

# Fiscal Implications of the Ageing Population in Croatia

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## Abstract

Demographic changes altering size and age-profile are recognised in many countries, including within the EU, as an important determinant of both the size and the structure of government expenditures and revenues in the long run. In Croatia, having a negative population growth rate and total fertility rate below 2.0, projected demographic trends are quite similar to those in the rest of Europe. Therefore, significant budgetary implications of the so-called ageing population phenomenon can be expected.

The aim of this paper is to use the standard methodology developed by the European Commission in order to assess the long-term implications of ageing population on the sustainability of public finances in Croatia. The results of the analysis show that demographic changes could, in the long-run, place Croatian public finances on an unsustainable path, and imply the necessity of adopting fiscal policy actions aimed at avoiding the negative budgetary consequences of an ageing population.

**Keywords:** sustainability of public finances, ageing population, age-related expenditures

**JEL Classification:** E62, H51, H55, H6, J11

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## 1 Introduction

In recent decades, in almost all developed countries, similar demographic trends can be observed. Extended life expectancy coupled with low fertility rates have changed demographic images, leading to a rising population of the elderly, and a diminishing population of those in younger age cohorts. The result of such trends is the so-called ageing population phenomenon, the economic, fiscal and social consequences of which deserve increased attention.

Both the OECD and EU countries recently developed similar methodologies aimed at assessing the fiscal consequences of ageing populations. The methodologies are focused on long-term projections of age-related expenditures, whereby the age-related expenditures mainly relate to public pension expenditures, health and long-term care expenditures and education expenditures. The impact of ageing populations on tax revenues, however, is generally not taken into consideration.

The available demographic projections indicate that in Croatia, having a negative population growth rate and total fertility rate below 2.0, the ageing population phenomenon will be more and more pronounced, posing a great challenge to the sustainability of government finances.

In this paper, standard methodology developed by the European Commission's Economic Policy Committee working group on ageing populations is used in order to assess the long-term implications of an ageing population on the sustainability of public finances in Croatia. In some details, however, the analysis in this paper departs from the standard methodology for different reasons which will be explained later.

The paper is divided into five sections. Following the introduction, the second section presents the main demographic trends until 2050. These come from United Nations' demographic projections. It also indicates the implication of these developments on the evolution of the working-age and elderly populations. The long-term effects of demographic developments on pensions and health-care expenditures, and social security contributions are assessed in the third section of the paper. After that, in the fourth section, the evolution of debt levels is extrapolated assuming that the tax burden and non-age related primary expenditures remain constant as a share of GDP at the 2005 level over the projection period, the interest-growth rate differential remains around zero, and age-related expenditures evolve in line with the projections. The assumptions

regarding age-related expenditures, initial budget position and the interest-growth differential from the baseline scenario is then relaxed in order to test the sensitivity of results to the underlying assumptions. Synthetic indicators of required adjustment effort are also calculated. The results made it possible to verify whether, in the long-run, the sustainability of public finances can be preserved in light of the ageing population. The final section concludes and indicates the avenues of possible improvements in the assessment of long-term analysis of public finance sustainability in light of population ageing in Croatia.

## 2 Demographic Projections

### 2.1 Underlying Assumptions

The age-related expenditure and social security contribution projections presented in the paper are based on demographic projections prepared by the United Nations (United Nations, 2003). Although criticized by Croatian experts, these are still the only available official demographic projections for Croatia, which explains their use in the paper<sup>1</sup>. Within the EU, budgetary implications posed by ageing populations used to be assessed on the basis of the demographic projections prepared by national statistics institutes, and the most recent assessments are made using the demographic projections prepared by Eurostat (Economic Policy Committee 2003, 2001). The same source of data for demographic projections should guarantee the use of the same methodology and thus the comparability of demographic projections for all of EU member states. In the near future, Eurostat should make demographic projections for all EU countries, both old and new, as well as Bulgaria and Rumania, and four EFTA countries (Economic Policy Committee, 2003.) Unfortunately, Eurostat has no plans to produce demographic projections for Croatia as a new candidate country yet.

The United Nations have prepared six demographic projection variants, four of which are available on the web. These four variants – medium variant, high variant, low variant and constant-fertility variant, will be used in this paper when assessing the fiscal implications of demographic changes, with medium variant taken as a starting point for the baseline scenario. The demographic projection variants differ among themselves with

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<sup>1</sup> *There are, however, several demographic projections carried out by independent experts, e.g. Mrđen (2004), Grizelj (2004) and Rozga (2003).*

respect to the assumptions made regarding the future course of fertility (United Nations, 2003).

The different projection variants can be described by the underlying assumptions, and the most important of them are presented in Table 1. It can be seen that in all the variants, except the high variant, fertility rates are too low to ensure a natural replacement of the population or to stabilize its age structure. In the medium variant, the fertility rate will, in the period 2005-2010, stand at 1.7, and will go up to 1.9 in the period 2045-2050. These fertility rates are similar to ones in the EU, where the average fertility rate stood at 1.5 in 2000, and is projected to rise to 1.8 in 2050 (Economic Policy Committee, 2001.)

Life expectancy at birth is expected to increase over the projection period from 74.1 years for men and 78.6 years for women in the period 2005-2010 to 76.6 years for men and 82.6 years for women in the period 2045-2050. For the EU, average life expectancy at birth for men is projected to rise from 75.3 in 2000 to 80.5 years in 2050, and for women from 81.4 in 2000 to 85.5 years in 2050.

**Table 1. Demographic projections, underlying assumptions for all variants**

	Medium variant			High variant		
	2005-2010	2045-2050	change	2005-2010	2045-2050	change
Total fertility rate <sup>1</sup>	1.67	1.85	0.18	1.81	2.35	0.54
Life expectancy (both sexes)	74.9	79.6	4.7	74.9	79.6	4.7
Male life expectancy	74.1	76.6	5.5	74.1	76.6	5.5
Female life expectancy	78.6	82.6	4.0	78.6	82.6	4.0
Population growth rate (%)	-0.26	-0.58	-0.32	-0.16	-0.11	0.05
Net migration (thousands)	-5	-5	-5	-5	-5	-5

	Low variant			Constant-fertility variant		
	2005-2010	2045-2050	change	2005-2010	2045-2050	change
Total fertility rate <sup>1</sup>	1.53	1.35	-0.18	1.60	1.60	0.00
Life expectancy (both sexes)	74.9	79.6	4.7	74.9	79.6	4.7
Male life expectancy	74.1	76.6	5.5	74.1	76.6	5.5
Female life expectancy	78.6	82.6	4.0	78.6	82.6	4.0
Population growth rate (%)	-0.35	-1.04	-0.69	-0.31	-0.85	-0.54
Net migration (thousands)	-5	-5	-5	-5	-5	-5

Note: <sup>1</sup> children per woman.  
Source: UN, 2003.

