UDC: 336.02(437.3);336.5(437.3);314(437.3)
Keywords: ageing population – fiscal policy – fiscal sustainability

Fiscal Implications of Population Ageing

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1. Introduction

Population ageing has a serious impact on future public spending and is considered an important challenge for fiscal policy. The recent demographic developments and trends have predetermined the age profile of the population for the upcoming decades. Low fertility rates and a rising life expectancy rate will significantly increase the number of elderly people. As a result, the old-age dependency ratio will rise rapidly. The Czech Republic belongs to the group of countries faced with the most pronounced ageing of the population (OECD, 2002), and its fiscal position will be strongly affected by increasing age-related spending.

Long-term projections have become an important instrument indicating the order of magnitude of future fiscal imbalances associated with public pension schemes. However, expenditure projections focusing on the impact of ageing populations have often been limited to pension spending and have not taken into account other budgetary items. The changing age structure will have an impact on many other spending categories, mainly health care and education expenditure and child/family benefits. Thus, the projection of pension spending, taken by itself, is likely to provide an incomplete view of the overall impact of ageing on public expenditure.

Although the long-term projections are subject to wide margins of uncertainty, they indicate the degree of future fiscal pressures stemming from population ageing and form a basis for the assessment of the long-term sustainability of public finances. The European Commission requires member countries to include a specific section on the budgetary impact of population ageing in their stability and convergence programmes. Long-term budgetary projections make it possible to assess whether the current budgetary position and medium-term targets are sufficiently ambitious to avoid the risk of large future budgetary imbalances.

The aim of this paper is to present long-term projections of the fiscal impact of population ageing on the main age-related spending items, budgetary balances and public debt in the Czech Republic. The projection exer-

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cise consists of three interrelated components – (i) demographic projection, (ii) labour market and macroeconomic projection and (iii) fiscal projection. Common macroeconomic assumptions as proposed by the OECD (2001) will be used to project labour market development and the macroeconomic aggregates of interest. A large part of this paper is an updated and extended version of work carried out at the Czech Ministry of Finance on this issue.[1]

The approach applied in the projection exercise can be considered a standard methodology for long-term projections focused on the impact of population ageing on public finances. The same approach has been adopted in many papers, especially those published by the OECD (2001) and EC (2001). However, the "current policy" (or baseline) scenario presented in this paper is not the most likely scenario. The baseline scenario shows the increase in public spending, deficit and debt under the assumption of unchanged policies[2] and the absence of feedback mechanisms from public finances to the rest of the economy and it neglects the likely reaction of the financial markets. The increase in age-related spending will result in a significant deterioration of the fiscal deficit and public debt. The government is likely to respond to such fiscal imbalances by cutting spending, increasing taxes and/or reforming the pension and health care systems. These measures will have an impact on the labour market and the growth path of the economy. If the government does not react fast enough, it will face financial difficulties, as the financial markets will punish it for unsustainable public finances. In any case, the government will not avoid undertaking fiscal consolidation. The more profound is the projected impact of population ageing on the public deficit and debt, the lower is the probability that the baseline scenario will actually materialise. As such, the baseline scenario is highly unrealistic. Nevertheless, its importance rests on the fact that it provides a measure of future spending pressures and sends a clear message to policy-makers.

Another model has been included in subsection 4.3 of this paper on pension system analysis. This projection technique has its origins in (Bezděk, 2000) and was updated and further improved for the purposes of this paper. The model represents a slightly different projection style. It relies on more simplified assumptions and does not work with the same comprehensive, subtle apparatus. However, as many data inputs as possible were unified for the two models, and thus we can compare the main results of both projection methods in the area of the Czech public pension scheme. Such a comparison can also serve as an indirect consistency check of the main model outcomes.

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[1] The Ministry of Finance participated in the OECD project "Fiscal Implications of Ageing" in 2000, and in the project "Projections of Health Care to 2050" in 2002. The current paper draws on the calculations submitted as part of both projects. The authors cooperated intensively with other staff members of the Department of Financial Policies and used many of their results. The paper would not have been written without the previous work of F. Cvengroš, L. Havlíček and K. Dybczak. The authors are grateful for their valuable input and helpful comments.

[2] The assumption of unchanged policies was relaxed on a few occasions (e.g. labour productivity catch-up, reflecting convergence to EU countries, and rise in share of students involved in tertiary education, capturing the trend observed in the last 25 years in EU countries).

As was already mentioned, the main aim of this paper is to analyse the likely impact of the process of population ageing on public budgets in the Czech Republic and in that way provide a pioneering study (to the best of the authors' knowledge) and complex input into the mounting debate on the long-term sustainability of Czech fiscal policy. In this paper, we do not attempt to deliver any fiscal reform suggestions (i.e. pension system, health care spending, etc.), which are, of course, unavoidable in the future. Although some proposals have already been formulated (inter alia by Kreidl (1997), Schneider (1998a, 1998b) and Bezděk (2000)), this area remains open for further detailed research.

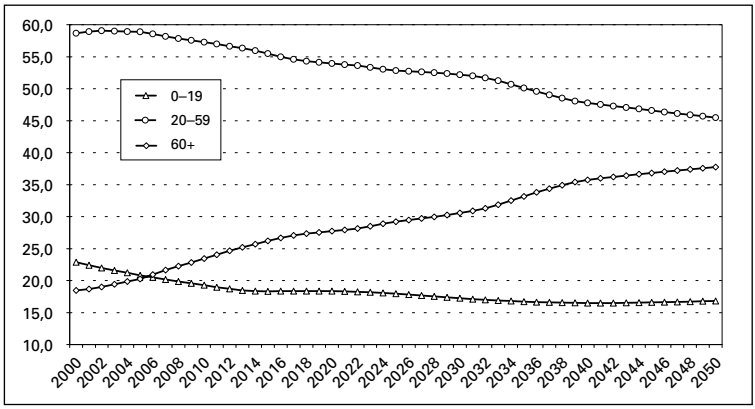
2. Demographic Projections

The demographic projection corresponds to the middle variant of the population projection produced by the Czech Statistical Office (CZSO) in January 2000. The CZSO had projected demographic development until 2030. The CZSO's projection was extended up to 2050, assuming the same parameter values as for 2030. In 2000, the United Nations published its own demographic projections for all countries, including the Czech Republic. As compared to the CZSO's middle variant, the Czech population will be ageing even more rapidly, and the Czech Republic will have one of the oldest populations in the world. The more pessimistic outlook results from the different assumptions applied by the UN. The UN projection is an extrapolation of the current situation and assumes that the current extremely low fertility rate will be maintained in the future. The CZSO projection, taking into account likely changes in the main demographic parameters, was preferred in the exercise.

The population profile over time depends on assumptions about fertility, mortality and net immigration flows. In 2000, the Czech Republic reported a fertility rate of 1.14, the lowest among the OECD countries (OECD average: 1.46). Although fertility is assumed to increase from 1.14 to 1.50 by 2030 and to remain at a higher level thereafter, it will probably not reach the OECD average (1.60 in 2030 and 1.61 in 2050). A fertility rate lower than 2.0 implies a long-run decline in the total population. Life expectancy at birth, reflecting mortality over the whole lifespan of a particular cohort, is expected to increase for both males and females, but the increases are smaller for women than for men. Life expectancy for males is assumed to rise from 71.5 to 75.2 years and for females from 78.4 to 81.5 years. Net immigration is difficult to predict, since it depends on the economic situation of the country, the situation on the labour market and immigration policy. The projection is based on the assumption of an increasing active migration balance. From 2030 on, net immigration will add roughly 15,000 persons to the Czech population. The assumptions and results of the demographic projection are summarised in *Table 1* and *Figure 1*.

The projection results in a gradual decline in the population from 10.3 million in 2000 to 9.7 million in 2030 and 8.4 million in 2050. In the medium and long term, the Czech Republic will face the effects of an ageing population. The age profile of the population is deteriorating and generating se-

FIGURE 1 Age Structure – Per cent of Total Population



rious concerns from the point of view of the labour market and fiscal perspectives. By the end of the projection period, the share of the elderly (defined as those over 60) in the total population will more than double from 18 % in 2000 to 38 %. The share of the working-age population (20–59) will drop from 59 % to 45 %, and the share of the young population (0–19) will shrink from 23 % to 17 %. The average age of the population will be almost 10 years higher (38 vis-à-vis 47). The old-age dependency ratio – defined as

TABLE 1 Assumptions and Results

	2000	2010	2020	2030	2040	2050
Assumptions						
Total fertility rate	1.14	1.32	1.44	1.50	1.50	1.50
Life expectancy of men (years)	71.5	73.7	74.5	75.2	75.2	75.2
Life expectancy of women (years)	78.4	80.5	81.0	81.5	81.5	81.5
Active migration balance (thousands)	9.5	11.3	13.2	15.0	15.0	15.0
Results						
Population (thousands)	10 268	10 244	10 098	9 691	9 047	8 367
Average age of population (years)	38.2	40.9	43.4	45.7	46.7	47.3
Old-age dependency ratio	31.4	40.9	51.4	58.6	74.8	83.0
Age structure (%)						
Men						
0–19	24.1	20.3	19.3	18.2	17.4	17.7
20–54	54.5	52.0	49.4	45.6	42.1	40.3
55–64	10.5	14.4	12.6	15.1	16.2	14.4
65+	10.9	13.3	18.7	21.2	24.4	27.6
Women						
0–19	21.7	18.3	17.4	16.4	15.7	16.0
20–54	50.6	47.9	45.7	42.0	38.8	37.0
55–64	11.1	14.9	12.5	14.8	16.0	14.0
65+	16.6	18.9	24.4	26.9	29.5	33.0

Source: Czech Statistical Office; Ministry of Finance; author's calculations

TABLE 2 International Comparison of Population Ageing – Old-age Dependency Ratio

Selected OECD countries	2000	2050	Change in p. points
Austria	25.2	58.2	33.0
Belgium	28.1	49.5	21.4
Czech Republic	***21.9***	***57.5***	***35.6***
Finland	25.9	50.6	24.7
France	27.2	50.8	23.6
Germany	26.6	53.2	26.6
Hungary	23.7	47.2	23.5
Italy	28.8	66.8	38.0
Netherlands	21.9	44.9	23.0
Norway	25.6	41.2	15.6
Poland	20.4	55.2	34.8
Portugal	26.7	50.9	24.2
Spain	27.1	65.7	38.6
Sweden	29.4	46.3	16.9
United Kingdom	26.6	45.3	18.7
OECD average	23.8	49.9	26.1

Note: The old-age dependency ratio is here defined as the number of persons aged 65 and over divided by the number of persons aged 20–64. Such a definition is common in international studies on ageing. The definition used in *Table 1* drew the line between the working age population and the old-age population at the age of 60, which is closer to the effective retirement age in the Czech Republic.

