The Czech
Fiscal Council

REPORT ON THE LONG-TERM SUSTAINABILITY OF PUBLIC FINANCES

October 2018

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Introduction

Preparing a *Report on the Long-Term Sustainability of Public Finances* (the "Report") and submitting it to the Chamber of Deputies of the Parliament of the Czech Republic is one of the Czech Fiscal Council's principal duties under Act No. 23/2017 Coll., on the rules of budgetary responsibility (the "Act").

The main objective of the Report is to evaluate how public finances would probably develop over the next 50 years if the current fiscal and expenditure policies were maintained. The Report, in which the Czech Fiscal Council has taken into account current economic and social trends, employment and intergenerational cohesion, also shows how the planned tax and spending policies would probably affect public finance sustainability in terms of their direct long-term effects. The analyses used in the Report also indicate which factors contribute positively to public finance sustainability and which, on the contrary, have a negative impact. The Report not only reveals where the greatest risks to the long-term sustainability of public finances lie, but also provides an overview of how significant the individual risks are.

It is clear that the 50-year projection is subject to considerable uncertainty. The question therefore naturally arises whether it is useful to work with such a long timescale at all. However, the Report is neither a prognosis nor a prediction in the traditional sense. That is to say, its purpose is not to predict how things will actually pan out. Instead, it should indicate what would happen if the current budgetary policy were to remain as it currently stands and the population and economic trends were to go in the direction we believe is most likely given the information currently available. So, even if the long-term projection points, for example, to a significant increase in the general government debt, this does not mean we think that the debt will actually follow that path. We are just pointing out that this is the path it is likely to follow unless adjustments are made to tax and spending policies and further reforms are enacted.

Even though we try to quantify our conclusions in the long-term projection, we are aware of the limitations associated with the long timescale. The specific numerical values contained in the projection are subject to higher uncertainty the further away they are from the present. Nevertheless, quantification still makes sense in that it makes it easier to identify the areas that are the largest potential sources of long-term unsustainability of public finances. Moreover, the numerical formulation indicates that while the short-term and medium-term outlook may still be relatively optimistic, looking into the more distant future reveals a whole range of problems that could dramatically threaten the sound operation of public finances. The Report thus gives politicians, economists and the general public a single document containing a detailed overview of whether the Czech Republic has a chance of keeping its general government debt below the "debt brake" of 55% of GDP in the long term. The Report also draws attention to the areas and factors which require the most attention so that the debt does not slip out of control. When preparing the projection, we considered various scenarios and numerous assumptions regarding their materialisation. In the end, however, we decided to present the variants that are, in our opinion, the most likely.

We believe that the conclusions of the long-term projection will stimulate a debate on how to keep public finances stable and healthy in the future. In a sense, then, the main purpose of our Report is to ensure that the scenario it contains does not in fact ultimately materialise.

1 Summary

The first ever *Report on the Long-Term Sustainability of Czech Public Finances* prepared by the Czech Fiscal Council looks at whether the Czech Republic will be able, while maintaining its current tax and spending policies, to cover its expenditure and obligations so that it is not threatened by unsustainable debt over the next 50 years.

The Czech Fiscal Council's analyses indicate that although the Czech economy will continue to grow faster than those of more advanced countries (a phenomenon that will strengthen tax revenues), Czech public finances are not sustainable. By the end of the projection period (i.e. 2068), the general government debt could reach 230% of GDP. This is higher than currently recorded by any other EU country, including Greece, which, as a result of the debt crisis and efforts to avert bankruptcy, has undergone significant cuts in government spending and an economic contraction of more than a quarter.

The long-term unsustainability of Czech public finances is due mainly to population ageing. Over the next half-century, the share of people aged 65+ in the population will increase from the current 19% to almost one-third. Rising expenditure on pensions and on health care and long-term care will put increased demands on public finances.

The population of productive age will meanwhile shrink. So, regardless of technological progress, economic convergence towards developed countries and other possible positive changes, Czech society will find itself facing a fundamental question: whether to raise taxes, move the retirement age, or reduce pensions relative to the average wage. Finding a compromise is clearly not only an economic problem, but also a socio-political issue.

Unless a consensus is found on how to address the sustainability of the pension system, the general government debt will grow explosively in the second half of the 50-year projection period. This will be due mainly to constant primary deficits in the post-2030 period, when the baby boomers of the 1970s will gradually retire. The pension system deficits will peak around 2059, when they will probably exceed 5% of GDP a year.

Faster growth in expenditure than in revenue would in itself increase the general government debt to around 180% of GDP. However, the breach of the debt brake, currently set by law at 55% of GDP, and the subsequent increase in debt would trigger a response from the financial markets, where the state raises funds by selling bonds. With the condition of Czech public finances worsening, investors would demand a risk premium in return for their funds, which would be reflected in an increase in the real interest rate. That would make the debt path even worse and the country would find itself in a debt trap.

The time left for politicians and the general public to find a consensus is rapidly getting shorter. The Czech general government sector should still be able to manage without substantial problems with the primary surplus over the next 10 years, but the impacts of population ageing will then quickly and inexorably start to kick in. Given the seriousness of the debate, the time lag associated with the legislative process and the need to address other economic and social problems, it is already high time to start this debate properly.

The long-term sustainability of public finances may also be affected by medium-term risks, to which this Report also pays attention. The medium-term risk scenarios are not intended to create a panic among politicians or experts. We use them to show how quickly and deeply a revenue shortfall, coupled with a need to continue financing rising mandatory expenditures, can reduce the room available for public finances to support a healthy economy in worse times.

It is clear that if the global economic disturbances of the past decade were to repeat, the public debt would worsen just as quickly as it did during the previous crisis. This time, however, we would have the disadvantage of

a worse starting position, as the current debt level is higher in relation to GDP than it was in 2008.

A public debt of 40% of GDP currently appears to be a relatively safe limit. Although the Czech Republic is about five percentage points below this level at the moment, it is important to realise that this is a ceiling, not a target. Only with rigorous adherence to this ceiling would public finances be able to bear the potential materialisation of the risks coming into the small, open Czech economy from the external environment without the need to unduly increase its debt burden.

All market economies are subject to cyclicality and the Czech Republic is no exception. Given the current state of public finances, however, a lengthy recession would generate a risk of activation of the debt brake, with all its accompanying adverse effects on economic activity. This is another reason why a clearly defined pension system strategy for the next ten years needs to be drawn up as soon as possible. Otherwise, a prolonged period of global economic difficulties would expose the problem of Czech public finance unsustainability even sooner than foreseen by the Czech Fiscal Council's current projection.

Key findings

31%

The likely share of people aged 65+ in the total population by the 2060s.

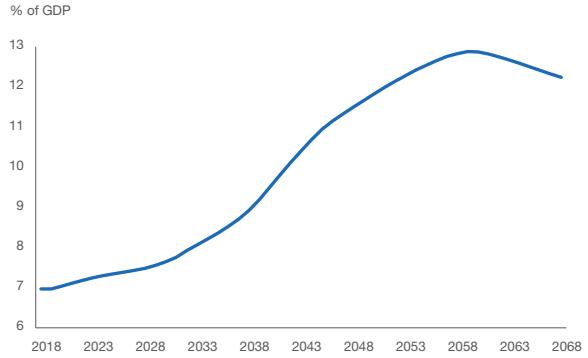
2.86

The number of percentage points of GDP by which the primary structural balance would have to improve every year over the next 50 years to ensure that the debt does not exceed the debt brake (55% of GDP) at the end of this period.

40%

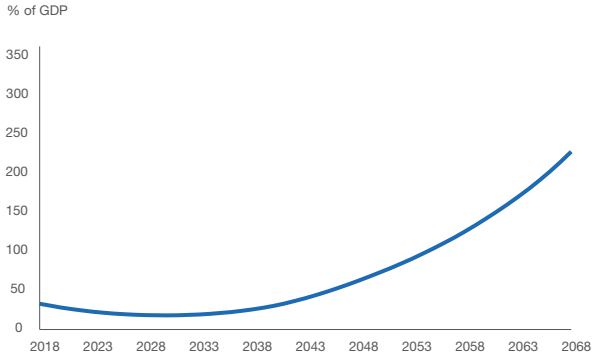
The approximate ceiling on government debt-to-GDP ratio which, under the current conditions, will ensure that the debt brake is not activated in the event of economic difficulties.

12.9% of GDP



Expenditure on old-age pensions will grow rapidly during the 2030s and peak at 12.9% of GDP around 2059.

230% of GDP



If the current fiscal and spending policies were maintained, the government debt-to-GDP ratio would start rising in the mid-2030s and climb to 230% of GDP over the 50-year horizon.

2 Starting point and medium-term outlook

In the medium-term outlook, we assess fiscal policy primarily with respect to the current and expected phase of the business cycle. By medium-term outlook, we mean the outlook for the current year and for the period that coincides with the time frame of the Budgetary Strategy approved for the General government sector, which is currently three years.

2.1 Starting point and fiscal effort

The Czech economy has been growing constantly since 2014. Gross domestic product (GDP) at 2010 prices increased by 15.6% between the start of 2014 and the end of 2017. Potential output growth is meanwhile gradually accelerating, mostly because of an upward trend in the aggregate productivity of factors of production.[1] Economic activity significantly exceeded the potential output level in 2017. This was reflected, among other things, in the unemployment rate falling below its natural level.[2] The positive economic situation has naturally also affected the key indicators of general government finances. In 2017, the structural surplus reached 1.1% of GDP and the debt ratio fell to 34.7% of GDP. [3] The fiscal policy implemented between 2015 and 2017 can be described as restrictive, as evidenced by a significant improvement in the structural balance (from -0.8% of GDP in 2014 to 1.1% of GDP in 2017).