Unlike in EU countries, for which the net inward migration of 0.2% of total population throughout the projection period is predicted, Croatia is expected to have a permanent net outward migration of more than 0.1% of its total population<sup>2</sup>.

## 2.2 Main Trends

As result of these demographic developments, the size of the Croatian population falls in all the demographic projection variants, with the size of the population being almost 20 percent lower in 2050 than in 2005, according to the medium demographic projection variant (see Table 2).

**Table 2. Total population and evolution of demographic dependency ratios for all demographic projection variants**

	Medium variant			High variant		
	2005	2050	change	2005-2010	2045-2050	change
Total population	4405	3581	-824	4420	4022	398
Median age	40.2	44.9	4.7	40.0	40.6	0.6
Elderly <sup>1</sup> (as % of total population)	17.0	25.0	8.1	16.9	22.3	5.4
Working age population <sup>2</sup> (as % of total population)	66.5	59.1	-7.4	66.2	58.0	-8.2
Old age dependency ratio <sup>3</sup>	25.5	42.3	16.8	25.5	38.5	13.0
Share of older workers in working age population <sup>4</sup>	16.8	21.2	4.4	16.8	19.3	2.5
Very old as % of elderly <sup>5</sup>	18.1	30.4	12.3	18.1	30.5	12.4

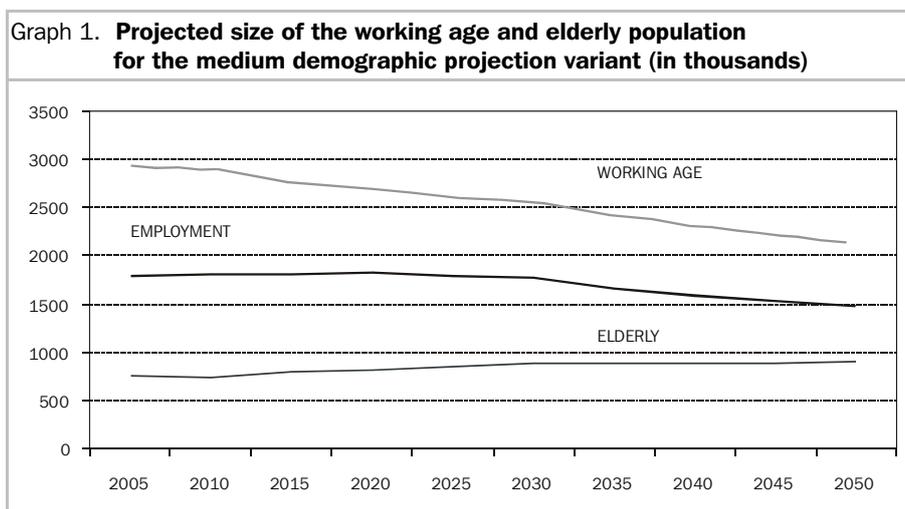
	Low variant			Constant-fertility variant		
	2005	2050	change	2005-2010	2045-2050	change
Total population	4391	3192	-1199	4398	3355	-1043
Median age	40.3	49.2	8.9	40.2	47.3	7.1
Elderly <sup>1</sup> (as % of total population)	17.0	28.3	11.3	17.0	26.8	9.8
Working age population <sup>2</sup> (as % of total population)	66.7	59.9	-6.8	66.6	59.6	-6.9
Old age dependency ratio <sup>3</sup>	25.5	46.9	21.4	25.5	44.9	19.4
Share of older workers in working age population <sup>4</sup>	16.8	23.5	6.7	16.8	22.4	5.6
Very old as % of elderly <sup>5</sup>	18.1	30.5	12.4	18.1	30.5	12.4

Notes: <sup>1</sup>Population aged 65+; <sup>2</sup>Population aged 15-64; <sup>3</sup>Population aged 65+ as % of population aged 15-64; <sup>4</sup>Population aged 55-64 as % of population aged 15-64; <sup>5</sup>Population aged 80+ as % of population aged 65+.  
Source: UN, 2003; author's calculations.

<sup>2</sup> Contrary to that, some authors e.g. Mrđen (2004) argue that net inward migration can be expected in Croatia in next three decades.

The number of elderly persons aged 65 and above will rise by almost 20 percent, as presented in Graph 1, and their share in the total population will grow from 17 percent in 2005 to 25 percent in 2050 (in the medium variant). For the sake of comparison, the increase in elderly persons in EU member countries is projected to be much higher, or some 70 percent.

At the same time, the working age population (persons aged between 15 and 64) is projected to fall by almost 30 percent and its share in the total population to decline from 67 percent in 2005 to 59 percent in 2050. The labour force itself is going to be older, too, with the share of workers aged between 55 and 64 in the total workforce increasing by 4 percentage points. The drop in the working age population in the EU between 2000 and 2050 is projected to be some 18 percent.



*Note: Working age population refers to persons aged 15 to 64.  
Elderly population refers to persons aged 65 and above.  
Source: UN, 2003; author's projections.*

The old-age dependency ratio (defined as persons aged over 65 as a percentage of the working age population) is, according to the medium variant, going to rise from 26 percent in 2005 to 42 percent in 2050, a development which is quite similar to the European average, where the old-age dependency ratio is projected to grow from 24 percent in 2000 to 49 percent in 2050. This means that in Croatia, the number of persons of working age for every elderly person aged 65 and over will go down from 4 to 2.4 and in the EU the same number will go down to only 2 persons.

The number of the very old (population aged 80 or more) is, according to the medium variant, going to double (from 135 thousand in 2005 to 272 thousand in 2050). Although this rise could have a significant impact on public spending on health and long-term care for the elderly, this development is far less dramatic than in the EU, where the number of very old is projected to triple from 2000 to 2050.

It has to be stressed that long-term population projections must always be taken with caution. In the special Croatian case, where there is only one official source of demographic projections, and where the projections it offers cannot be compared to data from other sources, even greater caution is needed when using the data. Therefore, the development of national demographic projections currently underway within the Croatian Bureau of Statistics must be welcomed, and the assessment of the fiscal implications of demographic changes should be revised once the population scenarios developed by the national statistics institution become available<sup>3</sup>.

### 3 Effects of Demographic Changes on Government Revenues and Expenditures

The Economic Policy Committee working group on ageing populations assesses possible effects of demographic changes on government revenues and expenditures by making long-term projections of the so-called age-related expenditures, such as public pension expenditures, health and long-term care expenditures and education expenditures. For the sake of consistency, it also includes unemployment benefit in its assessment, although this is not considered to be related to ageing.

In this paper, Croatian long-term fiscal sustainability will be assessed by projecting elements of both expenditures and revenues. Among the expenditure items, the analysis will include public pension expenditures and health expenditures, and among the revenue items pension contributions and other social security contributions.