Source: (OECD, 2001)

the elderly population of 60 years and over to the working-age population – will rise steeply from 31.4 to 83.0.

Demographic projections covering time horizons over several decades are generally very uncertain, as they are conditional on the assumptions applied with respect to the fertility rate, life expectancy and migration flows. These uncertainties may be even higher in the context of the Czech Republic. The extremely low fertility rate reported in the Czech Republic is a result of the transformation period, but it is difficult to judge how fast and to what level it will eventually rise. Moreover, the free movement of workers following EU accession will affect migration flows, but the magnitude of those migration flows is subject to considerable uncertainties. Leaving these uncertainties aside, an international comparison (*Table 2*) indicates that the Czech Republic ranks as a rapidly ageing country, as measured by the old-age dependency ratio (behind Italy, Spain, Austria and Poland). The increasing number of elderly people and the shrinking working-age population will have a major impact on the labour market and social and health care systems.

3. The Labour Market and Macroeconomic Projections

Labour market trends and macroeconomic indicators will be affected by the changing age profile of the population. In order to project the main labour market and macroeconomic variables, a population projection was com-

TABLE 3 Participation Rates for Men and Women

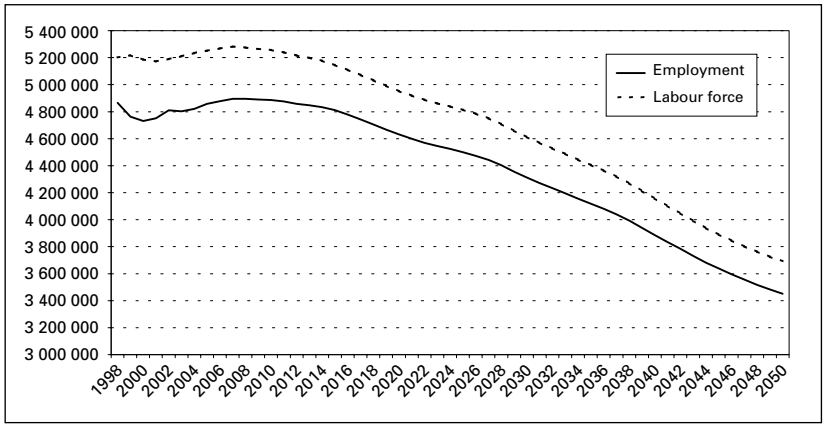
Participation rate	2000	2010	2020	2030	2040	2050
Men						
0–14	0.0	0.0	0.0	0.0	0.0	0.0
15–19	16.2	13.0	13.0	13.0	13.0	13.0
20–54	92.3	92.3	92.3	92.3	92.3	92.3
55–64	53.6	59.5	59.5	59.5	59.5	59.5
65–79	7.9	8.0	8.0	8.0	8.0	8.0
80+	0.0	0.0	0.0	0.0	0.0	0.0
Women						
0–14	0.0	0.0	0.0	0.0	0.0	0.0
15–19	14.1	10.2	10.2	10.2	10.2	10.2
20–54	78.6	80.3	82.1	83.8	85.6	87.3
55–64	23.3	36.0	39.4	42.8	46.1	49.5
65–79	3.0	2.8	2.8	2.8	2.8	2.8
80+	0.0	0.0	0.0	0.0	0.0	0.0

bined with macroeconomic assumptions on participation rates, the unemployment rate and labour productivity. The common assumptions proposed by the OECD (2001) were applied in all cases (participation rates, the unemployment rate) unless the transition nature of the Czech economy made the common assumptions unrealistic (labour productivity). Attention was paid to real variables only, because price development is hard to project and over longer time periods revenues and expenditures are influenced by price increases to a similar extent. As a result, economic performance is of utmost importance for long-term budgetary projections. All variables have been calculated at constant 1995 prices.

The labour market projection depends to a large extent on the underlying assumptions on participation rates (*Table 3*). It is assumed that for the whole projection period the participation rate will stay constant at the 2001 level for men in all cohorts (15–19, 20–54, 65–79) but one (55–64). The participation rate for men aged 55 to 64 is expected to increase by 6 percentage points by 2007, reflecting the effects of the Act on Extending the Retirement Age, and to remain at a higher level thereafter. The participation rates reported for women in 2001 are kept constant up to 2007 except for women aged 55 to 64, who are likely to withdraw from the labour market later as the retirement age[3] gradually increases up to 2007. From 2007 on, the participation rates for women aged 20 to 54 and 55 to 64 were allowed to rise[4] towards a predefined threshold at the end of the period. The thres-

[3] The participation rate for women is expected to increase by 11 percentage points from 2001 to 2007. The rise in the participation rate for women, reflecting the later statutory retirement age, is considerably higher than for men. While the retirement age will be extended by another year for men (from 61 to 62), women will have to work two years longer to reach the statutory retirement age (the age of retirement for a woman with two children will increase from 57 to 59 between 2001 and 2007). The rise in the participation rate is based on the assumption of almost full efficiency of the increasing statutory retirement age, i.e. men and women will stay in the labour force longer and will not rely on early retirement or disability schemes to a large extent.

FIGURE 2 Employment and the Labour Force



hold for women aged 20 to 54 was set equal to 5 percentage points below that of men in the same cohort, and for women aged 55 to 64, 10 percentage points below that of men.

From 2002 to 2006, the unemployment rate (measured by labour force survey data) corresponds to the medium-term projection of the Ministry of Finance. Starting in 2007, the unemployment rate is assumed to gradually decrease, converging towards its structural level in 2015. Beyond 2015, the unemployment rate is held constant at the structural level for the rest of the projection period. The structural unemployment rate was set at 6.5 %, a common assumption proposed by the OECD.

The participation rates determine the proportion of the population active on the labour market (i.e. the labour force), and the unemployment rate was used to calculate employment (*Figure 2*). Employment in 2007 will be higher than in 2001 and will amount to 4.9 million persons. The increase in employment results from higher participation rates for men and women aged 55 to 64 and a reduction in the unemployment rate. From 2007, employment will experience a declining trend, falling to 4.3 million persons by 2030 and 3.5 million by 2050. The rising participation rate for women will not come close to offsetting the unfavourable demographic trends. Between 2010 and 2015, the numerous cohorts of those born after World War II will retire, but the largest fall in the working-age population will occur around 2035 when the baby boom generation of the 1970s withdraws from the labour market.

The assumption on labour productivity growth is of crucial importance for the projection exercise. The OECD wants labour productivity growth to converge towards an annual rate of 1.75 % between 2020 and 2030. Labour productivity in the Czech Republic is significantly lower than average EU labour productivity, and convergence in levels is likely to appear. As a re-

[4] The same assumption was applied by the OECD (2001) and EC (2001). The assumed increases in female participation rates stem from the higher participation of younger female age-cohorts in the labour market as compared with earlier generations.

TABLE 4 Assumptions and Results

	2000	2010	2020	2030	2040	2050
Assumptions						
Participation rate (20–64) (in %)	77.3	77.5	79.3	78.7	78.7	80.3
Unemployment rate (in %)	8.8	7.0	6.5	6.5	6.5	6.5
Labour productivity (growth rate in %)	2.2	3.4	3.4	1.9	1.8	1.8
Results						
Employment (growth rate in %)	-0.9	0.3	-0.5	-0.7	-1.0	-1.2
Wage rate (growth rate in %)	1.6	3.3	3.4	1.9	1.8	1.8
Wage bill (growth rate in %)	0.7	3.6	2.8	1.2	0.7	0.5
GDP (growth rate in %)	1.2	3.7	2.8	1.2	0.7	0.5
GDP per capita (growth rate in %)	1.3	3.7	3.0	1.6	1.4	1.3

Note: Growth rates are average growth rates in the given period (2010 is the average growth rate projected between 2001 and 2010), except for 2000 (average growth rate from 1995 to 2000).

sult, labour productivity growth is assumed to significantly outstrip the labour productivity growth in EU countries, so that the Czech Republic will have reached over 80 % of the EU average by 2030. Labour productivity growth is projected to be at 4.0 % in 2008 and to decline to 1.75 % in 2030.[5] Labour productivity growth before 2007 was derived from the medium-term forecast of the Ministry of Finance.