In its current Macroeconomic Forecast (July 2018), the Ministry of Finance of the Czech Republic (MF CR) predicts a continued favourable economic trend over the entire medium-term outlook, i.e. between 2018 and 2021, albeit with annual GDP growth falling from 4.3% in 2017 to 2.4% in 2021. The envisaged fiscal policy stance presented in the September 2018 Draft Medium-Term Outlook for 2020–2021 points to expansionary fiscal policy in 2018 and 2019. This will lead to a gradual decline in the general government structural surplus from 1.1% of GDP in 2017 to 0.3% of GDP in 2021. The fiscal effort (i.e. the year-on-year change in the structural balance) will thus be negative in 2018 and 2019. The general government debt will continue to decline, from 34.7% of GDP in 2017 to 29.9% of GDP in 2021. At the end of last year, the average debt level of the EU Member States was 81.6% of GDP and that of the euro area 86.7% of GDP.[4]

The financial results planned for the general government sector for 2018–2021 assume adherence to the limits defined in the Act. Consequently, neither the structural deficit limit of 1% arising from the mechanism for deriving total general government expenditure (see Section 10 of the Act), nor the general government debt limit of 55% of GDP set forth in Section 14 of the Act will be exceeded. On the contrary, the expected figures are quite a long way from the limits in both cases (see Charts 2.1.1 and 2.1.2).

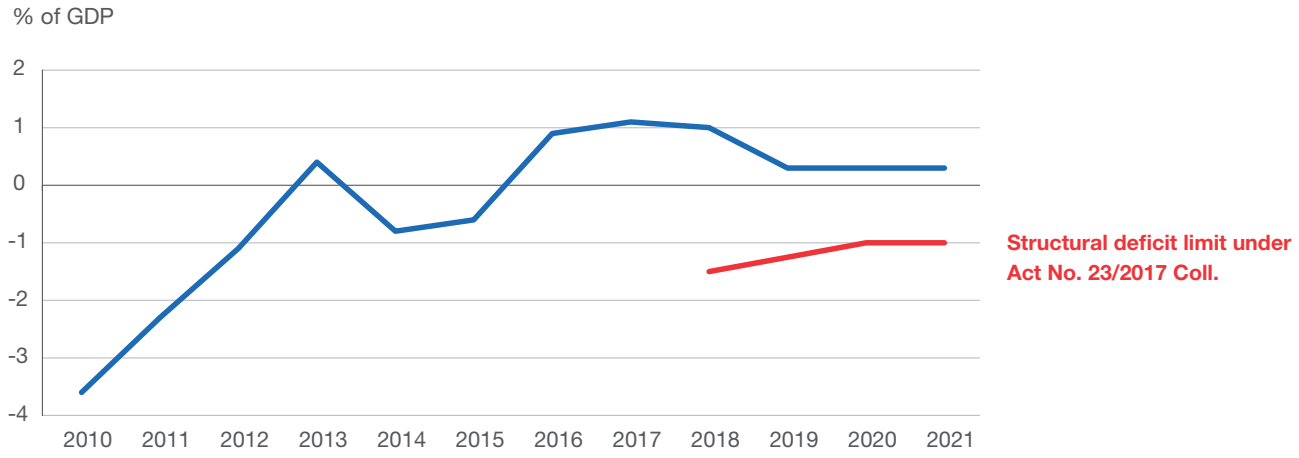
[1] Ministry of Finance of the Czech Republic (MF CR): Macroeconomic Forecast of the Czech Republic, July 2018, p. 26.

[2] The output gap was 1.4% in 2017 according to MF CR calculations presented in the July 2018 Macroeconomic Forecast of the Czech Republic.

[3] MF CR: Macroeconomic Forecast of the Czech Republic, July 2018, p. 16.

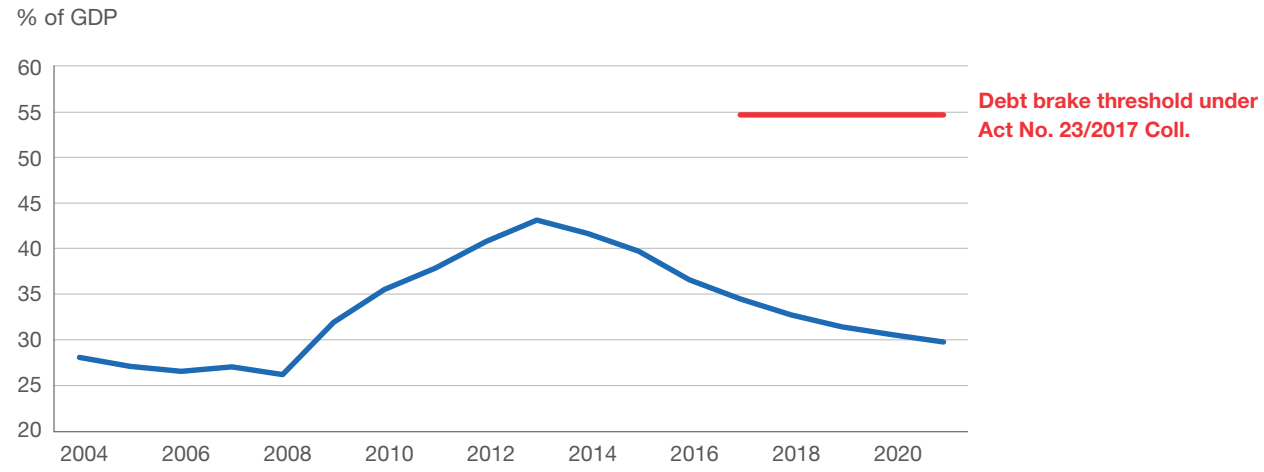
[4] Data from the Eurostat database.

Chart 2.1.1 The general government structural balance 2010–2021



Note: MF CR forecasts from 2018 onwards.
Source: Macroeconomic Forecast of the Czech Republic (July 2018), Draft Medium-Term Outlook for 2020–2021

Chart 2.1.2 General government debt net of the state debt financing reserve 2004–2021



Note: MF CR forecasts from 2018 onwards.
Source: State Final Accounts 2010–2015, Convergence Programme of the Czech Republic (April 2018), CFC calculations

2.2 Fiscal policy stance relative to the position in the business cycle

One of the functions of fiscal policy at the macroeconomic level is to stabilise the rate of growth of the economy. This can also be viewed as reducing the deviations in the real output of the economy from its potential level (potential output). Fiscal policy can perform this stabilisation function by increasing aggregate demand (for example by cutting taxes, increasing social transfers or increasing investment and non-investment expenditure) when the economy is below its potential output level and conversely by reducing aggregate demand (by raising taxes and reducing social transfers and other expenditures) when the economy is above its potential output level.

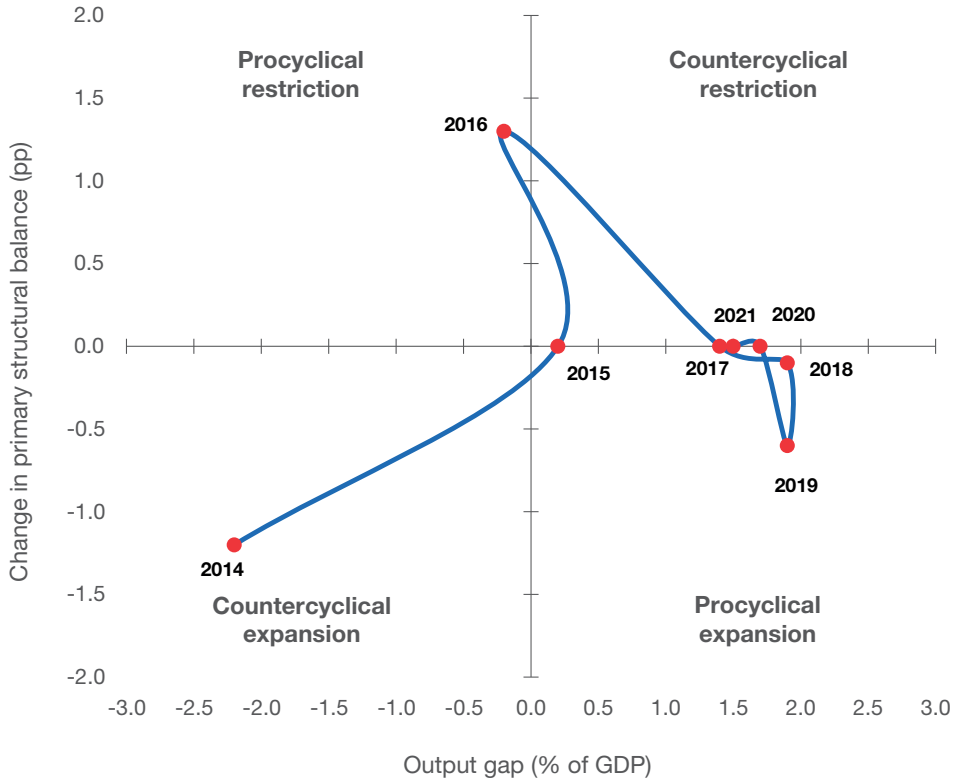
The stabilisation function of fiscal policy is implemented through two types of instruments. The first category of instruments consists of automatic stabilisers, in particular income taxes and the part of social transfers whose level is derived from households' disposable income (in the Czech Republic this includes, for example, part of state social support benefits, unemployment benefits and assistance in material need). In the event of rising unemployment and an associated decline in households' disposable income, these instruments activate without any direct government intervention. Their effectiveness depends on the design and rates of the individual tax and benefit items. In the general government balance, these instruments mainly affect the cyclical balance. The second category of instruments is made up of discretionary measures. These are deliberate government measures consisting in changes to tax rates, social transfers and purchases.