The standard methodology does not take account of the development of public revenues in light of ageing populations, since the age structure of the population is not seen as the key determinant of their size and evolution. The reasoning behind this is as follows. Firstly, pensioners pay income taxes which can increase collected tax revenues. Secondly,

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<sup>3</sup> *This information can be found in Grizelj (2004).*

it is argued that older workers, whose share in the working-age population rises, earn higher wages than young workers, thereby compensating for the negative effect of the decreasing working-age population on taxes. Recent studies on consequences of ageing populations on tax revenues confirm that population ageing can have ambiguous effects on tax revenues. Finally, the experience shows that the level of public spending is the main determinant of tax revenues as a share of GDP<sup>4</sup>.

There are, however, two reasons for taking into account the development of social security contributions in the Croatian case, the first one being the fact that social security contributions are paid only by those employed, and not by pensioners. In addition, even if the older workers earned higher wages in the future, the amount of collected social security contributions would probably not be high enough to offset the loss of contributions due to the falling number of younger employees, since, unlike taxes, social security contributions are regressive in their nature. In addition, a projection of pension contributions should be made to capture the effects of pension reform on collected pension contributions.

There are some other expenditure items in Croatia that could be sensitive to demographic changes, such as expenditure on unemployment benefit, child benefit and maternity leave, and also education expenditures, but at the moment it seems that their projection would have to consider non-demographic factors driving public spending, which are very hard to project. Therefore, the projection of these expenditure items is left for some other projection exercise.

### 3.1 Macroeconomic Assumptions

Long-run projections of government expenditures and revenues are based on macroeconomic assumptions regarding labour force participation rates, unemployment rates, real GDP rates and CPI inflation.

Labour force participation rates up to 2010 are, in accordance with the EPC working group on ageing populations methodology, based on projections by the ILO (1997). Participation rates for men are constant for all age groups. The participation rate for

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<sup>4</sup> *Review of the main findings of studies on consequences of ageing populations on government revenues can be found in Economic Policy Committee (2003, p. 20).*

women in the 15-54 age group are assumed to converge by 2050 to within 10 percentage points of the participation rate for men in the same age group. The participation rates for women in the 55-64 age group is allowed to converge by 2050 to within 20 percentage points of the participation rate for men in the same group (see Table 3).

	15-54			55-64			65+		
	2005	2050	change	2005	2050	change	2005	2050	change
<b>Male</b>	82.3	85.0	2.7	41.3	45.0	3.7	14.6	12.0	-2.6
<b>Female</b>	69.0	75.0	6.0	18.5	25.0	6.5	7.0	6.0	-1.0

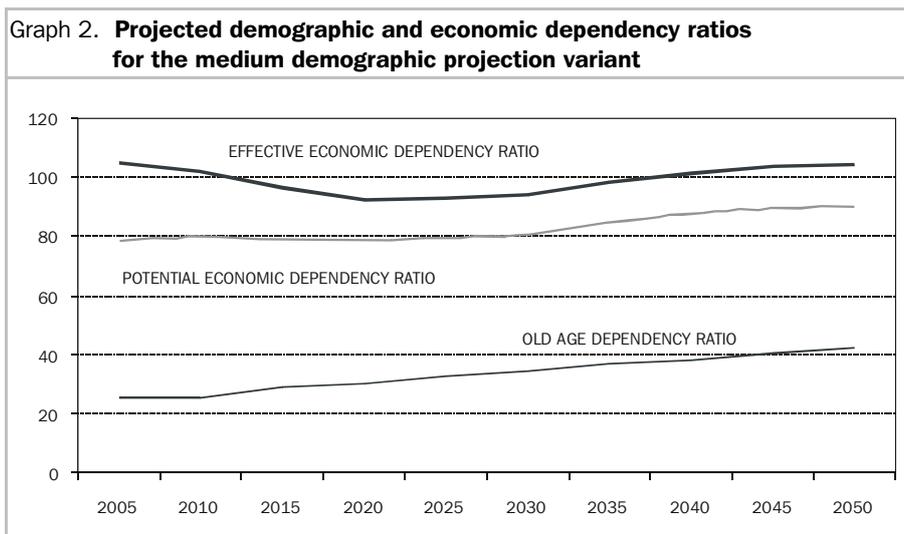
*Note: Participation rate = active population as a % of working-age population.  
Source: ILO, 1997; author's projections.*

Unemployment rates are assumed to fall from 17 percent in 2005 to 7 percent in 2050. In EPC working group on ageing populations methodology, unemployment rates are assumed to fall to their structural level, as defined by the OECD, by 2005 and to stay constant thereafter (Economic Policy Committee, 2001). For Croatia, there are no estimates of structural unemployment rate available. It is assumed that by 2050 Croatia could reach an unemployment level of 7 percent, equal to the structural unemployment rate of EU member countries with the highest structural unemployment rates.

Higher participation rates and lower unemployment rates will offset some of the impact of demographic developments on the balance between economically active and inactive persons who must be supported. Therefore, the potential fiscal influence of ageing does not so much depend on the old-age dependency ratio, but more on the potential and effective economic dependency ratios, the *potential economic dependency ratio* being the number of potentially inactive persons as a percentage of the total labour force, and the *effective economic dependency ratio* being the number of unemployed persons as a percentage of the number of persons employed. These dependency ratios are calculated for Croatia, based on labour force assumptions, and presented in Graph 2.

As is shown in the graph, the effective economic dependency ratio is projected to fall until 2020, and then to rise reaching its initial level in 2050. In the same period, the old-age dependency ratio is expected to rise throughout the projection period, and at the end of the projection period to increase by two-thirds compared to the initial level.

The real gross domestic product is projected to grow 3.5 percent annually, and the labour market productivity in the baseline scenario is projected to grow by 2.8 percent on average annually. It is expected that the annual inflation rate will remain stable at 2.5 percent.



*Note: Potential economic dependency ratio = population aged 15+ not in the labour force as a % of the number of persons in the labour force.*

*Effective economic dependency ratio = persons aged 15+ who are not employed as a % of number of persons employed.*

*Source: UN, 2003; author's projections.*

### 3.2 Effects of Demographic Changes on Public Pension Expenditures

As for the possible effects of demographic changes on public pension expenditures, Croatia has a rather unique position in Europe, since it launched pension reform in 1998 aimed at reducing fiscal pressure resulting from the existing PAYG system, and introduced a three-pillar pension system in 2002. The pension system in Croatia now consists of a downscaled PAYG pension pillar, a mandatory fully-funded pillar, and a voluntary fully-funded pillar<sup>5</sup>. Due to pension reform, in the future, one can expect diminishing public spending on pensions expressed as a share of GDP, in spite of the rising number of elderly. However, in the same period, due to the reduction of the rate of

<sup>5</sup> More information on Croatian Pension Reform can be found in Anusic, O'Keefe, Madjarevic-Sujster (2003).