The GDP projection is a product of labour productivity and employment. Under the given assumptions, GDP growth will reach 3.7 % on average in the first decade of the projection period and decline in further decades as labour productivity growth recedes and the decline in employment accelerates. Due to negative employment growth, GDP growth is substantially lower than growth in GDP per capita, reflecting population ageing and the parameters of the labour market.

The wage bill is an important variable for the fiscal module. The wage bill, a product of the average wage and employment, is an input for the estimation of social security contributions. The average wage was not differentiated by sex, and its growth was assumed to follow labour productivity growth. As a result, the growth rate of the wage bill is equal to GDP growth.

All the assumptions and results used to project macroeconomic developments are summarised in *Table 4*.

4. Fiscal Projections

This section presents projections for the impact of an ageing population on public expenditures. Many public expenditure programmes are affected by demographic shifts. In the projection exercise, public expenditures were divided into two subgroups – age-related expenditures and other expenditures. The main spending items included in age-related expenditures are

[5] Assuming productivity growth rates that deviate from historical patterns can create an additional margin of uncertainty. In one of the sensitivity tests we present an impact of lower productivity growth on the fiscal projection.

pensions, health care, education and child/family benefits. These expenditures account for 53 % of the overall public spending in the Czech Republic. While ageing populations are likely to drive up pension spending and health care costs, the shrinking youth age group may offset this rise by providing reductions in education expenditures and child/family benefits. As a result, it is necessary to analyse all age-related spending to have a complete picture of how population ageing impacts future public spending. However, projections of spending on health care and education are considerably more uncertain than for pension expenditures. Pension legislation provides a framework for estimating future benefits. No equivalent set of rules is available for projecting the supply and demand of health care and education.

The projections were based on an assumption of unchanged policy, and as such, they only take into account the legislative acts in force (e.g. the Act on Extending the Retirement Age). However, in some cases, the fiscal projections rest on assumptions anticipating the likely measures in the legislative framework (i.e. systematic adjustments of reduction bands for derivation of pensions, and wage indexation of child/ /family benefits).

All fiscal data are reported in the IMF's Government Financial Statistics methodology (GFS), i.e. on a cash basis. Transformation costs were excluded from public spending because they are of a transitory nature and are likely to disappear within several years. Thus, the deficit corresponds to the deficit excluding financial operations (i.e. net lending in the GFS methodology) and transformation costs. While 2003 (i.e. the budget programme) is the base year for the projection of revenues, total expenditures and public debt, the projection of age-related expenditures starts off with the 2001 figures. All fiscal data were deflated by the GDP deflator, and subsequent calculations were carried out in real terms.[6]

4.1 Basic Characteristics of the Czech Pension System

The pension system in the Czech Republic consists of two pillars. The first pillar is represented by a mandatory state-operated PAYG defined benefit scheme. The second pillar covers voluntary private pension funds. The private scheme has been supplementing the public component of the pension system since 1994, i.e. it is still a very immature system. Due to this fact, the private pension pillar is negligible in financial terms,[7] and in the next paragraphs we will concentrate entirely on the state pension scheme. From the financial point of view, the system has accumulated a deficit amounting to about 1 % of GDP every year. While the revenue side seems to be quite

[6] In view of the uncertainties associated with the long-term inflation profile and the fact that, over a sufficient period of time, inflation influences the revenue and expenditure side of general government budgets in the same way, all figures were calculated at constant 1995 prices. All past budgetary variables were deflated by the GDP deflator as a universal indicator of price development.

[7] At the end of 2001, the total assets of private pension funds were as low as 2.5 % of GDP.

TABLE 5 Financial Performance of the State Pension System

	Revenue	Expenditure	Balance	Revenue	Expenditure	Balance
	(CZK bn)			(% GDP)		
1996	133.9	129.5	+4.4	8.5	8.3	+0.3
1997	146.3	152.8	-6.5	8.7	9.1	-0.4
1998	156.3	168.8	-12.5	8.5	9.2	-0.7
1999	161.8	181.3	-19.4	8.5	9.5	-1.0
2000	170.5	186.8	-16.4	8.6	9.4	-0.8
2001	186.0	201.0	-15.0	8.6	9.3	-0.7
2002	197.7	217.3	-19.7	8.7	9.6	-0.9

Source: Czech Ministry of Finance

stable in terms of its share in GDP, the overall spending increased by 1.3 p.p. during the last six years (*Table 5*).

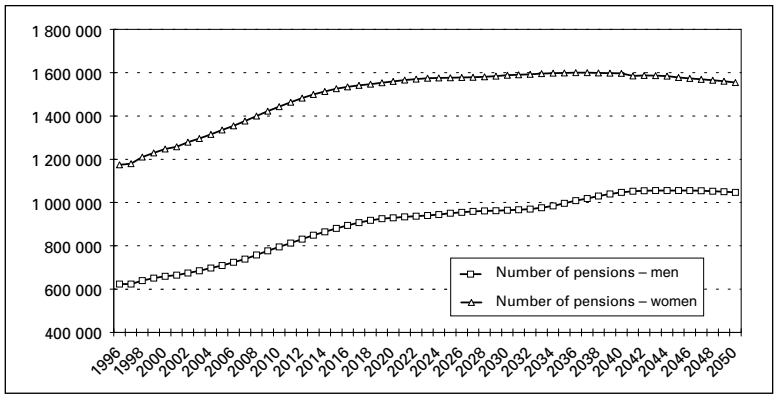
The public pension system is universal for the whole population, and there are no differences according to the economic sectors in the Czech Republic.[8] The system is mandatory for both employees and self-employed persons. There is a linear contribution rate in the system at the level of 26 % of the gross wage. In the case of employees, a part of it (19.5 %) is paid by the employer and the rest (6.5 %) is paid directly by employees. The official statutory retirement age has been gradually rising since 1996 (at a speed of 2 months per calendar year for men and 4 months per year for women) and will reach 62 years for men and 57 to 61 years (depending on the number of children) for women by 2007. The system also provides early retirement vehicles allowing withdrawal from the labour market up to three years before reaching the statutory retirement age. The public pension pillar provides four kinds of benefits – old-age (which represents the bulk of the spending), disability, survivors' and children's pensions. The average old-age replacement ratio (defined as the ratio of the average old-age pension to the average wage) has been approximately stable around 44 % in relation to the gross average wage, or 57 % with respect to the net average wage. Further details on the Czech pension system, as well as a discussion of its weaknesses, are provided in, for example, (Bezděk, 2000).

4.2 Pensions – the Baseline Model

The pension projection exercise covers several schemes including old-age pensions, survivors' and children's pensions and disability pensions. Old-age pensions account for 72 % of total pension spending, and the rest is made up of disability pensions, survivors' pensions and children's pensions. Up to 2001, all data (the total number of pensions, the average pension, the number of new pensions and the average new pension) were taken from the CSSZ[9] Statistical Yearbook.

[8] Certain exceptions to this rule are the pensions of the armed forces (military, police and customs officers). However, those expenditures represent only a very small proportion of the total pension spending (about 2.5 %).

FIGURE 3 Number of Old-age Pensions for Men and Women up to 2050



Major attention was paid to old-age pensions, due to their relative importance and share in total pension spending. The old-age pension projection estimates the flow of new pensions and the average pension. The current stock of pensions is treated separately. The flow of new pensions was projected separately for men and women on the basis of participation rates, which were used to calibrate the number of new pensions as a percentage of the total number of men and women in a particular cohort. It has been assumed that the average pension at the time of retirement is a fixed proportion of the average wage, i.e. the replacement ratio is kept stable at the 2001 level of 60.2 % for men and 51.3 % for women.[10]

The following chart shows the number of pensions for men and women from 1996 to 2050. As can be observed, the number of old-age pensions will rise as the population ages and the old-age dependency ratio increases. The highest increase is likely to appear between 2010 and 2020, when the large post-war cohorts reach the age of retirement. As of 2020, the number of old-age pensions will be flat for both men and women, but it will start rising again in 2030 for women and 2033 for men. The rise is more pronounced for men than for women. The number of pensions will stabilise and subsequently fall after 2040 (see *Figure 3*).

[9] CSSZ denotes the Czech Social Security Office, an institution in charge of social security administration.

[10] The replacement ratio refers here to the ratio of the average pension at the time of retirement as reported in 2001 by the CSSZ to the average gross macroeconomic wage. The gross macroeconomic wage is defined here as the ratio of the gross wage bill to employment (sum of employees and the self-employed). Due to the inclusion of the self-employed in the denominator, the macroeconomic wage is considerably lower than the average wage reported by the Czech Statistical Office (CZSO). As a result, the replacement ratio applied in the projection exercise is higher than that reported by the Ministry of Labour and Social Affairs. If the gross average wage reported by the CZSO were applied, the replacement ratio would amount to 51.9 % for men, 41.1 % for women and 44.9 % for all new old-age pensions originated in 2001. Moreover, the replacement ratio presented in the main text does not contain old-age pensions drawn before the statutory retirement age (the respective replacement ratios for temporary and permanently reduced old-age pensions applied in the projection exercise amount to 50.3 % and 51.0 % for men and 39.8 % and 41.4 % for women).