The nature of discretionary fiscal policy measures can be seen in the change in the primary structural balance. If this balance is improving, the government is taking action to reduce aggregate demand. If it is worsening, by contrast, the government is increasing aggregate demand. For fiscal policy to fulfil its stabilisation function and dampen the economic cycle, the primary structural balance should improve when the output gap is positive. Conversely, in the case of a negative output gap, it seems rational to stimulate aggregate demand. This is linked with a deterioration in the primary structural balance. Improving the structural balance at times when the economy is above its potential output level is also a condition for creating sufficient room for fiscal expansion in the future. This is especially true when the structural deficit is limited by a fiscal rule (the limit in the Czech Republic is set at -1% of GDP).

Whether discretionary fiscal policy is correctly configured in terms of functioning countercyclically can be analysed by looking at the relationship between the output gap and the change in the primary structural balance. For example, if the economy is below its potential output level and the primary structural balance in a given year is improving (i.e. the change in the balance is a positive number), fiscal policy is restricting demand just at the time when it should be strengthening it and is thus having a procyclical rather than countercyclical effect (see, for example, 2016 in Chart 2.2.1). If, however, the balance is worsening at a time when the economy is below its potential, fiscal policy is having an expansionary and hence stabilising effect (see, for example, 2014 in Chart 2.2.1). In total, therefore, four types of policies can be distinguished in terms of their cyclical effect: procyclical and countercyclical restriction and procyclical and countercyclical expansion (see Chart 2.2.1).

The graphical analysis shows that discretionary fiscal policy is configured procyclically for 2018 and 2019 (only slightly so in 2018), as aggregate demand is being stimulated further in years when the output gap is relatively large positive. The effect may be to exacerbate the existing economic problems arising from the overheating of the economy, such as the tight labour market and inflationary pressures. In a situation of a large positive output gap, moreover, the government is not taking the opportunity to reduce the general government debt faster and is not creating more room for fiscal expansion in the event of future economic problems. We can say generally that fiscal policy will probably not perform its stabilisation function and thus not act countercyclically in 2019.

Chart 2.2.1 Relationship between the output gap and the change in the primary structural balance 2014–2021



Source: Convergence Programme of the Czech Republic (April 2018); Draft Medium-Term Outlook for 2020–2021; CFC calculations; MF CR Macroeconomic Forecast (July 2018)

Box 2.1 Sustainability in the medium term

The medium-term sustainability of public finances is derived from the initial level of general government debt and is determined going forward by the main parameters of nominal GDP growth, the implicit (average) interest rate charged on general government debt, and the general government primary deficit, according to the following basic debt dynamics equation:

$$d_t = d_{t-1} \frac{1+r}{1+g_t} - \frac{PB_t}{GDP_t},$$

where d_t and d_{t-1} are the debt-to-GDP ratios in years t and t-1 respectively, r is the average (implicit) nominal interest rate paid on the debt, g_t is annual nominal GDP growth between years t and t-1, PB_t is the primary general government balance in year t, and GDP_t is nominal GDP in year t.

When assessing medium-term sustainability, the main issue is not so much the current level of debt, but how much it would increase in a particular crisis scenario. Such a crisis scenario also incorporates refinancing risk, i.e. the risk that the cost of refinancing the part of the debt that would mature during the scenario will increase significantly by comparison with current market interest rates.

At present, general government finances are being positively affected by towns' and municipalities' budget surpluses, which are covering the state budget deficits. Therefore, the primary focus should be on the state debt, i.e. the debt issued by the Ministry of Finance of the Czech Republic.

We calculated two stress scenarios:

- A severe stress scenario assuming flat nominal GDP over the next three years, i.e. in 2019, 2020 and 2021. For simplicity, we also assume flat nominal state budget revenues, while we still expect expenditure to be in line with the figures published in the Draft Medium-Term Outlook for 2020–2021.
- A moderate stress scenario assuming nominal GDP growth of 2% over the next three years and the same rate of growth for nominal revenues. The expenditure side in the moderate stress scenario is the same as that in the severe stress scenario.

In both scenarios, we additionally simulate the response of financial markets to the deterioration in the domestic economy. Based on the post-2008 experience, this response is estimated by a rise in the interest rate to 4.5% in the first year of the scenarios and 4.0% in the following two years. Bonds maturing in the individual years of the scenarios (based on the current stock of bonds actually issued) will thus be refinanced under these interest rate conditions. The same financing conditions will apply to the additional deficits generated under the scenarios. Given the favourable domestic debt management conditions, the situation is relatively comfortable for the next few years from the perspective of the average interest rate paid on the general government debt. The increase in interest rates from their current levels under the stress scenarios would not lead to any dramatic increase in debt service, since the refinanced debt tranches of previous years are also subject to a higher interest rate. However, the primary deficits are a different case; they would widen relatively significantly in an adverse economic situation.

Table B2.1.1 State debt stress scenarios

	2019	2020	2021	2019	2020	2021
	Flat nominal GDP (severe stress)			2% nominal GDP growth (moderate stress)		
Primary state budget balance (CZK billions)	-122.0	-180.0	-241.0	-97.0	-129.0	-164.0
Primary balance (% of GDP)	-2.3	-3.4	-4.5	-1.8	-2.4	-2.9
Implicit interest rate (%)	3.1	3.3	3.4	3.1	3.3	3.4
State debt (% of GDP)	34.8	39.3	45.2	33.6	36.4	39.8

Source: MF CR Macroeconomic Forecast (July 2018); Draft Medium-Term Outlook for 2020–2021; Government Debt Management Report 2017; CFC calculations

Under the severe stress scenario, the state debt would rise by more than 13 percentage points in three years. Even the moderate stress of a three-year stagnation in real GDP would generate a significant increase in the state debt-to-GDP ratio from the 31.5% estimated for 2018 to 40% (see Table B2.1.1). If towns and municipalities ceased to generate surpluses, as might reasonably be expected in an economic downturn, the overall general government debt would very likely increase even faster.

The debt dynamics equation can also be used to determine the maximum admissible general government debt level ensuring that the debt brake would not have to be activated over the three-year horizon of the severe stress scenario. The ratio of state debt to general government debt is assumed to stay at the present level. With a debt brake of 55% of GDP, the current limit is a state debt of around 38% of GDP and a total general government debt of around 40% of GDP. The maximum relatively permissible limit is not fixed; it depends on the current situation on the government bond market and on the three-year public finance outlooks. It will therefore change in future Sustainability Reports.

3 Long-Term macroeconomic projection

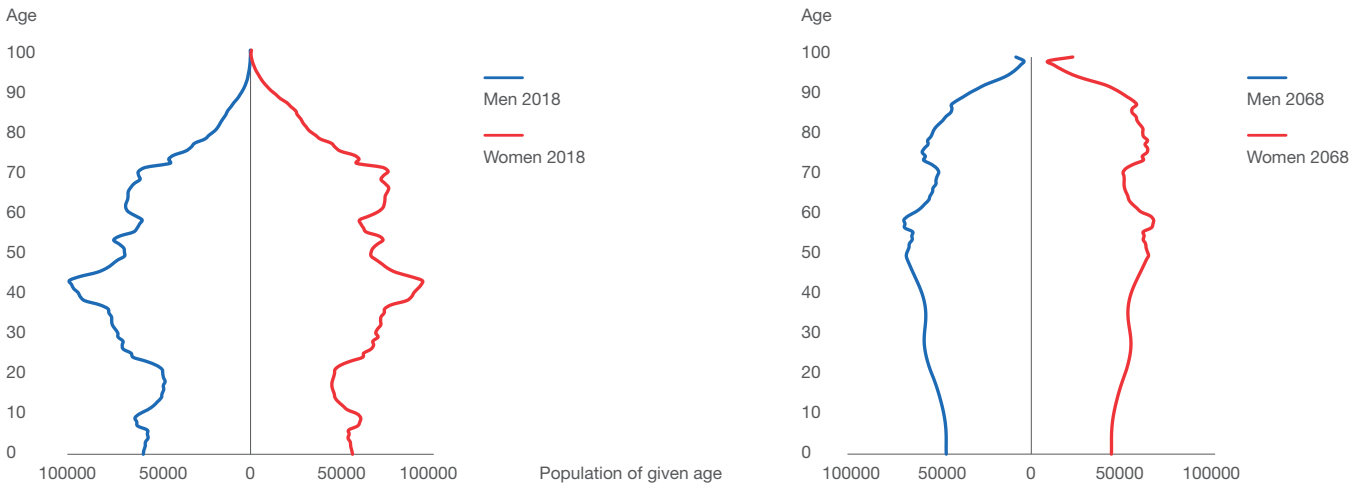
The long-term public finance projection as a whole must be based on the long-term projections for the main macroeconomic variables, most notably GDP, employment, the average wage and consumption. It is therefore necessary first to compile the long-term macroeconomic projection on which the individual component projections of public finances will be uniformly based. However, the long-term macroeconomic projection only concerns potential output (potential GDP), i.e. output that is not subject to the business cycle. Although actual output will oscillate around potential output, these fluctuations cannot be predicted in the long run, unlike in the medium-term outlook. The only option, therefore, is to concentrate solely on potential output. The long-term trend is explained by the theory of long-run growth, which we use for our long-term projection.

3.1 Demographic projection

One of the main inputs to the long-term macroeconomic projection is the demographic projection. Changes in the size and particularly in the structure of the population will have a fundamental impact on public finance sustainability. For our purposes, we use the demographic projection derived from the 2013 Czech Statistical Office (CZSO) demographic projection (the latest available projection). Based on an expert estimate and additional information now available, we opted for the upper variant of the CZSO demographic projection and made further modifications to it in order to account for new data on fertility and migration and other information that became known following the publication of the original projection.

