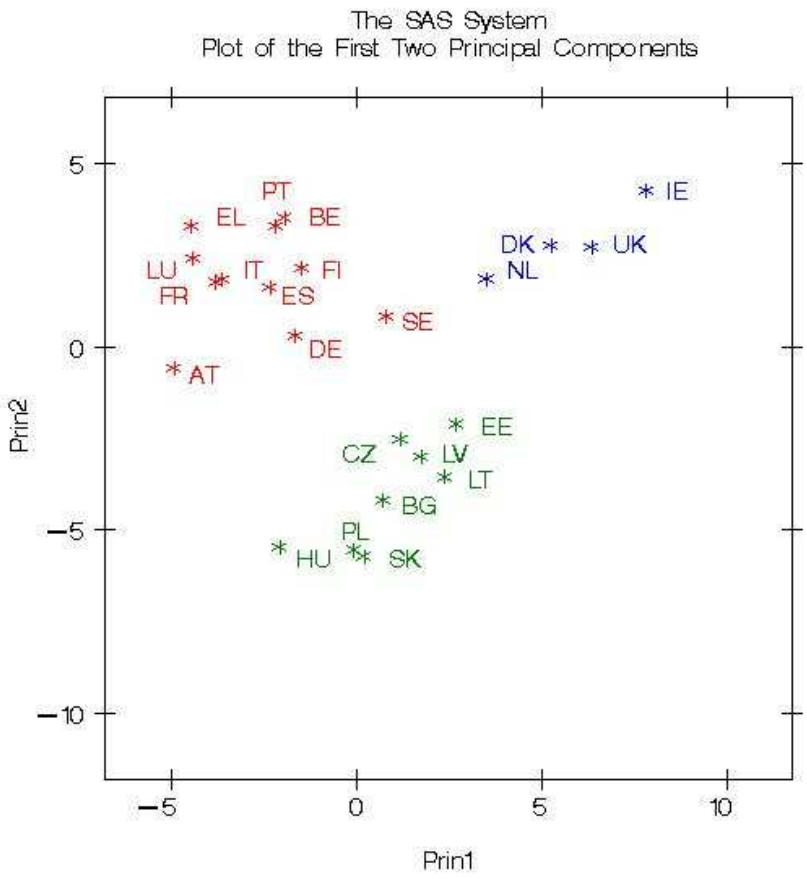
Annex table 23: Part of output from PROC PRINCOMP, SAS program

Eigenvalues of the Correlation Matrix				
	Eigenvalue	**Difference**	**Proportion**	**Cumulative**
1	12.4745690	1.8691910	0.2495	0.2495
2	10.6053780	6.7633975	0.2121	0.4616
3	3.8419805	0.3067820	0.0768	0.5384
4	3.5351984	0.7496868	0.0707	0.6091
5	2.7855116	0.2765593	0.0557	0.6649
6	2.5089523	0.1630134	0.0502	0.7150
7	2.3459389	0.6579818	0.0469	0.7620
8	1.6879571	0.1563373	0.0338	0.7957
9	1.5316198	0.0400725	0.0306	0.8263
10	1.4915472	0.2187921	0.0298	0.8562
11	1.2727552	0.2680329	0.0255	0.8816
12	1.0047223	0.0906401	0.0201	0.9017
13	0.9140822	0.0991997	0.0183	0.9200
14	0.8148825	0.2082966	0.0163	0.9363
15	0.6065858	0.0775412	0.0121	0.9484
16	0.5290447	0.0729910	0.0106	0.9590
17	0.4560537	0.0163088	0.0091	0.9681