The evolution of the ratio of the average pension to the average wage over time depends on the indexation mechanism, the relative weights of ordinary old-age pensions, temporary and permanently reduced old-age pensions, and on the relation between the flow of new pensions and the stock of pensions. The Czech government has substantial discretion in setting the indexation formulae, as the law stipulates the minimum indexation requirements only. In the past indexation, the aim was to stabilise or even raise the average pension to average wage ratio. In the projection exercise, three indexation mechanisms were assumed: (i) price indexation (i.e. a constant pension in real terms), (ii) wage indexation and (iii) indexation to prices plus 1/3 of real wage increases. Full indexing to wages after retirement exists in only a few countries. However, because retirement benefits are based on past earnings in the Czech Republic, earnings-related pensions grow with earnings and productivity even if pensions are not indexed to wages for those in retirement. Under earnings-related schemes with price indexing of pensions, the ratio of the average pension to the average wage does not fall indefinitely as the cohorts of new pensioners whose pensions were derived from their earnings replace the cohorts of old pensioners receiving pensions indexed to prices. *Figure 4* and *5* compare the evolution of the average pension to average wage ratio up to 2050 for men and women under the aforementioned indexation mechanisms, and *Figure 6* shows total old-age pension spending under the various indexation mechanisms.

Due to the unfavourable demographic trends, old-age pension spending will rise steeply in the coming decades. The government decision on the indexation formulae will affect the level of pension spending. Under wage indexation, old-age pension expenditure will rise monotonically, reaching almost 14 % of GDP by 2050. If wage indexation is abandoned and pensions are indexed to prices only, old-age pension spending will be contained between 6 and 7 % of GDP up to 2020. Between 2010 and 2020, large cohorts will retire and the effect of the falling ratio of the average pension to the average wage for those in retirement will diminish. This will result in rising pension spending as a percentage of GDP, but old-age pension spending will be 2.5 percentage points lower in 2050 as compared to the full wage indexation variant. Indexation to prices and 1/3 real wage increases lead to similar results and patterns of pension spending. But the average pension to average wage ratio will not decline to such an extent, and pension spending will be 1 percentage point higher than in the price indexation variant. To sum up, future old-age pension spending is to a large extent dependent on the indexation formulae applied. In the projection of the fiscal deficit and debt, the "middle variant" will be used, i.e. indexation to prices plus 1/3 real wage increases.

In addition to old-age pensions, the other pension expenditures (survivors' and children's pensions and disability pensions) were analysed. Disability pensions account for 18 % of total pension spending, while children's pensions amount to 1.2 % and survivors' pensions to 8.7 % of total pension expenditures. It was assumed that the number of disabled persons depends on the size and age profile of the population. The number of survivors' pensions was derived from the number of old-age pensions and the number of

FIGURE 4 Evolution of the Average Pension to Average Wage Ratio for Men under Various Indexation Mechanisms

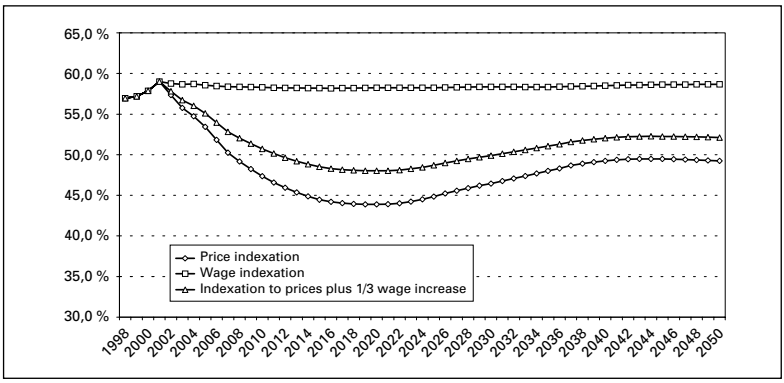


FIGURE 5 Evolution of the Average Pension to Average Wage Ratio for Women under Various Indexation Mechanisms

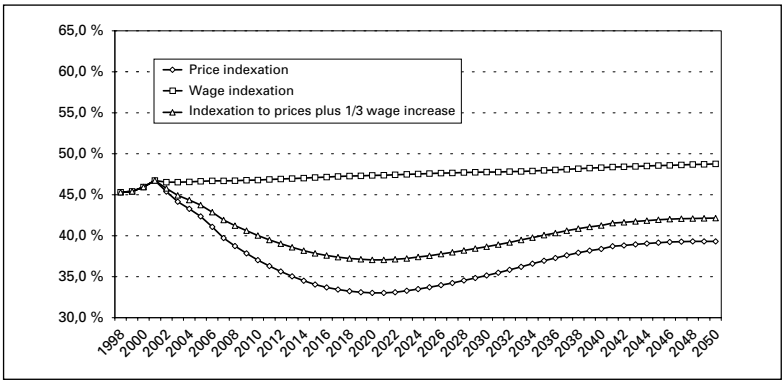


FIGURE 6 Old-age Pension Spending – in per cent of GDP

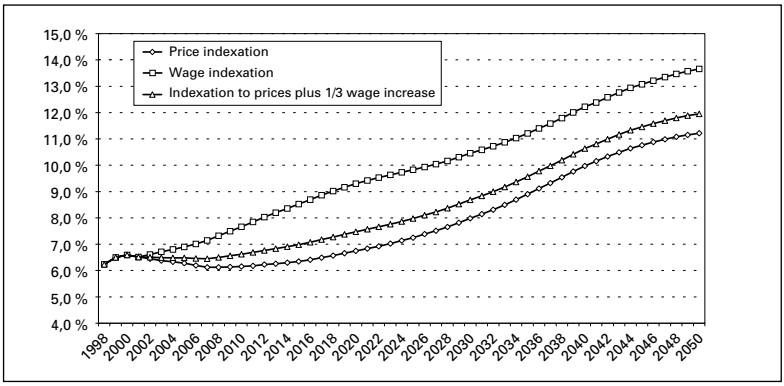


TABLE 6 Total Pension Spending as a Percentage of GDP

	2000	2010	2020	2030	2040	2050
Wage indexation						
Old-age pensions	6.6	8.0	9.5	10.5	12.2	13.7
Other pensions	2.7	2.8	3.0	3.2	3.4	3.7
Total pension spending	*9.3*	*10.8*	*12.5*	*13.7*	*15.7*	*17.3*
Price indexation						
Old-age pensions	6.6	6.4	6.8	8.0	10.0	11.2
Other pensions	2.7	2.3	2.3	2.5	2.9	3.1
Total pension spending	*9.3*	*8.7*	*9.1*	*10.5*	*12.8*	*14.3*
Indexation to prices and 1/3 wage increases						
Old-age pensions	6.6	6.9	7.6	8.7	10.6	12.0
Other pensions	2.7	2.5	2.5	2.7	3.0	3.3
Total pension spending	*9.3*	*9.4*	*10.1*	*11.4*	*13.7*	*15.2*

children's pensions was related to the number of children. The projection of total pension spending is shown in *Table 6*.

Under the assumption of the real wage bill growing at the same pace as real GDP and proportionality between pension contributions and the wage bill, pension contributions will equal 8.8 % of GDP and the ratio will be constant for the whole projection period. Keeping in mind the steep rise in pension spending as a percentage of GDP under full indexation to wages, there will be a considerable rise in the pension system deficit throughout the period. Under indexation to prices and 1/3 wage increases, the deficit of the pension system will be stabilised until 2015, but in subsequent decades it will start to rise rapidly as the age profile of the population shifts towards a larger and larger share of the elderly. Price indexation of pensions leads to similar results, with the pension system deficit a further 1 % of GDP lower.

4.3 Pensions – Alternative Model

Public pension spending in the Czech Republic amounts to almost 10 % of GDP, which is equal to only slightly less than one quarter of all general government expenditure. Any analysis of the sensitivity of the fiscal position to the process of population ageing is, therefore, crucially dependent on the public pension outlay projections. Keeping this factor in mind, we have decided to include another pension model in this paper to test the robustness of our baseline pension projection introduced in the previous section.

This alternative model was developed in (Bezděk, 2000). For the purposes of this paper, we have further improved the structure of the model and updated its data inputs. From a technical point of view, the alternative pension model is of a less detailed structure than the baseline model. In particular, it does not allow us to work with the participation rates of the individual age cohorts, since the model structure relies on more aggregated data. On the other hand, the alternative model introduces some new para-

TABLE 7 Total Pension Spending as a Percentage of GDP – Alternative Model

	2000	2010	2020	2030	2040	2050
Wage indexation:						
Old-age pensions	6,8	7,6	9,3	10,6	12,7	14,0
Other pensions	2,8	3,1	3,5	3,7	4,1	4,2
Total pension spending	*9,6*	*10,8*	*12,8*	*14,3*	*16,8*	*18,2*
Price indexation:						
Old-age pensions	6,8	6,1	6,8	8,3	10,7	11,9
Other pensions	2,8	2,5	2,6	2,9	3,4	3,6
Total pension spending	*9,6*	*8,7*	*9,4*	*11,2*	*14,1*	*15,5*
Indexation to prices and 1/3 wage increases:						
Old-age pensions	6,8	6,6	7,6	9,0	11,4	12,7
Other pensions	2,8	2,7	2,8	3,1	3,7	3,9
Total pension spending	*9,6*	*9,3*	*10,4*	*12,1*	*15,0*	*16,6*

Note: Contrary to the baseline pension model, the old-age pension projection accounts for armed forces benefits, which amounted to 0.2 % of GDP in 2000 (and may reach about 0.4 % GDP in 2050). "Other pensions" in the alternative model assume, moreover, the administrative costs of the public pension scheme (0.1 %–0.2 % of GDP), which are not included in the baseline pension model.

meters that have not been considered in the baseline pension projections. On the revenue side, the model takes into account the differences between employees and the self-employed,[11] and the model also assumes that a certain part of the contributions will not in fact be collected, due to tax arrears. On the expenditure side, the alternative model assumes, besides pension benefits themselves, the existence of administrative costs in the public pension system. It also takes into account the pension outlays of the armed forces. The values of all these parameters have been calibrated with respect to reality in the second half of the 1990s.