Our projection assumes that the population of the Czech Republic will have dropped by about 2% by 2068. However, more significant changes will take place in the age structure of the population – the number of people aged 65 and over will rise by more than 60% compared with the present and their share in the total population will thus increase from the current approximately 19% to 31%. This will be aided, among other things, by an increase in life expectancy of 9.4 years for men and 8.2 years for women by 2068. The demographic projection is well characterised by a comparison of the current and projected population tree (see Chart 3.1.1). We incorporate the population projection not only into the overall economic projection, but also into our projections for the pension system, the system of public health insurance, social benefits and other areas.

Chart 3.1.1 Comparison of the population tree in 2018 and 2068 (projection)



Source: CZSO and CFC

3.2 Real convergence

The primary starting point for our long-term economic projection is the fact that the Czech economy is in a process of real convergence. This means it is converging to the "steady state" where economies only grow at the pace of their labour force growth and rate of technological progress. However, the steady state itself is dependent not only on parameters such as investment rates and labour force growth, but also on difficult-to-quantify factors such as the quality of the legal framework, cultural habits and formal and informal rules. Instead of trying to explicitly model the steady state to which the Czech economy is converging, we assume that the Austrian economy represents the steady state (i.e. some sort of target economic state) for the Czech economy. We opted for the Austrian economy because – despite having some structural differences compared with the Czech Republic – it is a standard European mixed economy which, according to the available indicators, is already in the steady state and additionally has long had a similar investment rate to the Czech Republic.[5] We also assume that the above non-economic factors (customs, culture and so on) are also sufficiently similar to the Czech Republic in Austria. So, by taking the Austrian economy as the target state to which we are converging, we are also indirectly taking these unquantifiable effects into account.

According to economic theory, economies should converge to their steady states such that the difference between the steady state and the actual state of the economy shrinks by a constant percentage each year. The gap between the Austrian and Czech GDP per capita levels (expressed in purchasing power parity) has narrowed by roughly 1.9% a year on average over the last 20 years (see Chart 3.2.1), and this is the rate of real convergence we work with in our projection. We additionally assume that the Austrian economy will continue to expand at its current long-run average growth rate of annual GDP per capita of 1.4%. We compounded this rate and the gradually diminishing convergence effect to obtain the growth rate of Czech potential GDP per capita for our 50-year projection (see Table 3.2.1).[6] We derived the rate of growth of the Czech economy as a whole by combining the rates of growth of potential output per capita obtained above with the rates of population growth/decline according to the demographic projection. We set the growth rate of output per worker analogously, while we based our projection of the number of workers on the current retirement age ceiling of 65 years.

Wage growth plays a significant role in the projections for the pension system, education, health care and other areas. In our projection, we naturally derived the evolution of real wages from the long-run growth projection. In contrast to most of the other projections, however, we do not assume that real wages will grow at the same rate as GDP per worker, because the ratio of compensation of employees to GDP has long been relatively low in the Czech economy compared with other countries (only 41.4% in 2017). Nevertheless, even this indicator has been increasing steadily over the years. Moreover, we see no reason for the ratio of compensation of employees to GDP in the Czech economy to be permanently and systematically below the norm. In our projection, we therefore assume that this ratio will converge to the usual level in advanced economies (more than 50% of GDP) at a pace equal to the rate of convergence of real GDP per capita. So, here too we assume that the difference between the usual steady state level and the current Czech level will narrow by 1.9% a year.[7]

The increasing ratio of compensation of employees to GDP in our projection means that the volume of wages and salaries is growing at a slightly faster rate than GDP in the long term, at the expense of the gross operating surplus of firms. Average real wages are rising even faster, since demographic factors will cause the number of employees to decline over the long term and the growing share of GDP will thus be split between fewer people – employees will become scarcer and their labour will thus get more expensive. Overall, therefore, we assume in our projection that real wages will grow by 2.3% a year on average. This is about 0.4 percentage points higher than per capita GDP growth (see Table 3.2.1). We fully abstract from the effect of the terms of trade, which

[5] Although the Czech Republic's rate of investment in fixed capital is among the highest in Europe, this indicator is inflated by the fact that prices of capital goods are relatively high in the Czech economy. When we correct for this price effect, we find that the investment rate in the Czech Republic is virtually the same as that in Austria.

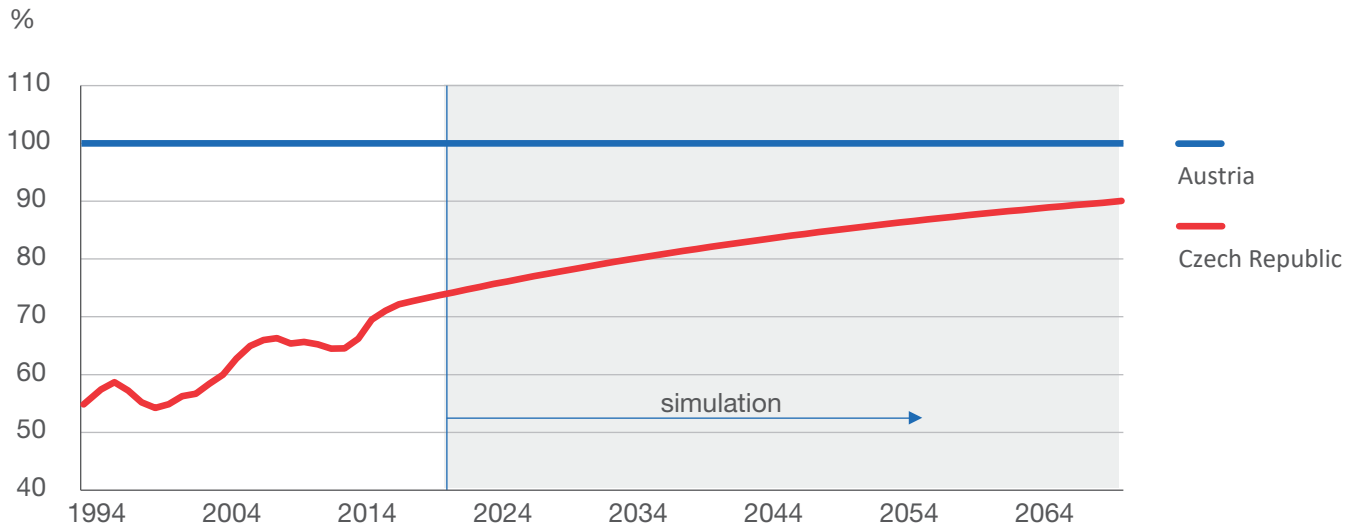
[6] For both theoretical and empirical reasons, we focused in our simulations on GDP per capita rather than on GDP per worker, which the growth theory usually works with.

[7] In our projection, we worked with compensation of workers, which we defined analogously to compensation of employees, except that we included an estimate of compensation of entrepreneurs (the self-employed).

could also affect the gap between real wage growth and GDP growth in the long run. Such a gap between per capita GDP growth and wage growth over a period of 50 years may seem to be a discrepancy, but note that this gap averaged 0.6 percentage points between 1995 and 2017 (an average real wage growth rate of 3% and an average rate of growth of GDP per capita of 2.4%), and even that was not enough to offset the unusually low share of wages in the Czech economy.[8]

For the entire period of our projection, we assume growth in consumer prices to be equal to the growth rate of the GDP deflator, i.e. 2% a year. This is in line with the CNB's current inflation target.

Chart 3.2.1 GDP per capita at purchasing power parity (Austria = 100%, simulation from 2018 onwards)



Source: OECD and CFC calculations

Table 3.2.1 Average growth rates based on the long-term projection (%)

	2018–2030	2031–2040	2041–2050	2051–2060	2061–2068	Entire period
GDP per capita	2.0	1.9	1.8	1.7	1.6	1.9
GDP	2.2	1.9	1.7	1.5	1.4	1.8
Compensation of employees	2.4	2.1	1.9	1.7	1.5	2.0
Average real wage	2.4	2.4	2.7	2.1	1.3	2.3

Source: CFC calculations

[8] OECD figures.

4 Expenditure and revenue in the long-term projection

We will start by splitting government expenditure and revenue in the long-term projection into two categories: first, expenditure and revenue that will be directly affected by demographic changes, and second, expenditure and revenue that will be affected by convergence effects, i.e. effects caused by the very fact of the Czech economy expanding and converging in the long run towards the level of advanced countries. In reality, the demographic and convergence effects will be more or less intertwined, but demographic effects will prevail in the area of the pension system, health care, social benefits and long-term care. Convergence effects will have more weight in the case of expenditure on public investment, public employees' pay and especially education and in the case of revenue from taxes and social security contributions.

4.1 Pension system

The pension system consists of old-age pensions, disability pensions and survivors' (widows', widowers' and orphans') pensions. The system is managed and administered by the Czech Social Security Administration (CSSA), with the exception of the armed forces, for which the system is managed by the relevant ministries (the Ministry of the Interior, the Ministry of Defence and the Ministry of Justice). However, the terms for members of the armed forces are the same as those for the insured falling under the CSSA, so in the simulation we treat the entire pension system as a single entity. We initially focus on the expenditure side of the system, first modelling the number of recipients of each type of pension and then the levels of those pensions. The revenue side of the system is modelled directly on the basis of our macroeconomic projection, as pension insurance contributions constitute taxation of labour income.