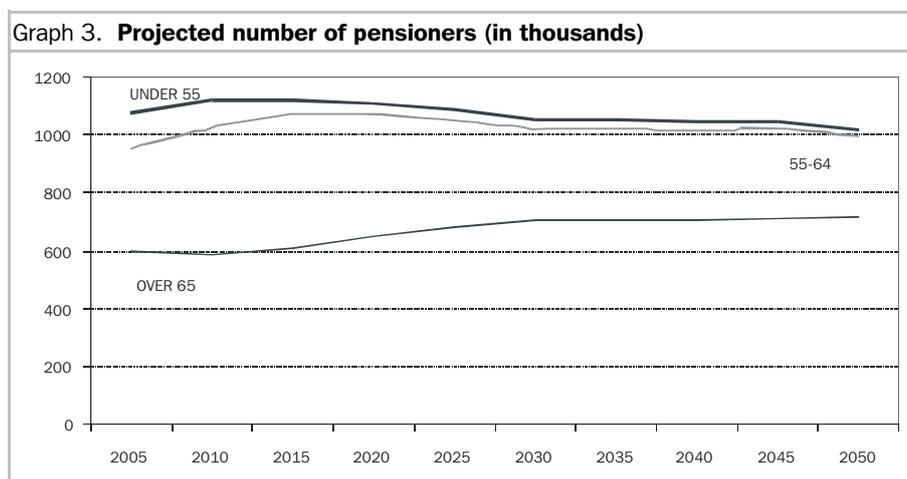
pension contributions for those that entered the second pillar (individuals below the age of 40 as of July 2000 and employees between the ages of 40 and 50 as of July 2000 who chose to join the multi-pillar system), the revenues from pension contributions will also go down, so that this effect should not be neglected when projecting future fiscal trends.

The starting point for the projection of public pension expenditures was the projection of the number of pensioners. In the last decade, the Croatian pension system has faced a huge inflow of pensioners, and the immense resulting deterioration of the so-called system dependency ratio (the ratio between contributors to the pension system and pensioners). The inflow of pensioners was not driven by demographic factors, but was predominantly influenced by economic (transition and privatisation influenced restructuring) and political factors (war). In the future, it is expected that economic and political forces driving early retirement will vanish and, in addition, that new legislation regulating normal retirement and early retirement age, as well as access to the system of disability and survivors pension, would put further restrictions on the retirement of persons of younger age groups. The share of pensioners younger than 55 is assumed to diminish gradually from 11 percent in 2005 to 3 percent in 2050, and the share of pensioners younger than 65 is expected to fall from 44 percent in 2005 to 30 percent in 2050. As a result of such assumptions, the number of pensioners should first rise until 2015, and then fall since the reduction in the number of early retired persons is projected to counterbalance the rise in the number of pensioners stemming from the population aged 65 and over (see Graph 3).

This projection is much more optimistic than the one found in Anusic, O'Keefe and Madjarevic-Sujster (2003), and which projects a constant rise in the number of pensioners, and is slightly more optimistic than the one that can be found in Marušić (2001), which expects a decline in the number of pensioners after 2020. The idea behind the optimism regarding the development of the number of pensioners in this paper is that one cannot expect high inflows of pensioners in the next few years, since many of those who would reach the normal retirement age during this period, have already been retired through various pension buy-out schemes, early retirement schemes or as war veterans.

For the projection of public pension expenditures it was also necessary to incorporate in the projection the number of persons aged 40 to 50, as of July 2000, who did not opt for the multi-pillar pension system and will, therefore, receive a pension from the first pillar. For this purpose, this projection exercise made use of the information that 77 percent of

employed persons aged 40 to 50 as of July 2000 did not opt for the multi-pillar pension system.



Source: UN, 2003; author's projections.

The projection of public pension expenditures is based on the projection of the number of pensioners, both those in the first pillar and those in the multi-pillar system. It also takes into account the corresponding formulas for the calculation of benefits<sup>6</sup> as well as the indexation at wages introduced at the beginning of 2004. The average gross pension in the initial period is expected to be some 2,200 kuna.

Public pension expenditures are calculated for the baseline scenario, in which average gross wages grow 6 percent annually, and for two alternative scenarios. In the high average wage growth scenario, wages are assumed to grow at 7 percent annually, i.e. the rate of average wage growth is higher than the nominal GDP growth. In the low average

<sup>6</sup> For those insured only in the first pillar, the following formula is applied:

(1) Amount of pension = actual pension value \* personal points \* pension factor.

For those insured in both mandatory pillars, a two part formula is applied. For years of service in the old system, the benefit is calculated in the same way as for those insured only in the first pillar, and for years of service in the new system the so-called basic pension is calculated in accordance with the following formula:

(2) Basic pension =  $0.25 * \text{actual pension value} * \text{personal points} * \text{personal factor} + 0.0025 * \text{average wage in Croatia in 1998 indexed at the same rate as the actual pension value} * \text{years of service in the new system}$ .

wage growth rate scenario, average wage growth is 5 percent annually. Results of the projection are presented in Table 4.

	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>	<b>2045</b>	<b>2050</b>	<b>change</b>
Baseline scenario	13.1	13.6	13.5	13.1	12.0	10.4	9.2	8.0	7.0	6.3	-6.8
High average wage growth scenario	13.2	14.4	14.9	15.1	14.1	12.9	11.8	10.5	9.4	8.7	-4.6
Low average wage growth scenario	13.0	12.8	12.2	11.3	10.0	8.4	7.1	6.1	5.3	4.7	-8.3

Source: Author's estimates.

Projected public pension expenditures are expected to fall in all scenarios, the decreases ranging from 4.6 to 8.3 percentage points of GDP. Such developments result from the application of new legislation introduced with pension reform. The projection exercise presented in this paper projects public pension expenditures in 2040 to reach 8 percent of GDP, while in the projection made by Anusic, O'Keefe and Madjarevic-Sujster (2003), the comparable figure is 8.2 percent of GDP, while in the projection made by Marusic (2001), public pension spending is projected to be around 6 percent.

In the EU, public pension expenditures are at the same time expected to grow around 5 percentage points of GDP on average (Economic Policy Committee, 2003). Such a difference in results between Croatia and the EU can be explained by two factors. Firstly, most EU countries rely on PAYG pension schemes. Secondly, EU countries expect a large inflow of pensioners belonging to the so-called baby-boom generation in the next decade, while in Croatia the members of the baby-boom generation are mostly already retired.

To discern the effect of population ageing on public pension expenditures from other factors, it is useful to decompose the results of the pension spending projection according to the four explanatory factors driving the projected changes in its share of GDP. These four factors are *population ageing effect* measuring changes in the ratio of persons aged 55 and over to the population aged 15 to 64, *employment effect* measuring changes in the share of the population of working age that are employed, *eligibility effect* measuring the share of the population aged 55 and over that receive a pension, and *benefit effect* measuring changes in the average pension relative to output per worker.