All other parameters and data inputs have been unified in line with the assumptions of the baseline pension model. In particular, both models use the same demographic database, and the macroeconomic scenario is also identical (i.e. GDP growth, rate of unemployment, real interest rates on government debt, labour productivity growth and wage growth). Both models reflect the gradual shifting of the statutory retirement age up to 2007. Similarly to the baseline model, the alternative model also assumes that the relation of "non-old-age" average pension benefits with respect to the average old-age pension will remain stable over time. The number of disabled people will correspond to the size and age profile of the population. The number of survivors' beneficiaries goes hand in hand with the number of old-age pensions and the number of children's pensions is a function of the number of youths. Thus, all data inputs for both models were unified and these differ only in terms of their in-built structure. This makes it pos-

[11] Under Czech law, the self-employed are allowed to pay relatively lower contributions than the average employee. The contribution rate is equal in both cases, but the way of calculating the contribution base is different. Moreover, in the case of the self-employed, Czech law introduces a ceiling on the contribution premium, whereas in the case of employees, the contribution rate is applied to the total gross wage without any limitations.

sible to check both pension models for robustness of the projections. The results of the alternative model are summarised in *Table 7*.

It is quite obvious that the alternative model delivers very similar projections when compared to the baseline pension model estimates. The difference between the two models in total pension spending over a 50 year period is only about 1 % of GDP, depending on the indexation mechanism. This is rather negligible given the enormous margins of error surrounding this kind of long-term projection exercise. Moreover, almost half of that dis-crepancy stems from the different approach to the expenditure side in the two models, which was discussed earlier. In other words, the alternative pension projections seem to confirm the robustness of the results of the baseline pension model. This is definitely a welcome conclusion for the purposes of testing the expected impact of ageing on the overall fiscal position.

4.4 Health Care

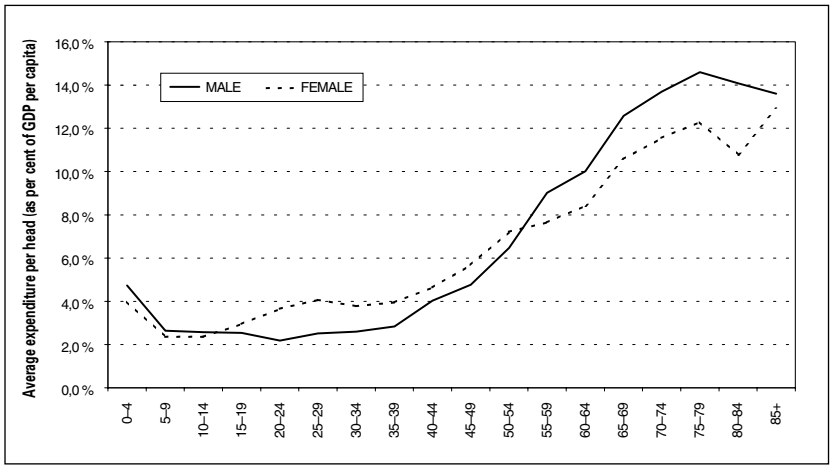
Health care spending is another expenditure category that is likely to be unfavourably affected by population ageing. Total health care outlays in the Czech Republic amount to about 7 % of GDP and are almost entirely of a public nature.[12] Thus, public health care spending represents almost one sixth of all general government expenditure. Projections of health care spending (partly including the costs of caring for the frail elderly) are considerably more uncertain than for pension expenditure, due to the absence of legislation providing a framework for estimating future benefits. Furthermore, there is a great deal of uncertainty on what demographic features are actually important for driving health care spending up – in particular, whether or not it is important having more people who are relatively old or having more people in the final years of their lives (OECD, 2001). The health care projection was based on per capita health care spending in each age group multiplied by the number of people in that age group. *Figure 7* shows average expenditure per head as a share of GDP per capita.

Data on the age and sex profiles of health care costs were provided by the General Health Insurance Company of the Czech Republic (GHIC) and cover about 70 % of the population. The GHIC calculated the age and sex profiles for 2000, and the data were further broken down by acute and long--term care. The average health care expenditure per head in the chart contains both acute and long-term care. The chart clearly shows that expenditure per head rises progressively with the age of the person, reaching the peak in the final years of life. As a result, health care spending will significantly raise public expenditure, as the largest increase in population size is projected to take place amongst the very old (population aged 80 and above).

Health care spending in the projection exercise includes all public health

[12] Private health care payments as a share in GDP are very low in the Czech Republic from an international point of view. More information on the Czech health care system from the international perspective can be found in (Bezděk, 2002).

FIGURE 7 Average Health Care Expenditure per Head as a Share of GDP per capita



Source: GHIC; author's calculations

care expenditure for both acute and long-term care. Thus, spending on the elderly is reflected in the long-term health care costs, but another part of the care for the frail elderly is financed through social programmes. Due to a lack of data on social spending on care for the frail elderly, part of this expenditure has been neglected.

The health care projection was carried out separately for acute and long--term care and for men and women. Acute and long-term care was projected as a product of average expenditure per head in a particular cohort, the size of the cohort and the trend growth rate of health expenditure per head. The trend growth rate of health expenditure per head was set equal to the growth rate of GDP per capita. This assumption may underestimate the future health care costs, as health expenditures per head tend to rise faster than GDP per capita[13]. The rise will be further reinforced by convergence of health care spending (especially its wage component) towards EU levels. On the other hand, health care costs per capita depend on age and rise steeply in the final years of life. Increasing longevity will shift the curve plotting per capita spending as a function of age to the right, which may offset the higher-than-assumed growth rate of per capita spending. The age profile of the health expenditure (as shown in *Figure 7*) underestimates the total health care spending as reported in the functional classification of expenditures in the Government Finance Statistics. As a result, the age profiles have been calibrated so that they generate estimates of

[13] The ratio of health care expenditure to GDP increased from 6.5 % in 1996 to 6.7 % in 2001. While GDP per capita increased by 1.1 % on average, real health care expenditure adjusted for demographic changes rose by 1.2 % in the same period. The difference is relatively small, but it has to be emphasised that the comparison was made over a very short period and the figures are biased by the economic recession of 1997–1999 and the 1997/1998 spending cuts.

TABLE 8 Health Care Spending as a Percentage of GDP

	2000	2010	2020	2030	2040	2050
Acute care	5.7	6.1	6.6	6.9	7.2	7.3
Long-term care	0.8	0.9	1.0	1.1	1.2	1.3
Total health care spending	*6.6*	*7.0*	*7.6*	*8.0*	*8.4*	*8.5*

health expenditure in line with estimates of health care from macro sources for the year 2000.[14]

Table 8 indicates that health care spending will become another source of future expenditure pressures resulting from population ageing. Total health care spending will increase by almost 2 % of GDP by 2050. The rise in health care spending is driven by the rapidly increasing number of the elderly, who consume the largest portion of health services. The rise in health care spending may even be higher, because it has been assumed that the growth of average health expenditure per head will be equal to the growth rate of GDP per capita. As the quality (and financial requirements) of health services is increasing rapidly, the assumption may lie on the optimistic side.

4.5 Education

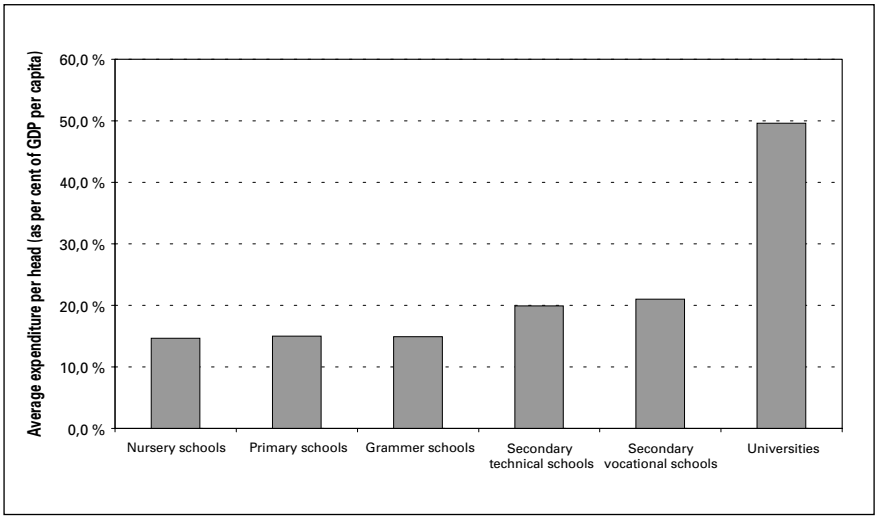
Education expenditures are a spending category that is likely to offset, to some extent, the spending pressures stemming from increasing pension and health care spending. Education expenditures are related to the number of school-aged youths, who will account for a declining proportion of the Czech population. The size of the population aged 0 to 26 will fall by 46 % from 2000 to 2050. Such a rapid decline in the youth population indicates a potential area for substantial spending containment. However, the scope for spending containment may be reduced by lower efficiency (smaller average class sizes) and improvements in quality (implementation of new technologies, etc.).