4.1.1 Old-age pensions – number of beneficiaries

The number of old-age pension beneficiaries is affected primarily by the demographic structure of the population, the statutory (legal) retirement age, and, last but not least, by people's decisions on whether to retire before or after the statutory age (e.g. early old-age pensions). The statutory retirement ages are different for men and women. This is one reason why we project the number of pensioners separately based on sex. The statutory retirement age is gradually rising, but under the current legislation it should stop at the age of 65 for both men and women (in 2030 for all men and for women with one child or no children and later for other women).[9]

However, the number of old-age pension beneficiaries cannot be derived simply from the demographic projection and the statutory retirement age alone. A substantial role is played by the option of retiring early or, conversely, by the option of working beyond retirement age and thus improving one's old-age pension. For these reasons, we define the "rate of retirement" as the ratio of the number of persons who are old-age pension beneficiaries to the number who are a given number of years younger (or older) than their statutory retirement age. The rate of retirement thus tells us, for example, what per cent of those who are, say, two years short of the statutory retirement

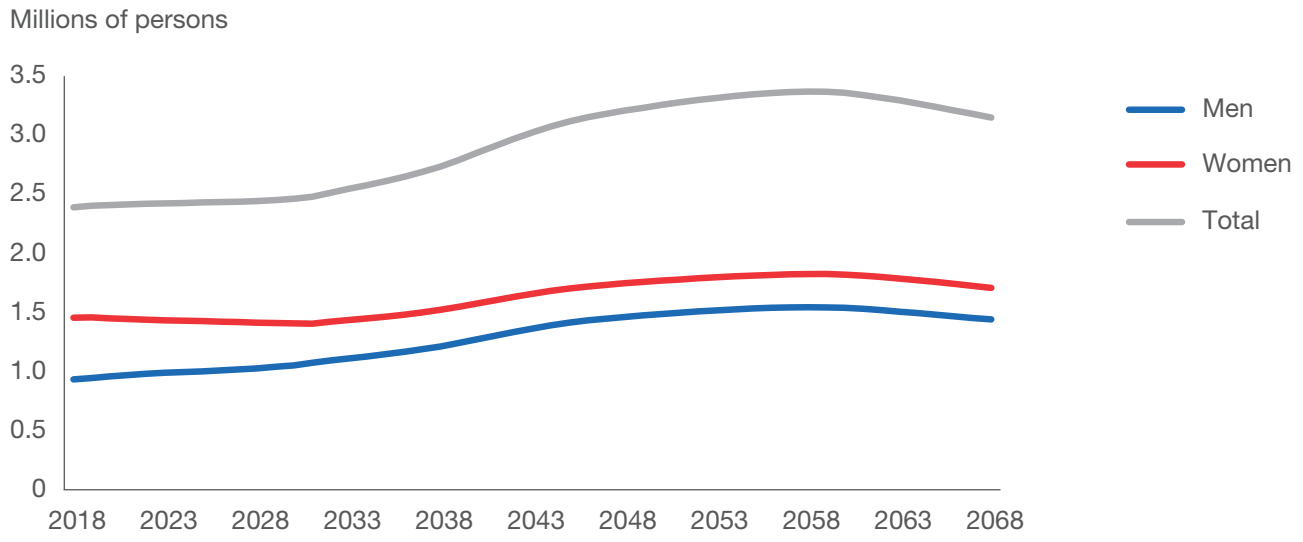
[9] Although Section 4a of the Act on Organisation and Implementation of Social Security (No. 582/1991 Coll., as amended) indicates that the statutory age may change in the future depending on the development of life expectancy, the actual statutory retirement age is governed by an annex to the Act on Pension Insurance (No. 155/1995 Coll.) currently in force, and this statutory age thus enters our projection.

age are already pension beneficiaries, or what per cent of those who reached the statutory retirement age, say, a year ago are now receiving a pension. In other words, the rate of retirement is defined as a function in which the time to the statutory retirement age is a variable.

For the purposes of the projection, we derived the future rates of retirement based on the actual situation in the period 2013–2016. We construct them separately by gender and assume they are stable for both sexes over the entire projection.[10] The crucial question for the purposes of the simulation, however, is to what extent demand for early retirement is stable or saturated. The share of pensioners taking early (and thus permanently pension-reduced) retirement has been rising in recent years.[11] If this trend were to persist, the rates of retirement used in the projection would underestimate the number of pensioners. The phases of the economic cycle, especially the slow recovery from the crisis after 2009, may also have had some effect on actual rates of retirement.

Aware of certain methodological constraints, we use the rates of retirement not only to simulate the number of old-age pensioners, but also to model the number of newly granted pensions. A pronounced rise in the number of old-age pensioners will be evident in the 2030s, when first, the increase in the statutory retirement age will halt under the legislation currently in force and second, the baby-boomers born in the first half of the 1970s will gradually start entering old-age retirement. Overall, the number of old-age pensioners is expected to peak some 40% higher than the present level around 2060. Later on, the number of pensioners will begin to fall as the baby-bust cohorts of the late 20th century reach retirement age. In addition to a change in the number of pensioners, there will be a change in gender structure, as the equalisation of the statutory retirement ages for men and women will lead to an increase in the proportion of men in the total number of old-age pensioners. The persisting predominance of women in the future will be due solely to the higher life expectancy among women, whereas today a major role is also played by the fact that women reach statutory retirement age earlier.

Chart 4.1.1 Projection of the number of old-age pensioners



Source: CFC calculations

[10] For women, we considered a single aggregated retirement rate only. The model scenario involved a woman with two children.

[11] For more on early retirement, see, for example, Ministry of Labour and Social Affairs: Pojistněmatematická zpráva o důchodovém pojištění [Actuarial Report on Pension Insurance], Prague 2017.

4.1.2 Old-age pension levels

In order to project old-age pension expenditure, we also need to estimate the average old-age pension level. It is affected both by the level of newly granted pensions and by the level of pensions already in existence and thus granted at various times in the past. Let's focus first on the level of newly granted pensions. Every new pension (like any other) consists firstly of a "basic assessment", which is tied to the average wage in the economy. At present (2018) it stands at 9% of the average wage, but from 2019 it will be 10%. This is the figure that enters our projection. The second component is a "percentage assessment", which is derived from the insured person's past earnings indexed according to the average wage and the number of years of insurance (including credited periods and other adjustments). The calculation also contains two "reduction limits", which are a redistributive element reducing the differences in newly assessed pensions. These reduction limits change every year on the basis of average wage growth.

We simulate all pension levels as a percentage of the average wage. As the starting point for our projection of the level of newly granted pensions we use the latest known figure (for 2016, obtained from the CSSA), according to which the replacement ratio was 47.7% of the average wage for men and 40.2% for women. The lower newly assessed pensions of women are due both to their lower wages and to their lower statutory retirement age and thus shorter insurance period. Following the equalisation of the statutory retirement ages for men and women (i.e. after 2030), and assuming that the gender wage gap is maintained, the difference between the newly granted pensions of men and women will drop to roughly one half of the current figure (the insurance period will be extended more for women). Beyond 2030, we use additional assumptions to project the ratio of newly granted pensions to the average wage at 47.7% for men and 44.8% for women.[12] For men we assume a constant ratio of newly granted pensions to the average wage, while for women we gradually increase the replacement ratio in our simulation so that it reaches 44.8% of the average wage in 2030.

To calculate the overall average pension, however, we also need to model already granted pensions. The indexation scheme currently in place assumes full indexation to inflation (with some modifications – see below) and semi-indexation to real wage growth. Though current pensions are fully indexed to the inflation rate, the current indexation system now additionally allows for indexation based on the costs of living of households of pensioners. In any given year, the index that will be more favourable for pensioners will be used to index pensions. So, if the costs of living of households of pensioners rise faster in the future than the rate of inflation, this will be taken into account in the indexation.

We take this rule into consideration in our simulation, as we believe there are reasons for the inflation rate determined from the consumption basket of households of pensioners to be systematically higher than the inflation rate based on the overall consumer price index. This is mainly because of the higher share of services in the consumption basket of households of pensioners. In a growing economy, prices of services rise faster than prices of industrial goods in the long run, due to slower growth in labour productivity in the service sector than in tradable goods-producing sectors (a phenomenon analogous to the Balassa-Samuelson effect). According to CZSO data, the rate of growth of living costs of households of pensioners has been 0.4 percentage points higher on average than the rate of growth of consumer prices as a whole in recent years. For our simulation, we use a slightly smaller difference, as we assume that real wage growth (which basically explains the difference in the growth of the relative prices of services in the long run) will gradually slow. In addition, it should be noted that the share of pensioners in the total population, and therefore also in total consumption, will increase in the future, so the standard consumption basket will converge in structure towards the consumption basket of households of pensioners, further reducing the gap between the consumer price index and the cost of living index. In our simulation, we therefore assume a 0.3 percentage point difference for the whole period. This means we add an extra 0.3 percentage points to the real wage-based indexation of pensions every year. For pensions drawn for 25 years, for example, this indexation