Annex table 24: Eigenvectors from PROC PRINCOMP

Eigenvectors									
	Prin1	Prin2	Prin3	Prin4	Prin5	Prin6	Prin7	Prin8	Prin9
olddep_2007	-.103470	0.118132	-.264350	0.061605	0.024926	0.079336	-.174066	0.199862	0.169288
dif_olddep2007_1970	-.083361	0.103615	-.073641	0.098159	-.290377	-.162510	0.020176	-.055724	0.220830
dif_olddep2050_2007	-.019165	-.222846	0.181885	0.049986	-.051642	0.084765	0.092553	0.090717	0.173849
exp_2004	-.201669	0.059876	0.073381	0.212058	0.041304	0.065727	-.033503	-.125558	0.115768
exp_2004_2050	-.092195	0.168636	0.027200	-.304880	-.158661	0.127561	0.062588	-.155130	0.072872
norm_age_m	-.035855	0.204168	0.204846	0.149626	0.242899	0.044980	0.078758	-.112547	-.106696
norm_age_w	0.015766	0.206312	0.059438	-.038500	0.195450	0.226952	0.063075	-.073975	-.056412
early_age_m	0.202651	0.000779	0.222070	0.099899	0.009989	-.076554	0.103932	-.141171	0.098171
early_age_w	0.200489	0.003199	0.192460	0.118098	-.101840	0.026551	0.073388	-.144872	0.121426
median_age_m	0.182397	0.084236	-.234169	-.193240	0.069620	0.041242	0.013380	-.021817	0.134377
median_age_w	0.141210	0.141695	-.261875	0.018818	0.002940	0.153100	0.138071	-.050929	0.082505
take_up_early	-.066726	0.018227	0.065479	-.118399	0.113994	0.393923	0.106213	-.044868	-.013488
act_rt_55_64	0.180607	0.089995	-.282275	0.077278	0.002241	0.183837	0.080737	-.061668	0.016041
emp_55_64_m	0.220172	0.094932	-.109763	-.031743	0.087453	0.179031	0.046534	-.048971	0.080613
emp_55_64_w	0.179848	0.008639	-.281929	0.192062	-.106900	-.009427	-.036263	-.208059	-.054573
reduc_early	0.194004	-.091330	0.078735	0.060735	0.003107	-.040783	0.346352	-.070743	0.008302
increase_after	0.192341	-.065172	-.016147	0.025445	-.277850	0.091705	0.025748	0.096612	0.103189
earnings_limit	-.115825	0.165891	0.179915	-.142149	0.081021	-.112405	0.105070	0.108371	-.222582
pension_base	0.154310	0.052294	0.202911	-.026214	0.021434	0.244987	-.193791	0.111889	-.085680
first_tier_targeted	0.000645	0.205916	-.053835	0.215256	-.134352	-.066670	-.208860	0.019080	-.003763
first_tier_minimum	-.005183	-.138193	0.106549	-.204310	-.144467	-.124226	0.080150	-.226635	0.395366
first_tier_basic	0.119577	0.091862	0.036352	-.069509	-.212100	0.076057	-.138062	-.011465	-.406480
second_tier	0.223264	0.115900	0.170834	0.092477	-.042336	0.045682	0.024193	-.003742	0.032519
funded_tier	0.048623	-.252051	-.113674	-.019017	0.061474	0.129452	0.098615	0.120981	0.064310
contr_of_private	0.096144	-.128364	0.174370	-.293437	0.181524	0.069036	-.055061	0.069413	0.013136
private_income	0.195319	0.175471	0.144859	0.073964	-.006431	0.083492	-.003717	-.069935	0.083091
funds_GDP	0.153142	0.124350	0.090046	0.122132	-.038237	-.004467	0.319778	-.117160	-.042427
occup_pension	-.031621	0.265666	-.009243	0.079978	0.120153	0.053924	0.055501	-.051520	0.106778
civil_servant	0.093596	0.133768	0.142221	-.218325	0.242879	-.237144	0.113352	0.102856	0.077739
nmb_years_full_pension	-.020226	0.196246	0.131225	0.147037	-.208289	-.002672	-.171376	0.157214	-.085809
tot_contrib	0.015035	0.162989	0.081405	0.080255	-.055106	0.213427	-.102747	0.414718	0.251749
gross_repl	-.192974	-.112891	-.035363	-.035634	-.020955	0.086663	0.229841	0.113583	-.105154
net_repl_low	-.133291	0.146507	-.021635	-.048373	-.145685	0.260424	-.143245	-.187883	0.099585
net_repl_avg	-.222571	-.070251	-.021109	0.002608	0.021138	0.225482	0.161189	0.187347	-.013113
net_repl_high	-.187529	-.066692	-.082072	0.022456	-.111930	0.227842	0.329583	0.022730	-.016656

Annex figure 1: The plot of the first two principal components from transformed data, SAS program



Projekt diplomové práce

Termín státní závěrečné zkoušky: Zimní semestr 2008/2009
Autor diplomové práce: Hana Peroutková
Vedoucí diplomové práce: Doc. MPhil. Ondřej Schneider Ph.D., McKinsey Chair
Téma: Pension Reform in the in European countries - what can we learn from reforms?

Cíl práce: In my master thesis I will search for the "best" practices to the pension reforms that took place in the European countries. I will describe main trends in the changes of the pension systems, and evaluate them with respect to their eventual applicability to the future reform of the Czech pension system. As criteria for assessing a successful pension reform will serve mainly the adequacy of pension system, sustainability of the pension system with respect to labor market, sustainability of pension system with respect to public finance, transparency of the pension system, and the adjustment of pension system to new trends in modern society (as deepening of EU integration or changes in employment pattern).

Particularly, my interest will be to investigate an appropriate link between the retirement-income system and increasing life expectancy. In recent years, some countries have innovated their pension systems by linking the level of pension benefits (or the eligibility of pension benefits) to increasing life expectancy. This was done from several reasons and by different policy measures. I suppose that linkage of pensions to life expectancy is crucial for sustainability of future pension systems, and thus it can be worthy to discuss it in more detail.

V práci bude hledána odpověď na následující otázky:

- Can be parametric reform sufficient or do we need paradigmatic reform?
- Should be the pension provision linked to life expectancy?
- How could be older workers encouraged to stay working longer?
- Can the system be more efficient without introducing mandatory minimum eligibility age?
- How should be the life expectancy risk pooled?

Osnova:

1. Introduction
2. Demographic Background – What is gong on?
3. Pension Systems – description and typology
4. Main features of pension reforms in the EU, European Union approach, and evaluation
5. Link between the (increasing) life expectancy and pension system
6. Conclusion

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V Praze dne ……

Podpis vedoucího diplomové práce Podpis autora