Education expenditures were projected in a similar way as health care spending. Education expenditures are expressed as a product of average expenditure per head in each particular school cohort, the size of the cohort and the trend growth rate of expenditure per head. Education expenditure per head was derived from the data given in the Statistical Yearbook of the Czech Republic (CZSO, 1999–2002), which contains the number of children and students in various education facilities (nursery schools, primary schools, grammar schools, other secondary schools and universities) and total expenditure for the particular form of education. *Figure 8* shows the average education expenditure per head derived as the ratio of expenditure for education in 2001 to the average number of children and students in the school years 2000/2001 and 2001/2002.

The projection divided education expenditure into four categories – nursery schools, primary schools, secondary schools and universities, i.e. gram-

[14] The value of the adjustment coefficient (or scaling factor) was equal to 1.217 for acute care and 1.056 for long-term care.

FIGURE 8 Average Education Expenditure per Head as a Share of GDP per capita



Source: (Statistical Yearbook of the Czech Republic, 2001, 2002); author's calculations

mar schools, secondary technical schools and secondary vocational schools were aggregated – and average expenditure per head was calculated as a weighted average. It was assumed that the share of university students will double[15] by 2050, reaching 30 % of those aged 19 to 26. The number of primary and secondary school pupils is not expected to change. Furthermore, the growth rate of education expenditure per head is projected to equal the growth rate of GDP per capita, reflecting the improving quality of education.

Education expenditure as a percentage of GDP will decline by 0.6 percentage points (see *Table 9*). The decline is considerably lower than the declining school population indicates. It results from the fact that average expenditure per head rises with GDP per capita and the share of university students is assumed to rise over time.

4.6 Child/Family Benefits

Child/family benefits encompass a wide range of benefits directed to families with children. Some of the benefits are means tested, while others

[15] In the period of 1998 to 2001, the share of university students increased by one percentage point a year. According to international statistics, students enrolled in tertiary education account for 12 % of all pupils and students enrolled in the Czech education system (EC, 2002 – chapter F, p. 5). The corresponding number for EU countries is 15 %, with fairly large differences across countries (12 % in Germany and 21 % in Greece, Spain and Finland). In the EU, on average, the number of students in tertiary education has more than doubled over the last 25 years. The assumption used in the projection exercise, although not directly comparable to the international statistics mentioned, seems to be reasonable, as the trend of higher enrolment in tertiary education is likely to persist into the future.

TABLE 9 Education expenditure as percentage of GDP

	2000	2010	2020	2030	2040	2050
Education expenditure	4.1	3.9	3.6	3.6	3.5	3.5

TABLE 10 Child/Family Benefits as a Percentage of GDP

	2000	2010	2020	2030	2040	2050
Child family benefits	1.6	1.3	1.3	1.2	1.3	1.3

are paid irrespective of the income of the family. The benefits included under child/family benefits in the projection exercise are child allowances, social allowances, transportation allowances, parental allowances, maternity grants and maternity benefits. Except for maternity benefits, which are part of the social security system based on the insurance principle, the other benefits are provided within the system of state social support. As the number of children will decline, spending on child/family benefits is likely to be affected by these demographic shifts.

The number of benefits was derived from the number of children entitled to receive the benefits. In principle, entitlement to each of the benefits is governed by different parameters (age of the child, income of the family and other conditions, as in the case of schools transportation allowance). It was assumed that the shares of those entitled in the size of the respective cohort will not change. The shares (in the case of means-tested benefits) were calibrated on the basis of the average benefit and data from the household survey. Another assumption was that the average benefit to average wage ratio would be maintained.

Under these assumptions, child/family benefits will decrease by 0.3 % of GDP by 2050, with a somewhat larger decline in the middle of the projection period (*Table 10*). Child/family benefits do not fall significantly, as the average benefit is indexed to wages and the drop in the number of children is offset by an increasing eligibility ratio with regard to child benefit and transport benefit resulting from the increasing share of university students.

4.7 Other Spending and Public Revenues

Non-age-related spending and taxes were kept constant as a share of GDP at the 2003 level (budget programme). The ratio of primary non-age-related expenditures to GDP will remain unchanged at the 2003 level of 21.5 %. Due to an assumed decline in the unemployment rate, the number of unemployment benefit entitlements was allowed to drop. Unemployment benefits account for a very small proportion of total expenditures and are expected to amount to 0.3 % of GDP in the 2003 budget programme, fall to 0.2 % of GDP in 2006 and remain at a lower level thereafter.

Social security contributions in the Czech Republic are related to the wage bill. As the wage bill grows proportionally to GDP growth in the projection

exercise, social security contributions[16] make up a constant proportion of GDP (14.9 %). The ratio of other taxes and revenues to GDP was fixed at the 2003 level.[17] As a result, total general government revenues remain at the 2003 level of 39.8 % of GDP.

The assumption of constant revenue and other expenditure as a percentage of GDP is convenient for evaluating the impact of population ageing on the public deficit and debt. It allows age-related spending to fully affect the primary deficit/surplus and debt with second-round effects through interest payments. The real interest rate applied for computation of interest payments was set at 4 %.

4.8 Results

In this subsection, the projections of age-related spending, other spending and revenues will be put together, and the impact of population ageing on the primary balance and debt will be examined. The strongest pressure on public expenditure stems from pension spending and health care. These two spending items will raise public spending by 7.8 % of GDP up to 2050. The rise in public spending will be somewhat mitigated by a drop in education expenditure and child/family benefits. The results of the projection exercise are summarised in *Table 11*.

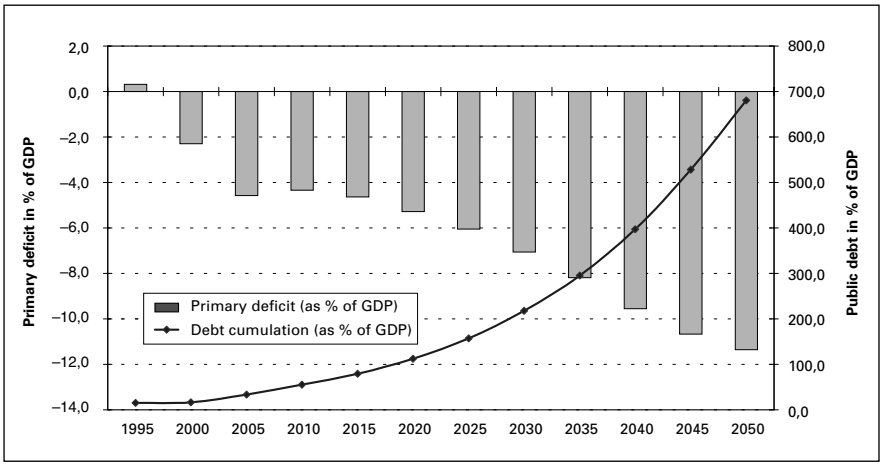
The impact of population ageing on the budget position is significantly affected by the starting position, in particular for the primary deficit. For countries with a primary deficit, like the Czech Republic, as opposed to countries with primary surpluses, rising age-related spending leads to a further rise in deficits and debt. Thus, early increases in government savings can significantly attenuate the coming demographic shock (OECD, 2001). Unfortunately, the opposite has happened in the Czech Republic. The primary balance has further deteriorated since 2000 and is expected to reach 4.8 % in 2003, the base year for the projection exercise.

In the first decade of the projection, the primary balance improves, as education expenditure and child/family benefits decline in per cent of GDP and the impact of population ageing on pension spending is not yet that apparent. From 2010, the primary deficit starts rising from the level of 4.3 % of GDP, reaching 7.1 % of GDP in 2030 and 11.3 % of GDP in 2050. The highest increase in primary deficit is likely to occur between 2030 and 2040. The primary deficit stabilises at the very end of the projection period. A permanent primary deficit of large magnitude results in a ballooning debt, which is projected to reach 50 % of GDP in 2009, 100 % in 2018 and 300 %

[16] In the GFS 86 methodology, social security contributions are consolidated and account for a lower share in GDP as compared to the National Accounts (ESA95). This results from the fact that contributions paid by the government for its employees are part of both compensation to employees on the expenditure side and social security contributions on the revenue side. When assessing the pension system deficit, gross contributions should be considered an income to the system. In 2003, gross pension contributions are expected to amount to 8.8 % of GDP, and all social security contributions to 16.1 % of GDP.

[17] Public pensions are not subject to taxation in the Czech Republic, and the importance of the private pension pillar is negligible for the time being.

FIGURE 9 Public Deficit and Debt as a Percentage of GDP from 1995 to 2050



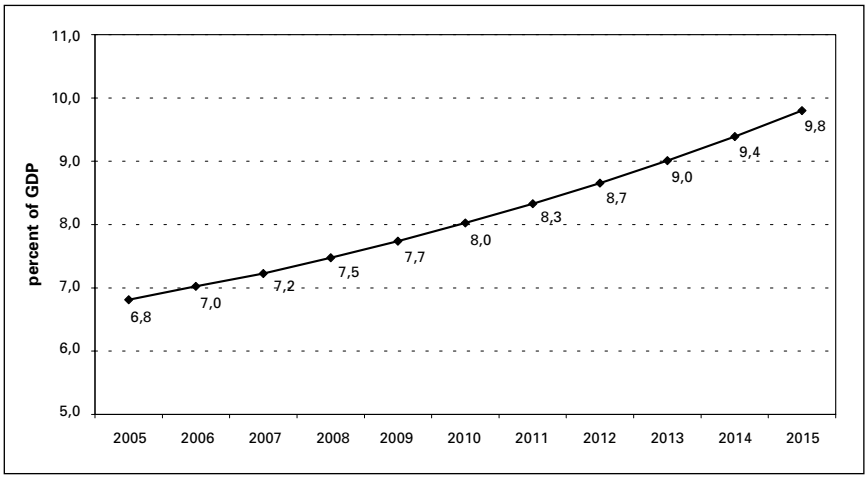
in 2035. In 2050, the public debt would be close to 700 % of GDP. It is obvious that such an explosive rise in public debt (*Figure 9*) cannot be sustained.