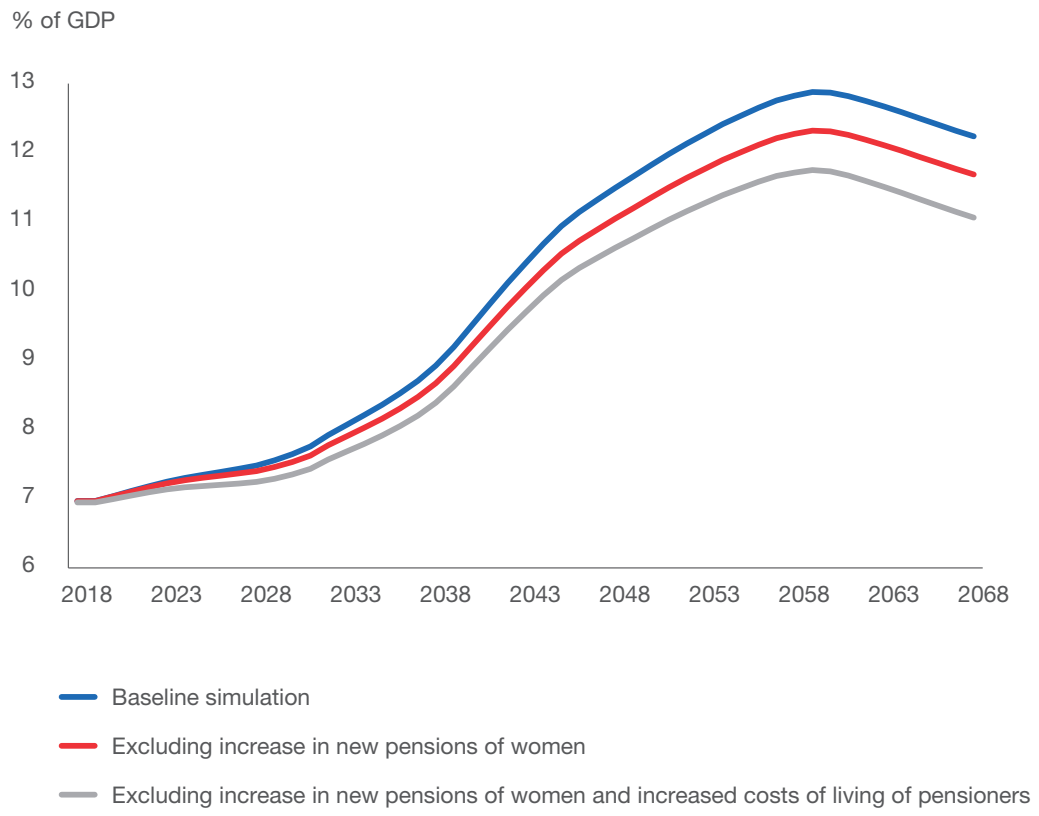
[12] The increase in the basic assessment from 9% to 10% of the average wage will increase the replacement rate by comparison with the present, but future limits on credited insurance periods will have the opposite effect.

"detail" makes them approximately 8% higher, which is no longer negligible in terms of the balance of the system.

In addition to newly granted pensions and indexation, the average old-age pension is affected by the demographic structure of pensioners. Each year, pensioners with newly granted (and hence relatively high) pensions will swell the total pensioner count. On the other hand, a proportion of pensions will cease to be paid. The change in the average pension thus reflects the change in existing pensions (i.e. their indexation to inflation and real wage growth), the number and levels of newly granted pensions and, finally, the number and levels of terminated pensions. However, the average level of terminated pensions is not captured in any available statistics. For simulation purposes, therefore, we simply assume that the average terminated pension in a given year is equal to the average old-age pension in that year.[13]

Integrating all these assumptions into our demographic projection implies a fairly stable average pension to average wage ratio. According to the simulation, the average pension should fluctuate in a range of about 38% to 39.5% of the average wage in the future. From our knowledge of the path of the ratio of pensions to the average wage and the path of the number of old-age pensioners, we can easily derive the path of old-age pension expenditure expressed as a percentage of GDP. The expenditure peaks at 12.9% of GDP around 2059 (see Chart 4.1.2). Based on our simulation, the increase in pensions newly granted to women (which, however, stems fully from the extension of their insurance period) and the incorporation of the increased living costs of households of pensioners together imply a cost of roughly 1.1% of GDP. The rise in expenditure is partly due to the assumed increase in the ratio of compensation of employees to GDP. However, the most important factor is naturally growth in the number of pensioners.

Graf 4.1.2 Share of old-age pension expenditure in GDP



Source: CFC calculations

[13] This assumption probably reduces the simulated average pension somewhat – payment of pensions is more likely to be terminated for older pensioners, who have lower pensions on average. The average terminated pension is thus probably smaller than the average pension in a given year. This reduces the estimate of the average pension – and hence also the estimate of total pension system expenditure – in our projection.

4.1.3 Disability pensions

When projecting disability pensions, we again project first the number of beneficiaries and then the average disability pension. The projection of the number of disability pensioners is based on the size of the cohort aged between 18 years and retirement age (for the sake of brevity, we will refer to this cohort as "non-old-age adults"), which is the cohort from which disability pensioners can be recruited. There are three factors that interact here. On the one hand, the number of non-old-age adults will decline from a certain year onwards (and this will reduce the total number of disability pensioners). On the other hand, however, it is clear that the rate of disability is higher among older cohorts, which conversely, given the rising statutory retirement age, increases the number of disability pensioners. Nevertheless, despite the extension of the statutory retirement age, there has been a decline in the number of disability pensioners in recent years. This fact is difficult to interpret – it may have been a consequence of tightened recognition of entitlement to a disability pension, or it may have been a manifestation of improvements in the health status of the population of pre-retirement age. Of course, it may also have been a combination of both these factors.[14]

Improvements in health status represent the third factor under consideration – increasing life expectancy and rising quality of health care are reducing the rate of disability in any given age group. If, for example, the health status of future 65 year-olds will be comparable on average to that of today's 60 year-olds, the rate of disability among pre-retirement cohorts will also be similar to that of current 60 year-olds (this is known as the healthy ageing hypothesis – see Box 4.1).

Unfortunately, the last-mentioned factor is practically impossible to quantify. Nevertheless, if we assume that the decline in the rate of disability among older cohorts will be roughly such that it offsets the fact that there will be more older people in the non-old-age adult population, the rate of disability among the non-old-age adult population as a whole will remain unchanged. When projecting the number of disability pension recipients, we start from the rates of disability (three degrees of disability are distinguished) of the non-old-age adult population in 2016 (the latest available data). However, assuming constant rates of disability does not necessarily mean that the number of disability pensioners is proportional to the size of the non-old-age adult population. The latter decreases over our projection horizon due to population ageing, hence the number of disability pensioners also declines in our simulation.

Due to the structural similarity in the calculations of disability pensions and old-age pensions, we can easily model the average disability pension (separately for each degree of disability) by assuming a constant ratio between the average disability pension for a given degree of disability and the average old-age pension. These ratios have indeed been sufficiently constant in recent years. Overall, despite a modest decrease in the number of recipients of disability pensions, according to the simulation there will be a slight increase in expenditure on these pensions, from the current roughly 0.8% of GDP to more than 1% of GDP at the end of the projection horizon (see Table 4.1.5). The reason for this is that wage growth will systematically exceed GDP growth. Owing to the method used to calculate and index disability pensions, this will be reflected in the average disability pension.

4.1.4 Survivors' pensions

Survivors' pensions comprise widows', widowers' and orphans' pensions. Again, we first simulate the number of recipients of each type of pension. For orphans' pensions, we will assume a constant ratio of beneficiaries to the population of new-born to 21-year-old persons.[15] In the case of widows' and widowers' pensions, however, it is still necessary to distinguish between pensions paid out individually (solo) and pensions paid out in combination with retirement (or disability) pensions, as there is a substantial difference in the levels of these pensions.

For solo widows' and widowers' pensions, we assume – similarly to disability pensions – a constant share in the non-old-age adult population. There will be a slight decline in the number of beneficiaries of orphans' pensions and the number of recipients of solo widows'/

[14] Ministry of Labour and Social Affairs: Pojistněmatematická zpráva o důchodovém pojištění [Actuarial Report on Pension Insurance], Prague 2017.

[15] An orphan's pension can be drawn by a beneficiary of up to 26 years of age (if studying at university).

widowers' pensions, as both demographic groups used as the basis for the projection shrink slightly.

To simulate the number of recipients of a survivor's pension in combination with an old-age pension, in the aggregate model we will use an approach based on the fact that the most important factor for combined pensions from the quantitative perspective is the number of widows. We will therefore focus on that number and simulate it based on the difference between the number of women and the number of men aged over 60, as the difference between the number of women and men condenses not only information on the size of the population aged over 60, but implicitly also information on the expected evolution of life expectancy (which may be different for men and women). According to the demographic projection, the gender gap will narrow slightly in this respect, because life expectancy will increase more for men than for women (by 9.4 years to 86 years for men and by 8.2 years to 90.6 years for women by 2068). According to this simulation, therefore, the number of widows' pensions paid in combination will decrease.

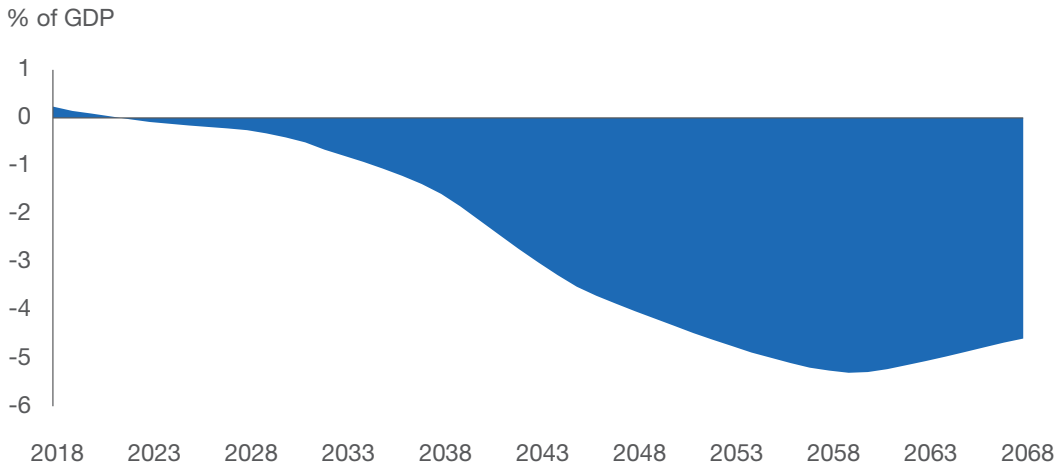
As regards the level of each type of pension, we will again take advantage of the structural similarity between the calculation of survivors' pensions and the calculation of old-age pensions. We will thus model the level of survivors' pensions as a fixed proportion of the old-age pension. The simulation of survivors' pensions generally points to a fairly insignificant figure of around 0.5% of GDP over the entire projection period (see Table 4.1.5).