Table 5 compares the changes in each of these ratios between 2005 and 2050<sup>7</sup>. It is obvious that the ageing effect is the only force driving public pension expenditures upwards, and, with other ratios remaining at their initial level, the pure effect of population ageing will result in an increase in pension spending in terms of GDP by 6.5 percentage points.

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	% change
Dependency ratio <sup>1</sup>	42.3	45.1	50.4	51.5	53.6	54.4	58.4	60.9	62.7	63.5	50.1
Inverse of employment ratio <sup>2</sup>	163.2	161.1	152.1	147.7	145.0	144.2	145.0	145.7	145.0	143.6	-12.0
Benefit ratio <sup>3</sup>	21.9	21.8	21.7	21.5	19.7	17.5	14.5	12.1	10.2	9.0	-58.7
Eligibility ratio <sup>4</sup>	86.7	85.7	80.9	79.8	78.1	75.7	74.9	74.1	75.3	75.9	-12.4

Notes: <sup>1</sup>Dependency ratio = population aged 55+ as % of population aged 15-64; <sup>2</sup>Inverse of employment ratio = population aged 15 to 64 as % of number of persons employed; <sup>3</sup>Benefit ratio = average pension as % of GDP per person employed; <sup>4</sup>Eligibility ratio = number of pension beneficiaries as % of persons aged 55+.

Source: Author's estimates.

### 3.3 Effects of Demographic Changes on Public Expenditures on Health and Long-Term Care

The expenditures on health and long-term care are considered to be highly related to age and therefore are projected within the assessments of long-term fiscal implications of ageing. According to the standard methodology, public expenditures on health and long-term care should be projected separately. In the case of Croatia, however, it is not possible to disentangle long-term care expenditures and total healthcare expenditures. Therefore, long-term care expenditures will be for the purpose of this paper considered as part of health expenditures. For the sake of simplicity, it will also be assumed that the age profiles for public expenditures on long-term care correspond to those for public expenditures on healthcare.

Since there are, unfortunately, no data available on age profiles for public expenditures on healthcare in Croatia, this exercise will be based on the assumption that average

<sup>7</sup> The following equation is used:

$$(3) \quad \frac{\text{PensionsSpending}}{\text{GDP}} = \frac{\text{AveragePensionBenefit}}{\text{GDP} / \text{Employment}} * \frac{\text{Pensioners}}{\text{Population}(55+)} * \frac{\text{Population}(55+)}{\text{Population}(15-64)} * \frac{\text{Population}(15-64)}{\text{Employment}}$$

For further information see Dang et al. (2001).

expenditures per head on healthcare for different age groups (expressed as a share of GDP per capita) correspond to the typical age distribution of healthcare expenditures in EU member countries. Justification for such an assumption can be found in the fact that average expenditures per head on healthcare for different age groups are quite similar across EU countries, so that one can believe that the age distribution of healthcare expenditures in Croatia could not significantly differ from the European pattern.<sup>8</sup> Due to the fact that projections started from an estimation of the age profiles for public expenditures on health and long-term care, and not from the exact data, in order to avoid the stacking of miscalculations, it is taken that there are no significant differences between the age profiles for males and females.

The distribution of average expenditures per head on healthcare in Croatia is estimated on the basis of the average distribution in EU countries, but applying this distribution to total expenditures on health and long-term care in Croatia. The figure for the total expenditures on healthcare refers to 2001, since this is the most recent year for which official data on healthcare expenditures are available. In 2001, the total expenditures on health and long-term care in Croatia were as high as 8.2 percent of GDP, which is rather high compared to the European weighted average of 6.6 percent of GDP in 2000. The estimated age profiles for public expenditures on health and long-term care in Croatia are presented on Graph 4.

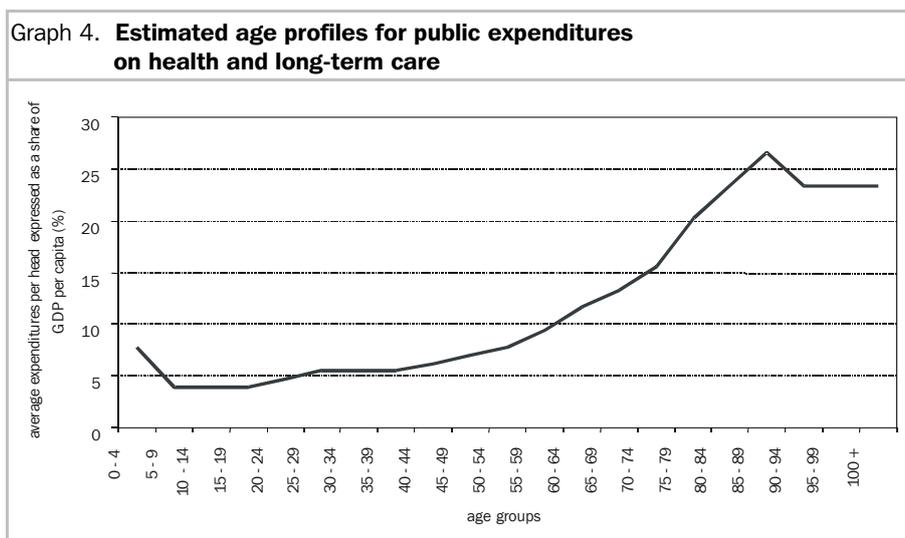
The projection of public expenditures on health and long-term care in Croatia is carried out using the assumption that expenditures per head on health and long-term care grow at exactly the same rate as GDP per capita. The relative magnitudes of expenditures per head across age groups are considered to be the same in all projection years, and to be the same as in the base year profiles. Projections are made for all the four demographic projection variants and presented in Table 6.

According to the results obtained, the pure consequence of demographic changes on expenditures on health and long-term care over the projection period would be around 1.3 percentage points of GDP in the medium variant, i.e. between 0.8 and 1.8 percentage points in other demographic projection variants. The result is somewhat more optimistic than the one obtained for the EU countries, where ageing is projected to raise health and long-term care expenditures between 2000 and 2050 from 1.7 to 3.2 percentage points of

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<sup>8</sup> *In the recent study by Bezděk, Dybczak and Krejdl (2003) on fiscal implications of population ageing, we can see that the age distribution of healthcare expenditures in the Czech Republic is also very similar to the typical age distribution of healthcare expenditures in the old EU countries.*

GDP or 2.2 percentage points on average, when calculated using the same approach as the one in the projection of health and long-term care expenditures for Croatia (European Policy Committee, 2003).



Source: Author's estimates.