It should be made explicit that the rapid accumulation of debt is not the result of population ageing only, but results from a poor starting position. If

TABLE 11 Impact of Population Ageing on Public Spending, Revenues, the Balance and Debt in Per cent of GDP

	2000	2010	2020	2030	2040	2050
Pension spending						
Old-age pensions	6.6	6.9	7.6	8.7	10.6	12.0
Other pensions	2.7	2.5	2.5	2.7	3.0	3.3
Total pension spending	*9.3*	*9.4*	*10.1*	*11.4*	*13.7*	*15.2*
Other age-related expenditure						
Health care	6.6	7.0	7.6	8.0	8.4	8.5
Education expenditure	4.1	3.9	3.6	3.6	3.5	3.5
Child family benefits	1.6	1.3	1.3	1.2	1.3	1.3
Total other age-related spending	*12.3*	*12.3*	*12.5*	*12.9*	*13.2*	*13.4*
Total age-related spending	*21.5*	*21.6*	*22.6*	*24.3*	*26.8*	*28.6*
Other gen. government spending	*20.1*	*22.6*	*22.5*	*22.5*	*22.5*	*22.5*
Total spending	*41.6*	*44.2*	*45.1*	*46.9*	*49.4*	*51.2*
Revenues						
Social security contributions	14.5	14.9	14.9	14.9	14.9	14.9
Other gen. government revenue	24.9	24.9	24.9	24.9	24.9	24.9
Total revenue	*39.3*	*39.8*	*39.8*	*39.8*	*39.8*	*39.8*
Primary balance	*-2.3*	*-4.3*	*-5.3*	*-7.1*	*-9.6*	*-11.3*
Debt interest payments	1.1	1.9	4.1	8.1	14.9	25.7
Debt	*16.7*	*55.0*	*112.5*	*217.8*	*397.3*	*680.6*

FIGURE 10 The Tax Gap



the primary deficit were removed by 2007,[18] the public debt would be 60 % lower in 2050, i.e. 280 % of GDP, which may better represent the impact of population ageing on the primary deficit and debt. On the other hand, this sensitivity test indicates that even a considerably more favourable level of the primary deficit is not enough to prevent the debt from rising steeply.

Another way of analysing the long-term sustainability of public finances is to compute synthetic indicators of the budgetary adjustment needed to stabilise the debt level. The most widely used synthetic indicator is the tax gap. The tax gap measures the difference between the current tax-to-GDP ratio and the constant tax-to-GDP ratio ensuring that public debt will not exceed a predetermined level. As the projection was carried out up to 2050 and extending the projection beyond 2050 requires additional assumptions on the evolution of age-related expenditures, the calculation of the tax gap was restricted to the requirement that the public debt will not exceed a predetermined level at 2050. The target debt level was arbitrarily set equal to 60 % of GDP, i.e. the Maastricht criterion on public debt. Should the government adjust the tax-to-GDP ratio in 2005, they would have to raise taxes by 6.8 % of GDP not to break the Maastricht debt level in 2050. If the decision is postponed till 2015, the fiscal adjustment needed is considerably higher and amounts to 9.8 % of GDP (*Figure 10*). The tax gap would further increase beyond 2015. Clearly, the current fiscal policy setting is unsustainable in the long run. To reverse the unfavourable trend would require an enormous increase in the tax-to-GDP ratio, which would undermine the potential for growth.

It is interesting to compare the impact of population ageing on age-related expenditures with other European countries. The European Commis-

[18] The reduction can be achieved through tax increases or, preferably, through a reduction in other expenditures.

TABLE 12 International Comparison of Fiscal Projections – Per cent of GDP

Selected EU countries	2000		2030		2050		Change in p. points	
	Pensions	Health-care	Pensions	Health-care	Pensions	Health-care	Pensions	Health-care
Austria	14.5	5.8	18.1	7.5	17.0	8.5	2.5	2.7
Belgium	10.0	6.1	13.3	7.6	13.3	8.1	3.3	2.0
Finland	11.3	6.2	14.9	8.3	15.9	9.0	4.6	2.8
France	12.1	6.9	16.0	8.1	15.8	8.5	3.7	1.6
Germany*	11.8	5.7	15.5	6.7	16.9	7.1	5.1	1.4
Italy	13.8	5.5	15.7	6.9	14.1	7.5	0.3	2.0
Netherlands	7.9	7.2	13.1	9.1	13.6	10.3	5.7	3.1
Portugal*	9.8	5.4	13.6	5.8	13.2	6.1	3.4	0.7
Spain*	9.4	5.5	12.6	6.5	17.3	7.2	7.9	1.7
Sweden	9.0	8.8	11.4	10.6	10.7	11.8	1.7	3.0
United Kingdom	5.5	6.3	5.2	7.3	4.4	8.2	-1.1	1.9
Czech Republic	*9.3*	*6.6*	*11.4*	*8.0*	*15.2*	*8.5*	*5.9*	*1.9*

Note: Results for public spending on long-term care are not available for all countries. Countries denoted by an asterisk publish projections for health care (excluding long-term care) only. Coverage of both pension and health care spending is not fully comparable across countries.

Source: (EC, 2001)

sion published its most up-to-date long-term projections in 2001 (EC, 2001). The EC cooperated closely with the OECD and used identical or very similar demographic and macroeconomic assumptions. Moreover, the same methodology was applied, which further contributes to the international comparability of our results and those presented by the EC. It was documented that the Czech Republic belongs to the group of fast ageing countries. This has consequences for the evolution of pension and health care spending, which are the major items driving public expenditure up. It is apparent from *Table 12* that the Czech pension system will be severely hit by population ageing and pension spending will rise rapidly even in comparison with other countries facing unfavourable demographic development. This result can be partly attributed to the fact that pension spending continues rising even beyond 2030, while spending increases are contained or even turn negative in other European countries. Dampening demographic pressures in EU countries beyond 2030 and the introduction of pension reforms in many European countries can explain the difference in the pattern of pension spending. In the Czech Republic, a consensus over pension reform has not yet been reached; the reform has been postponed and only minor parametric changes have been phased in. On the other hand, the increase in health care spending can be considered average vis-à-vis EU countries.

4.9 Sensitivity Analysis and Policy Simulations

Sensitivity analysis is an important part of long-term projections, as the final outcome is very much dependent on the assumptions applied. To check the robustness and the degree of uncertainty of the projection results, several sensitivity tests were performed. These tests were focused on

the macroeconomic assumptions, and an isolated change in a given parameter only was considered. The following sensitivity tests were undertaken:

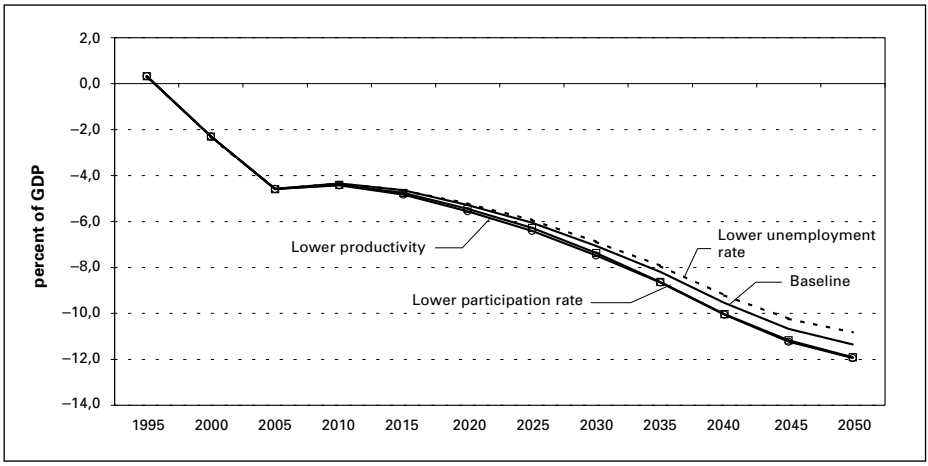
– Lower productivity: Productivity growth was set 0.5 percentage points lower than in the baseline starting in 2008.
– Lower unemployment rate: The structural unemployment rate was lowered from 6.5 % to 4.0 %, which was the unemployment rate observed in 1996/1997. The fall in the unemployment rate is assumed to be slow. It converges from 6.5 % towards 4.0 % at the end of the projection period.
– Lower participation rate: It was assumed that the convergence of female participation rates towards those of men will not occur, unlike in the baseline. As a result, the female participation rate (20–64) is over 10 percentage points lower as compared to the baseline and the total participation rate (20–64) is 5 percentage points lower at the end of the projection period.

The lower productivity growth results directly in lower GDP growth but at the same time in slower growth of the average wage, as productivity growth determines the growth rate of the average wage. The evolution of the average wage is an important determinant of the average pension at the time of retirement. While the lower level of GDP will tend to raise pension spending as a percentage of GDP, the lower average wage will cause a fall in the average pension and consequently in the volume of pension spending. However, the final outcome will be negative and pension spending will increase as a percentage of GDP. The explanation rests on the fact that the stock of pensions in the sensitivity scenario consists of both "new" lower average pensions from the period of lower productivity growth (as compared to the baseline), but also of "old" pensions at the same average level as those in the baseline (from the period before productivity growth was lowered). When compared to the baseline, the "old" pensions are higher in relation to the "new" pensions, which drives pension spending up as a percentage of GDP. Other spending items are not significantly affected by lower productivity growth, as the trend growth of spending per head (health care and education) is related to GDP growth. Thus, the fall in GDP (denominator) is offset by the drop in the given spending item (nominator). The total impact of lower productivity growth on public expenditure and the primary deficit is limited to 0.6 % of GDP as compared to the baseline.