4.1.5 Total revenue, expenditure and balance of the pension system

We model pension system revenue on the basis of the expected evolution of compensation of employees.[16] Recall that in the macroeconomic projection we expect the ratio of compensation of employees to GDP to increase as a result of convergence. The ratio of pension system revenue to GDP will thus rise proportionately as well. Overall, the revenue of the system under the current legislation will thus go up from the present 8.4% of GDP to more than 9.1% of GDP at the end of the projection period.

However, it is apparent that such growth in the revenue of the system cannot cover the sharp rise in expenditure that will occur after 2030. The deficits of the system as a whole will peak around 2059, when they will exceed 5% of GDP a year according to the simulation (see Chart 4.1.5). The subsequent drop in expenditure will be due to a reduction in the number of old-age pensioners from the generation born in the mid-1970s.

Chart 4.1.5 Annual balances of the pension system



Source: CFC calculations

[16] It could also be modelled on the basis of compensation of workers, which, in addition to compensation of employees, contains part of mixed income (see section 3). However, the share of the self-employed in employment is assumed to be constant, so although compensation of workers is higher than compensation of employees in absolute terms, the two change proportionately. Estimating pension system revenue using compensation of workers would therefore be equivalent.

Table 4.1.5 Summary of pension system projections for selected years (% of GDP)

	2020	2030	2040	2050	2060	2068
Old-age pensions	7.0	7.6	9.5	11.8	12.9	12.2
Disability pensions	0.9	1.0	1.0	1.0	1.0	1.1
Survivors' pensions	0.5	0.5	0.5	0.5	0.5	0.5
Total expenditure	8.4	9.0	10.9	13.3	14.3	13.7
Revenue	8.4	8.6	8.8	8.9	9.0	9.1
Balance	0.1	–0.4	–2.2	–4.3	–5.3	–4.7

Note: The totals in the table may be subject to inaccuracies due to rounding.
Source: CFC calculations

4.2 Health care

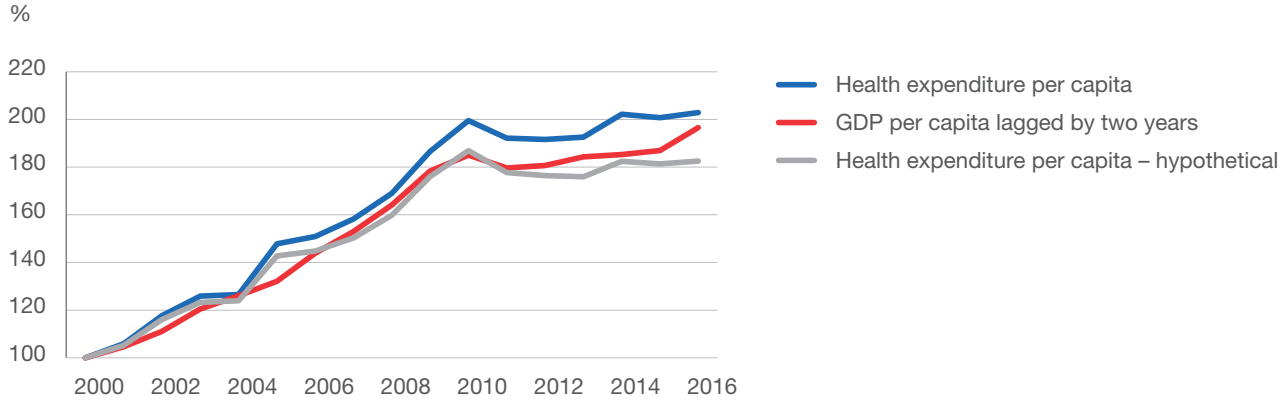
Another item of public expenditure that is very sensitive to demographic changes is health care. Health care expenditure is covered by both public and private sources. In the Czech Republic, expenditure covered by public sources traditionally has a very high weight (over 80%, similar to Germany, France and the Scandinavian countries). In most other OECD countries, the share of expenditure from public sources is lower. This expenditure will be the sole subject of our projection. Public expenditure is mainly covered by public health insurance. Other funding, albeit less significant in terms of overall volume, is provided from the state budget and local government budgets, for example. In the latter case, the funds are intended mainly to maintain or modernise existing facilities for which the link to the amount of output provided is less clear than in the case of public health insurance. The following analysis will therefore focus solely on expenditure from the public health insurance system. For other health care expenditures, we assume that their ratio to GDP remains unchanged at the present level (except for those related to the provision of long-term care – see below).

For the projection, however, we first need to determine the pace at which the cost of health care would change even if there were no demographic changes and the population maintained its current age structure. We will assume that the per capita cost of health care covered by health insurance (excluding changes in demographic structure) will grow at the same rate as per capita GDP, as it has done, broadly speaking, in recent years. However, when comparing health expenditure per capita with GDP per capita (both at current prices), it is important to note that demographic change is already going on and is thus naturally already affecting health care expenditure. For a better comparison, we therefore also calculated the hypothetical health care expenditure that would have occurred had the demographic structure of the population remained fixed where it was in 2000 (the oldest consistent data available).[17] This hypothetical time series of expenditure covered by health insurance is therefore adjusted for demographic effects. The relationship between demographically adjusted health expenditure and GDP per capita seems quite reliable, especially when we allow for a two-year lag between GDP and health expenditure (see Chart 4.2.1).

If, therefore, expenditure covered by health insurance grows at the same pace as GDP, its ratio to GDP will stay constant, unless, of course, the demographic structure changes. However, the rising weight of older age groups in the overall population will, ceteris paribus, lead to growth in health expenditure as a percentage of GDP. We will estimate this purely demographic effect using the health care cost curve based on five-year age groups (see Chart 4.2.2). Assuming this age group-based cost curve (expressed as a percentage of GDP per capita) remains unchanged, we can estimate the effect of demographic change according to how the weights of the individual

[17] We calculated the hypothetical average expenditure per capita using the actual expenditure per capita in individual age groups (we work with five-year age groups) in individual years, although we assigned these groups the constant weights they had in the population in 2000 rather than the actual weights they had in the population in the individual years.

Chart 4.2.1 Comparison of health expenditure per capita and GDP per capita (current prices, year 2000 = 100%)

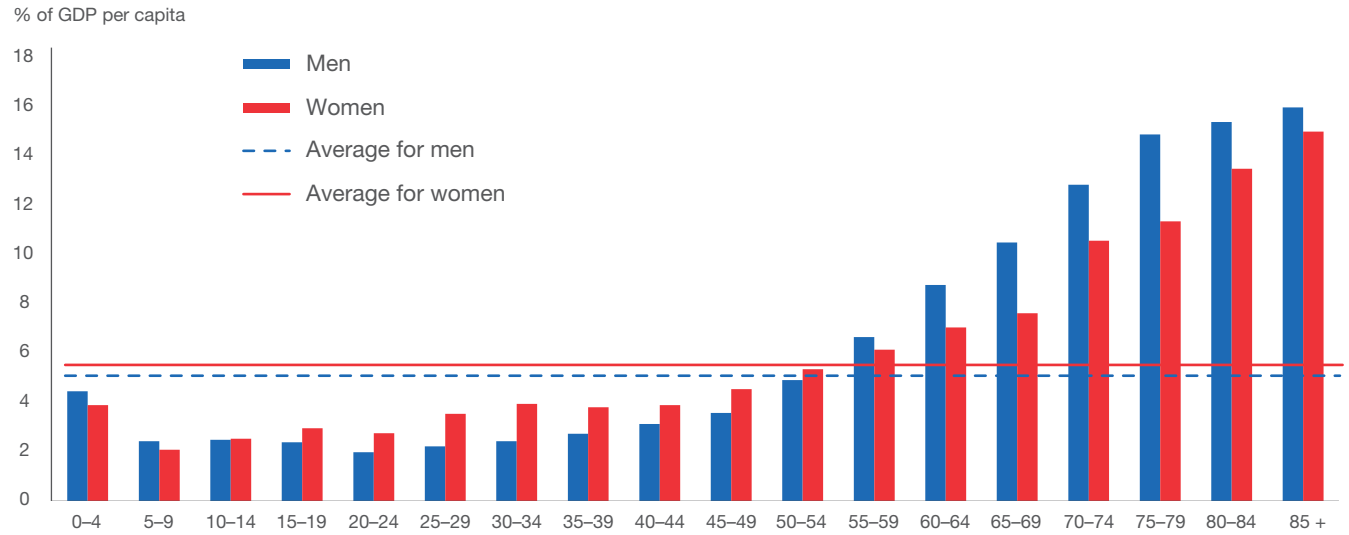


Source: CZSO, Eurostat and CFC calculations
Note: Health expenditure per capita – hypothetical is calculated assuming a constant age structure of the year 2000.

groups in the overall population change. This estimate will therefore capture the impact of change in the demographic structure only. The projection will not capture any changes in the cost curve itself, changes that will certainly also occur (see Box 4.1 for details). According to this estimation method (and our demographic projection), expenditure covered by health insurance will gradually rise from 5.4% of GDP today to 6.8% of GDP around 2064, when it will peak.

The revenue side of the health insurance system relies on contributions paid by employees, employers, the self-employed and individuals with no taxable income, and on contributions paid by the state for "state insurees" (children, students, old-age and disability pensioners, the unemployed etc.). We will estimate the contributions paid by the first group as a constant ratio to compensation of workers. As in the case of pension insurance contributions, our projection foresees growth in revenue due to the assumed rise in the ratio of wages to output. The state-funded contributions for state insurees will increase even more significantly, as we assume that the assessment base for state insurees will rise at the same pace as the average wage in the economy and their number will simultaneously increase (mainly because of growth in the number of old-age pensioners). The total revenue of the public health insurance system will thus gradually rise from its current level of 5.6% of GDP to around 6.6% of GDP at the end of the period. However, around 2030 the system will still switch from the present slight surplus of 0.2% of GDP to a moderate deficit, which will gradually rise to around 0.25% of GDP.