**Table 6. Projected public expenditures on health and long-term care for all demographic projection variants (as % of GDP)**

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	change
Medium variant	8.2	8.4	8.7	8.7	8.8	8.9	9.2	9.3	9.4	9.5	1.3
High variant	8.2	8.4	8.5	8.6	8.7	8.9	9.0	9.1	9.1	9.0	0.8
Low variant	8.2	8.4	8.6	8.8	8.9	9.2	9.4	9.7	9.8	10.0	1.8
Constant-fertility variant	8.2	8.4	8.6	8.7	8.9	9.1	9.3	9.5	9.7	9.8	1.6

Source: Author's estimates.

It should be stressed that the projections of the development of health and long-term care costs in Croatia should be taken with caution, since they result from the application of a large number of assumptions. It would therefore be important that institutions in Croatia (e.g. the Croatian Institute for Health Insurance) provide data that are necessary for better quality results of such analysis, in particular data on health and long-term care expenditures by age groups.

The approach used in this exercise is relatively simple, but has at least one drawback. It ignores the concentration of health expenditures at the end of life irrespective of age at death, and tends to overestimate the impact of demographic changes on overall expenditure level. Therefore, the Economic Policy Committee working group on ageing populations suggests producing the optional scenario that takes account of the concentration of health expenditures towards the end of life. Such a scenario implies running projections which include estimates of so-called death-related costs. Although the results of such projections would be interesting for Croatia, their production requires a higher reliability of input data than in the Croatian case, and they cannot be carried out within the current exercise.

### 3.4 Effects of Demographic Changes on Revenues From Social Security Contributions

As previously mentioned, in the case of Croatia it also seems reasonable to run projections of the long-term effects of ageing on revenues from social security contributions. Two projections have been made, one for the contributions for pension insurance, and one for all other types of contributions. The contributions for health and unemployment are treated together because they share the same calculation base and differ only in the rates applied.

As for the revenues from pension contributions, they are based on the projection of the number of employees in the first pillar only, for which a 20-percent rate is applied, and on the projection of the number of employees in the multi-pillar system, for which a 15-percent rate is applied. It is assumed that average gross wages will develop proportionally for both groups of insured persons. It is also assumed that the compliance of contributions will gradually improve from the initial 85 percent to 94 percent in 2050 (a similar assumption is made by Anusic, O'Keefe and Madjarevic-Sujster, 2003).

The results of the projection presented in Table 7 reveal that the decrease in collected pension contributions, resulting from both changes in legislation and demographic developments, could be as high as 3.6 percentage points of GDP, i.e. between 3.1 and 4 percent if the alternative demographic projections are also taken into account.

The projection of revenues from other social security contributions is simple, and consists in applying statutory rates to the average gross wage of employed persons. It is also based on the assumption of gradually improved collection of contributions from 85 percent in 2005 to 94 percent in 2050.

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	change
Medium variant	7.6	7.5	7.1	6.5	6.0	5.7	5.2	4.7	4.4	4.1	-3.6
High variant	7.7	7.7	7.2	6.7	6.2	5.8	5.5	5.1	4.8	4.6	-3.1
Low variant	7.7	7.7	7.2	6.6	6.0	5.6	5.1	4.6	4.1	3.7	-4.0
Constant-fertility variant	7.7	7.7	7.2	6.6	6.1	5.6	5.2	4.7	4.3	3.9	-3.8

Source: Author's estimates.

Due to the reduction in the number of employed persons caused by demographic factors, other revenues from social security contributions will also fall according to the projection (see Table 8). In the scenario based on the medium demographic projection variant, the projected fall in collected revenues from other social security contributions amounts to 3 percentage points of GDP over the projection period, and in alternative scenarios between 2.5 and 3.5 percent.

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	change
Medium variant	7.7	7.8	7.6	7.4	6.9	6.6	5.9	5.4	5.0	4.7	-3.0
High variant	7.8	8.0	7.8	7.5	7.1	6.7	6.3	5.9	5.5	5.3	-2.5
Low variant	7.8	8.0	7.8	7.4	6.9	6.4	5.8	5.3	4.8	4.3	-3.5
Constant-fertility variant	7.8	8.0	7.8	7.5	7.0	6.5	5.9	5.4	4.9	4.5	-3.3

Source: Author's estimates.

These simple calculations show that the pure effect of demographic changes together with the effect of the changes in legislation regulating pension contributions could lead to a significant reduction in collected social security contributions, which currently provide approximately one third of total general government revenues.

Although the simulations of developments carried out in this exercise should not be considered as forecasts, but rather projections of possible outcomes, they may indicate that demographic changes could lead to important changes in the size and structure of government revenues and expenditures. The next section will try to assess the effects of these changes on the overall sustainability of public finances.

## 4 Assessment of the Sustainability of Public Finances in Light of Ageing Populations

After the so-called age-related expenditures are projected, as well as the revenues that could be treated as being determined by demographic developments in the Croatian case, it is possible to assess the long-run sustainability of public finances. For this purpose, standard methodology developed by the Economic Policy Committee working group on ageing populations will be applied. This methodology consists of a two-step procedure. In the first step, the evolution of the budget balances and debt levels is extrapolated on the basis of baseline projections. The second step consists of the calculation of different synthetic indicators of the required adjustment effort. Both sets of sustainability tests will be done for Croatia.

### 4.1 Extrapolation of Debt and Budget Balance Developments up to 2050

First, the long-term sustainability of public finance will be assessed by extrapolating debt and budget balance developments up to 2050. As suggested by the EPC working group, sustainable public finances will be defined as those complying with the budgetary requirements of EMU, i.e. avoiding excessive deficits, keeping debt levels below the 60 percent of GDP reference value, and respecting the “close to balance or in surplus” requirement of the Stability and Growth Pact (European Policy Committee, 2001). A breach of the reference values for either budget balance or debt during the projection period indicates that there may be a risk of budgetary imbalances emerging due to ageing population and that measures may be required to ensure the sustainability of public finances (European Commission, 2003.)

In order to verify whether current fiscal policy in Croatia meets the sustainability requirements in the long-run, several tests have been undertaken: a baseline test and seven stress tests. In accordance with standard methodology, a baseline test is run by extrapolating budget balances and debt levels on the basis of the baseline projections of age-related expenditures and revenues. The starting position in terms of the current budget balance, level of debt, primary spending and revenues other than social security contributions are the figures for 2005 reported by the Ministry of Finance in its *Fiscal policy guidelines for 2005-07 period* (“Načela fiskalne politike za razdoblje 2005. – 2007. godine”, Ministry of Finance, 2004).

It is further assumed that revenues other than social security contributions as well as non-age related primary expenditures will remain stable as a share of GDP at the 2005 level over the projection period, interest-growth differential remains at around zero<sup>9</sup>, and age-related expenditures and social security contributions evolve in line with previously presented projections. Seven stress tests have been carried out in order to test the sustainability of public finances under different circumstances. Three stress tests are run using different demographic projection variants. The other two stress tests are done by setting the initial total and primary budget balance at a level 1 percentage point more/less favourable compared with the baseline scenario. The remaining two stress tests assume the interest rate-growth rate differential as being higher/lower by 1 percentage point.