Another sensitivity test was focused on the impact of a lower unemployment rate on the public deficit. The falling unemployment rate raises employment and GDP growth vis-à-vis the baseline. There is no direct effect of the lower unemployment rate on pension spending, but it drops as a percentage of GDP due to the higher GDP growth. The lower unemployment leads to a fall in the number of unemployment benefits and child/family benefits. In this scenario, the public deficit is lower by 0.5 % of GDP.

The last sensitivity test was aimed at investigating the impact of a lower (female) participation rate. Unlike the fall in the unemployment rate, the lower participation rate reduces employment through a smaller workforce. As labour productivity is fixed, the lower employment brings about a decrease in GDP as compared to the baseline. The lower GDP is com-

FIGURE 11 Sensitivity Tests – Impact on Primary Deficit



pensated to some extent by a smaller number of (female) pensions and unemployment benefits. But the negative effect of the lower participation rate on GDP outweighs the fall in the pension eligibility ratio and the number of unemployment benefits. In this scenario, the primary deficit is higher by 0.6 % of GDP.

The results of the sensitivity tests are summarised in *Figure 11*. We prefer to present the impact of the sensitivity tests on the primary deficit, as the debt level reflects the cumulative impact of the changes over several years or decades and we want to see the impact on public spending at a given point in time. Moreover, we have emphasised that the high end-period debt level is a result of the currently high primary deficit, which is not related to population ageing. On the basis of *Figure 11* we can conclude that the impact of the sensitivity test on the primary balance is fairly limited and surprisingly[19] similar in magnitude.

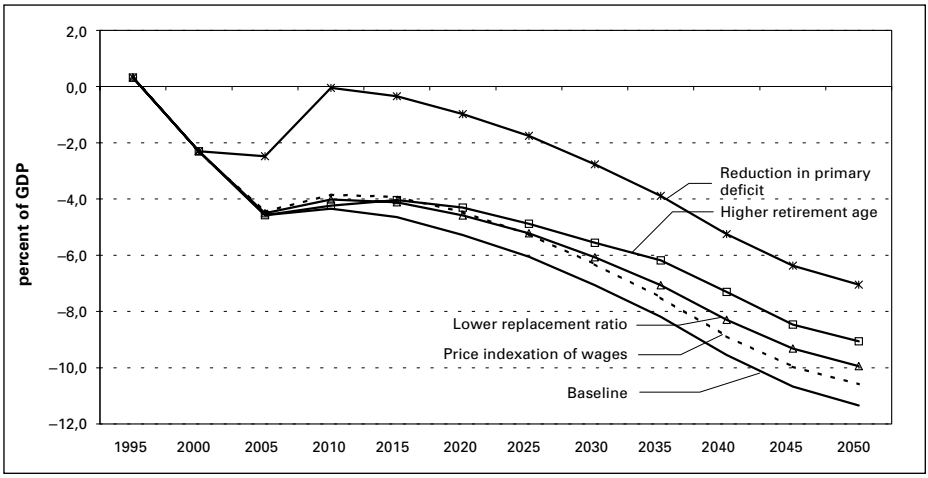
Besides the sensitivity tests, several policy simulations were undertaken. Policy-makers have several options for containing the future spending pressures stemming from population ageing. Leaving aside fundamental pension and health care reforms requiring a broad policy consensus, substantial savings can be achieved through parametric changes to the current systems, and early primary deficit reductions can provide room for future fiscal manoeuvre. Four options were examined:

– Primary deficit reduction: At present the Czech Republic reports a high primary deficit, which is leading to a rapid accumulation of debt irrespective of the future rise in age related-spending. It was assumed that the primary deficit is removed in 2007.[20]

[19] No *a priori* attempt was made to calibrate the parameter changes so as to generate similar deviations from the baseline.

[20] We referred to this option in subsection 4.8 as we tried to show the isolated impact of population ageing on public finance sustainability.

FIGURE 12 Policy Simulations – Impact on the Primary Deficit



– Indexation of pensions to prices: In this policy scenario pensions were indexed to prices rather than to prices plus one third of real wage growth as in the baseline.
– Lower replacement ratio: The ratio of the average pension to the average wage at the time of retirement was reduced by 5 percentage points.
– Extension of the retirement age: Beyond 2007 an extension of the retirement age was phased in with the aim of increasing the retirement age to 65 years for both men and women. The retirement age was lengthened by 3 months a year for men and 4 months for women. Under this assumption men will retire at 65 from 2019 on and women (with two children) from 2025 on.

Figure 12 shows the results of the policy simulations. It is apparent that an early fiscal adjustment reducing the primary deficit makes it possible to better face the future fiscal pressures. Fiscal consolidation is a precondition for fiscal sustainability. Indexation of pensions to prices and a reduction in the replacement ratio help contain pension spending. The simulations indicate that the lower replacement ratio and indexation to prices reduce pension spending and the primary deficit by 1.4 % and 0.7 % of GDP respectively. On the other hand, these measures could impair the welfare of the elderly. In such a case, the reduction in the primary deficit may be lower as some pensioners may become dependent on social assistance and state social support programmes.

The extension of the retirement age is the most efficient measure for generating budgetary savings. The higher retirement age leads to a fall in the primary deficit by 2.2 % of GDP. We have to point out that the reduction in the primary deficit is achieved through a fall in pension spending only. In reality, the extension of the retirement age not only contains pension spending, but also results in a higher participation rate, which has a fa-

vourable impact on employment and GDP growth. Higher employment will raise the wage bill and bring in additional revenues for the government. In our simulation, the positive effect of the higher retirement age on the labour market was switched off, as we were trying to demonstrate the isolated impact on pension spending.[21]

5. Conclusion

Long-term projections have become an important instrument for assessing public finance sustainability, and their importance has been further strengthened by the challenges posed by population ageing. Population ageing will have serious consequences for fiscal policy formulation in most developed countries. The Czech Republic will be strongly hit by a demographic shock, as its population will be ageing rapidly. A comparison with other OECD countries shows that the Czech Republic ranks as one of the fastest ageing countries. To examine the likely impact of population ageing on future fiscal imbalances under the current policy settings, projections of the main age-related expenditures have been carried out. The projection exercise is an extension of similar exercises focusing on pension spending only. It covers projection of health care costs, education expenditure and child/family benefits.

All long-term projections are very uncertain, as small changes in starting values or in key parameters and assumptions can have a large impact on the projections, in particular the further out the projection goes. However, an alternative model of the public pension system confirmed the relative robustness of the baseline model's pension projections. Each of the calculations should be regarded not as a forecast, but rather as a projection of the possible outcome under explicit assumptions. The projection indicates that the cumulative effect of population ageing on the labour market and public finances will be profound. However, from the point of view of policy-making, the fact that these changes will become apparent only gradually may be dangerous. As a result, policy-makers may be tempted to postpone hard policy decisions and essential reforms.

Although the exercise was only a spreadsheet projection omitting many important links and effects, it still sheds some light on the effects of population ageing on public expenditures and raises many questions relevant for policy-makers. Given the unfavourable demographic trends, policy-makers will have to contemplate how to address the pressures on public expenditures stemming from population ageing. Although some of the expenditures may attenuate the impact of population ageing on the pension system and health care spending, they are unlikely to reverse the unfavourable trends of the deteriorating primary deficit and exploding public debt. However, in addition to population ageing, the path of public debt is to a large extent determined by the poor starting position of Czech public finances.

[21] An additional argument for not increasing the participation rate is the fact that in international terms the participation rates in the Czech Republic are already fairly high.

Three conclusions can be drawn from the projection exercise. Firstly, full indexation to wages should be avoided, as it leads to a mounting imbalance between the incomes and outlays of the pension system. Less generous indexation formulae and other parametric changes (especially extension of the retirement age) could stabilise the system in the next decade and provide time for implementing pension reform. Secondly, the starting position of the Czech Republic is very poor, in spite of its low debt level and debt interest payments. The high primary deficit is fostering a rapid rise in the debt irrespective of population ageing. A consolidation strategy aimed at primary deficit reduction will have to be introduced. Thirdly, the results of the projection exercise call for a thorough analysis of the systems most affected by population ageing, namely the pension system and health care system. Profound reforms of the pension and health care systems will have to be drawn up and introduced, so that the impact of population ageing on public spending can be withstood.

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SUMMARY

JEL Classification: E62, H11, H5, H6, H81
Keywords: ageing populations – fiscal policy – fiscal sustainability

Fiscal Implications of Population Ageing

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The paper explores the long-term fiscal implications of population aging in the Czech Republic. The results, although bearing a significant margin of uncertainty due to the very long-term character of the projection exercise, do not impart encouraging fiscal outlooks for the Czech Republic. This is hardly surprising given that the Czech Republic is facing pronounced population ageing. Moreover, the fiscal position of the Czech Republic is presently very poor, in spite of its (still) low level of debt and debt interest payments. The Czech Republic's high primary deficit will foster a rapid rise in debt irrespective of population ageing. Therefore, to cope with the expected fiscal pressures, it is necessary not only to overhaul the pension and health-care systems in the medium term, but also to immediately start an intensive strategy of consolidation aimed at significantly reducing the high primary deficit.