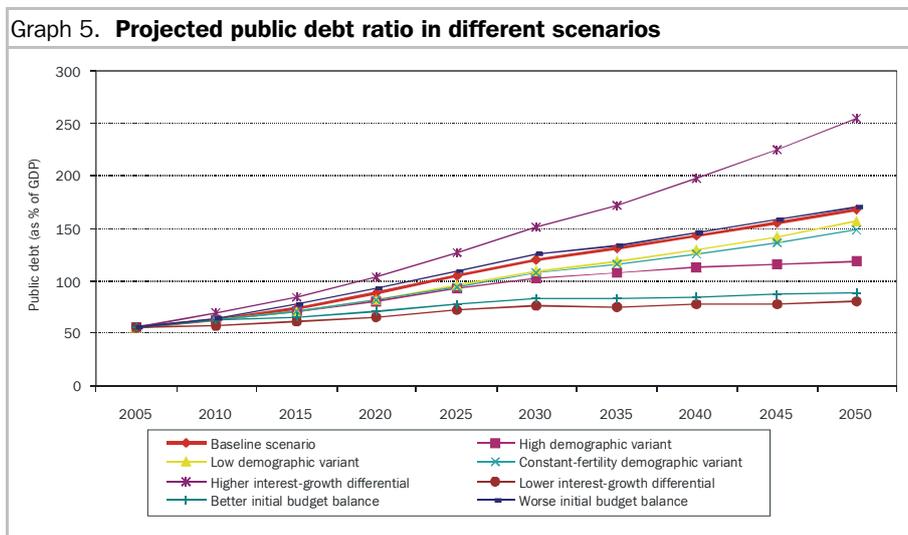
The budget balances that result from the extrapolation up to 2050 are presented in Table 9, and the debt levels in Graph 5. It is obvious that in every scenario the fiscal balance, already rather unfavourable in the initial period, deteriorates even further as a consequence of pure demographic changes. In the baseline scenario, the budget balance resulting from the projections reaches a level of 11.8 percent of GDP, and a level of debt of 167 percent of GDP in 2050.

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Baseline scenario	-3.7	-5.5	-6.9	-8.1	-9.0	-8.9	-10.0	-10.5	-11.1	-11.8
High demographic variant	-3.7	-5.1	-6.2	-7.3	-7.9	-7.8	-7.8	-7.8	-7.6	-7.5
Low demographic variant	-3.7	-5.1	-6.3	-7.6	-8.6	-9.0	-9.6	-10.3	-11.2	-12.3
Constant-fertility demographic variant	-3.7	-5.1	-6.3	-7.6	-8.4	-8.7	-9.2	-9.8	-10.4	-11.3
Higher interest-growth differential	-3.7	-7.0	-8.9	-10.7	-12.4	-13.4	-15.2	-17.0	-18.9	-21.2
Lower interest-growth differential	-3.7	-4.2	-5.1	-5.7	-5.9	-5.2	-5.5	-5.4	-5.3	-5.4
Better initial budget balance	-2.7	-4.6	-5.6	-6.3	-6.7	-6.1	-6.4	-6.4	-6.4	-6.5
Worse initial budget balance	-4.7	-6.6	-8.2	-9.4	-10.4	-10.4	-11.2	-11.8	-12.3	-13.0

Source: Author's estimates.

<sup>9</sup> A nominal interest rate of 6 percent is assumed, and a nominal growth rate of 6.1 percent resulting from the assumption of 2.5 percent inflation and 3.5 percent real growth rate. A 6 percent nominal interest rate is also assumed in EPC working group projections.

The budget balance remains negative throughout the projection period in all scenarios even though the simulations are based on a projection of the budget balance for 2005 that assumes fiscal consolidation and improvement of the budget balance compared to the preceding year. The most dramatic developments can be expected if the interest rate increases above the level of the nominal growth rate, in which scenario the budget balance could reach 21 percent of GDP in 2050. Very high levels of deficit would also result from a higher initial budget balance and fertility rates lower than in the medium demographic projection variant.



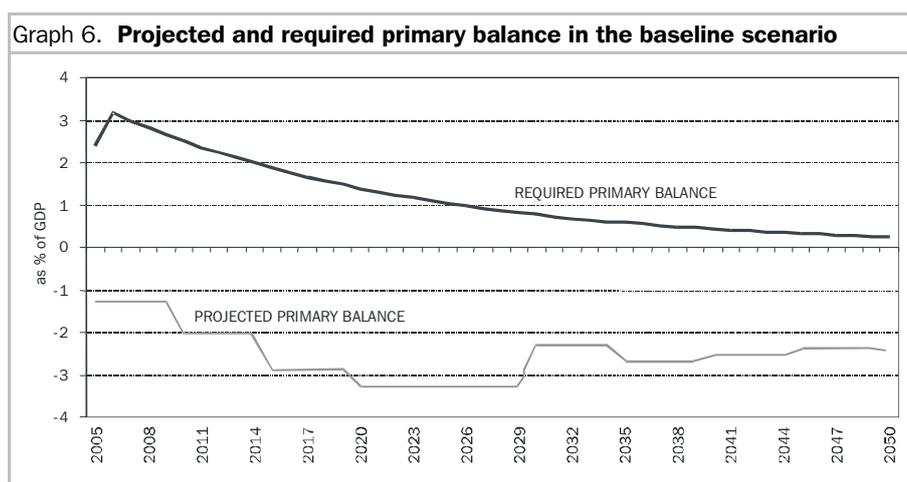
Source: Author's estimates.

Starting from 56 percent of GDP in 2005, the debt ratio breaches the debt requirement of 60 percent of GDP already in 2010 in all the scenarios except the low interest-growth rate differential scenario, where the requirement is breached in 2015. The sustainability is at highest risk in the alternative scenario assuming a higher interest rate-growth rate differential, and this scenario leads to a debt ratio of 255 percent of GDP in 2050. High risk is also coupled with a worse initial budget balance and demographic developments resulting from low or constant fertility rates.

## 4.2 Synthetic Indicators of the Required Adjustment Efforts

In accordance with standard methodology, there are different measures that provide an estimate of the scale of budgetary adjustment required for a sustainable public finance position to be reached.

A first synthetic indicator considers the difference between the projected primary surplus based on the projections and the primary surplus necessary to ensure a balanced budget in all the years of the forecasts. Such a synthetic indicator is calculated for Croatia for the baseline scenario. The calculated required primary balance and the projected primary balance are shown in Graph 6. As can be seen from the graph, the difference between them is large over the entire projection period, and amounts to 2.7 to 4.7 percentage points of GDP.



Source: Author's estimates.

A second synthetic indicator is the measure of the tax (financing)<sup>10</sup> gap. This measures the difference between the current tax ratio and the constant tax ratio over the projection

<sup>10</sup> The EPC working group previously called these indicators "tax gaps", but in its recent documents it suggests using the term "financing gap", since the previously used term could lead to the wrong conclusion that it is the tax ratio that should be changed if the public finance position proves to be unsustainable in the long-run. Instead, the positive financing gap should be considered as an indication that an appropriate combination is needed of changes on both the revenue and the expenditure side of the budget.

period necessary to achieve a pre-determined debt level at a specified date in the future. The EPC working group calculates three gaps. T-1 measures the difference between the current and constant tax ratio required to reach the same debt level in 2050 that would result from a balanced budget position being maintained over the entire projection period. T-2 measures the difference between the current and constant tax ratio required to reach a debt level of 40 percent of GDP in 2050. The T-3 measure is similar to tax gap measures found in economic literature based on the present value budget constraint. It indicates the change in tax revenues as a share of GDP that would guarantee compliance with the intertemporal budget constraints of the government. It equates the actualised flow of revenues and expenditures over an infinite horizon (Economic Commission, 2003; Economic Policy Committee, 2003).

For Croatia, all three financing gap measures are calculated. In addition, a fourth financing gap measure is included, measuring the difference between the current and constant tax ratio required to reach a debt level of 60 percent of GDP in 2050. The calculated indicators measure the required change in government revenues (as a percentage of GDP) other than revenues from social security contributions, since those revenues are projected separately and treated as being dependent on demographic changes.

The results of the calculation of financing gaps are shown in Table 10.<sup>11</sup> A positive financing gap implies that revenues other than social security contributions should be increased, or that non-age related expenditures should be reduced, or that further

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<sup>11</sup> The applied formula for the T-1 to T-3 financing gaps is as follows:

$$(4) \quad T_{1003} = \frac{r-n}{1+r-n} \frac{b_{2005} - b_{2050}(1+r-n)^{-45} + \sum_{i=1}^{45} (1+r-n)^{-i+1} g_{2005+i}^{AR} - \sum_{i=1}^{45} (1+r-n)^{i+1} ssc_{2005+i}}{1 - (1+r-n)^{-45}} + g^{NAR} ,$$

where  $g^{NAR}$  is the actual share of non-age related expenditures on GDP (assumed to remain constant),  $ssc$  is the share of social security contributions on GDP,  $g^{AR}$  the share of age-related expenditures on GDP,  $b$  debt ratio,  $r$  is the nominal interest rate, and  $n$  is the nominal growth rate (both assumed to be constant).

The formula for the T-4 gap is as follows:

$$(5) \quad \frac{\tau}{r-n} \left( 1 + \frac{T-4}{t} \right) = b_t + \frac{\sum_{i=1}^{45} g^p (1+n)^i}{(1+r)^i} + \frac{g_p}{(r-n)} \left( \frac{1+n}{1+r} \right)^{45} - \frac{\sum_{i=1}^{45} ssc(1+n)^i}{(1+r)^i} - \frac{ssc}{(r-n)} \left( \frac{1+n}{1+r} \right)^{45} ,$$

where  $\tau$  is the actual share of tax revenues on GDP (assumed to remain constant), and  $g^p$  is a share of primary expenditures on GDP (assumed to remain constant after 2050).

reforms of the pension or healthcare system should be undertaken in order to reduce the impact of ageing on government expenditures.

	<b>T-1<sup>1</sup></b>	<b>T-2<sup>2</sup></b>	<b>T-3<sup>3</sup></b>	<b>T-4<sup>4</sup></b>
Baseline scenario	3.7	2.9	2.3	2.4
High demographic variant	3.1	2.2	0.7	1.8
Low demographic variant	3.9	3.1	3.6	2.6
Constant-fertility demographic variant	3.7	2.9	3.0	2.5
Higher interest-growth differential	4.3	3.8	4.9	3.5
Lower interest-growth differential	3.2	1.9	-1.1	1.2
Better initial budget balance	2.6	2.8	1.3	1.3
Worse initial budget balance	4.7	3.9	3.3	3.4

*Notes: <sup>1</sup>T-1 = difference between the current and constant tax ratio required to reach the debt level in 2050 that would result from a balanced budget position over the entire projection period; <sup>2</sup>T-2 = difference between the current and constant tax ratio required to reach a debt level of 40 percent of GDP in 2050; <sup>3</sup>T-3 = difference between the current and constant tax ratio required to reach a debt level of 60 percent of GDP in 2050; <sup>4</sup>T-4 = change in tax ratio that would ensure the intertemporal budget constraints of the government were respected. Source: Author's estimates.*

The financing gaps, assuming positive values in all scenarios, indicate the necessity of fiscal adjustment if the sustainability of public finances is to be maintained in the long-run. The size of the adjustment varies depending on the definition of sustainability, i.e. the choice of the reference value. If the goal of fiscal policy is a debt ratio in 2050 of the same size as that in the initial period, a fiscal adjustment of the size of 2.6 to 4.7 percentage points of GDP (depending on the underlying assumptions) throughout the projection period is required. If the targeted debt ratio in 2050 is to meet the reference value of 40 percent of GDP, the required adjustment effort would be between 1.9 and 3.9 percentage points of GDP. The third calculated financial gap suggests that the flow of revenues and expenditures would be equalized over an infinite horizon if a fiscal adjustment of 0.7 to 4.9 percentage points of GDP took place in all the years in the projection period. Only in the case of a negative difference between the interest and growth rate, could the intertemporal budget constraint of the government be obeyed even without any fiscal adjustment. The sustainability gap measured by the T-4 indicator is less strict than the one measured by the T-2 indicator, requiring the debt level to converge to 60 percent of GDP in 2050. As is shown in Table 8, an adjustment of the size of 1.2 to 3.4 percentage points of GDP would be needed for public finance to comply with such a sustainability requirement.

## 5 Conclusions

The analysis presented in this paper indicates that, in spite of the introduction of pension reform, Croatian public finances are highly sensitive to demographic changes. The long-term sustainability tests reveal a clear risk of emerging budgetary imbalances caused not only by demographic changes, but also by the initial budgetary set-up. To insure sustainability, an improvement in the budget balance and debt reduction as soon as possible are essential. In order to minimize the negative budgetary implications of ageing, healthcare expenditures as a share of GDP should be reduced and better control should be achieved over public expenditures on health, especially by controlling the evolution of age-related expenditures. Efforts should be made to increase compliance of social security contributions.

The budgetary implications of ageing should be permanently assessed, and efforts should be made in order to develop methodology and to include other age-related budgetary items in the assessment. In future assessments, non-demographic factors influencing the evolution of government expenditures and revenues should also be considered. It will be necessary to improve the statistical basis for the analysis, and also to take into consideration qualitative information while reaching policy conclusions. Additional sensitivity tests should also be carried out.

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