Chart 4.2.2 Costs covered by health insurance by age group (% of GDP per capita at current prices, average for 2013–2016)



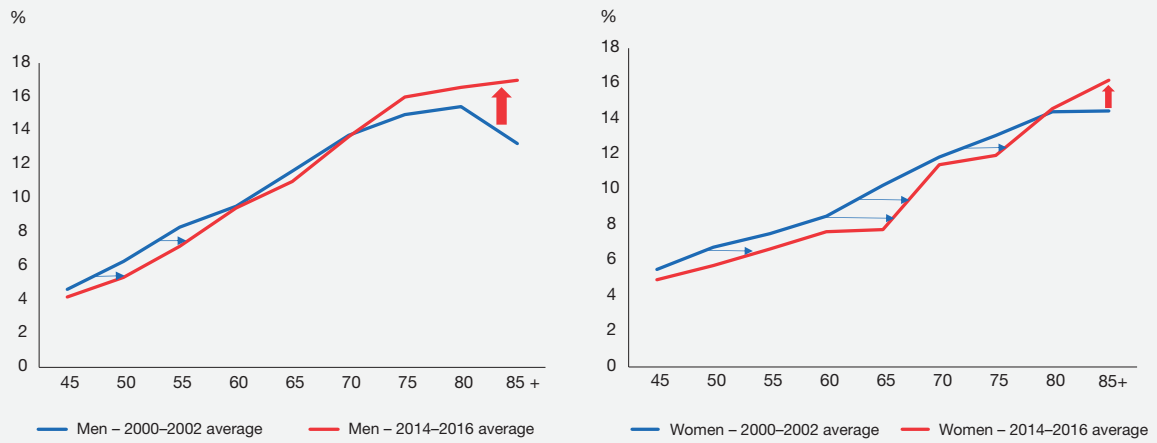
Source: CZSO and CFC calculations

Box 4.1 Cost of health care by age group

When projecting the costs covered by public health insurance, we assumed that the age group-based cost curves will be stable over time. It is clear that this is an uncertain assumption, since technological progress in treatment methods is rapid and hard to predict. However, it is not easy to say how technological progress will manifest itself in terms of costs. On the one hand, one could argue that modern treatment methods and more advanced drugs will be ever more expensive. On the other hand, more accurate (albeit more expensive) diagnostic methods will facilitate earlier treatment, and more advanced methods and pharmaceuticals will lead to more effective and better targeted treatment (for example by reducing side effects, shortening treatment times and preventing chronic and recurring health problems). These increased expenditures will in turn prevent, reduce or delay further health care costs that would arise if the original methods were used. Estimating the impact of research and development on age-related health care expenditure is therefore largely hypothetical.

Nevertheless, the fact that life expectancy is increasing should result in a change in the shape of the age-based cost curve, especially at its long end, i.e. for older cohorts. If, thanks to improved care, the average health status of future 60 year-olds will be comparable with that of today's 55 year-olds, the cost curve can be expected to stretch at its right-hand end (in a certain section). For example, the current costs for 55 year-olds will move to those for future 60 year-olds, the costs for current 60 year-olds will move to those for future 65 year-olds, and so on (a phenomenon known as the healthy ageing hypothesis). Between 2000 and 2016, the average life expectancy in the Czech Republic increased by 4.6 years for men and 3.7 years for women (CZSO figures), so if the healthy ageing hypothesis holds, a change in the shape of the curve should already be evident. Empirical data suggest that the above-described change in the shape of the age-based cost curve in the Czech Republic is indeed occurring (see Chart B4.1.1). If life expectancy continues to increase (as all the demographic projections predict), growth in age-related health care expenditure will slacken – there will be more people in older cohorts, but caring for them will be less expensive. This will be counteracted, however, by a phenomenon that is common in advanced economies and is also apparent in the data for the Czech Republic – very rapid growth in health care costs for the oldest age groups (see Chart B4.1.1). Towards the end of life, the healthy ageing hypothesis evidently no longer holds; on the contrary, there is a rapid rise in expenditure on delaying death and providing palliative care. This increase in expenditure may completely eliminate the potential savings arising from the healthy ageing hypothesis. In the circumstances, our health expenditure projection seems balanced to us.

Chart B4.1.1 Shift in the health cost curve for age groups from 45 years upwards (costs in % of GDP per capita in relevant years)



Source: CZSO and CFC calculations

4.3 Non-pension social benefits in cash and long-term care

Another expenditure item that will be affected by demographic changes is spending on certain non-pension social benefits in cash. We focus on benefits that are both sufficiently fiscally significant (amounting to at least 0.1% of GDP) and identifiably linked to demographics. Benefits that do not meet these two criteria (sickness benefit excluding maternity benefit, unemployment benefit, child allowance, foster care benefit, birth grants, funeral grants and social assistance/need benefit) are classed as "other" and assumed to maintain their current share of GDP. For example, despite being traditionally cited as an example of an automatic stabiliser of the economy, unemployment benefit has such a low weight in the GDP of the Czech Republic that any changes in it resulting from demographic trends would run to only hundredths of a percentage point of GDP.

Expenditure on fiscally significant social benefits is simulated separately using the CZSO's demographic projection, which we have modified for this purpose. Maternity benefit, parental allowance, care allowance and housing allowance can be regarded as fiscally significant. Their link to demographic changes was estimated on the basis of their past evolution (e.g. housing allowance) or arises directly from how the benefit itself is constructed (e.g. maternity benefit). Besides the demographic effect on the number of benefits paid, we also consider the effect of convergence, which will also influence the average benefit level. For the purposes of the projection, we assume that the current average benefit to average wage ratio will be maintained and additionally that the current non-take-up rates of some benefits will be maintained as well. Table 4.3.1 summarises the projection methodology. A more sophisticated approach was used for housing allowance, where, based on past developments, the 65+ cohort was assigned a weight of 25% and the remaining adult population a weight of 75%.

Chart 4.3.1 shows the expected evolution of expenditure on the various benefits. Until 2030 it is flat, as gradual growth in the care allowance is offset by a decrease in childbirth- and child care-related allowances. This effect, however, ends around 2035, when care allowance expenditure increases due to a significant rise in the share of people aged 65+. The amount of non-pension social benefits in cash peaks around 2060, at the same time as pension system expenditure reaches its maximum. According to the projection, in approximately 40 years they will have increased by around 0.6 percentage points of GDP relative to the present level.

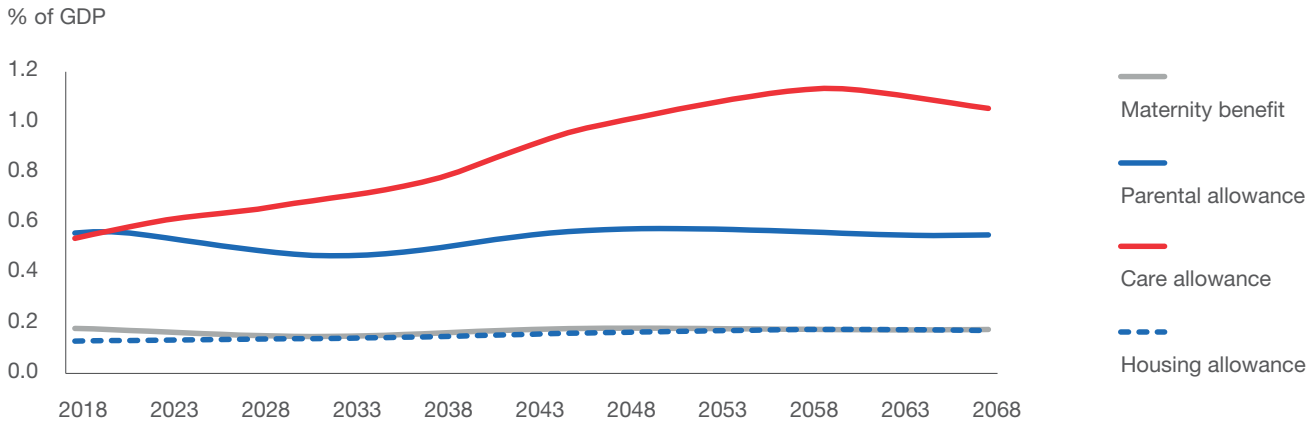
Owing to population ageing, however, we expect growth in other long-term care expenditure in addition to the increase in pensions and health-related benefits (care allowance). Part of this expenditure (approximately one-third) is financed by the public health insurance system and is thus recorded under health care expenditure. The rest, however, is funded from other public sources (the state budget and local budgets). For these expenditures, we assume the same sensitivity to demographic changes as in the case of the care allowance. This means we simulate them according to the change in the number of persons aged 65+. By 2060, long-term care expenditure will have increased by about 0.4 percentage points of GDP compared with the current level.

Table 4.3.1 Demographic variables used to predict expenditure on individual social benefits

Benefit	Input variable for projection of number of benefits
Maternity benefit	Number of new-borns
Parental allowance	Number of children aged 0–3
Care allowance	Number of people aged 65+
Housing allowance	25% share of number of persons aged 65+ 75% share of number of persons aged 18–64

Source: CFC

Chart 4.3.1 Projections of non-pension social benefits in cash (% of GDP)



Source: CFC calculations

4.4 Expenditure associated with convergence effects and other expenditure

So far, we have focused on expenditure that we expect to be associated more or less with demographic changes. For the remaining general government expenditure, we could assume that its share in GDP will be approximately stable (see the scenario of stability of other expenditure in Table 4.4.1). Nevertheless, irrespective of demographic trends, the mere fact that the Czech economy is a converging economy will, in the long run, systematically affect some other expenditures. It is not our goal, however, to simulate the shares and evolution of individual expenditure categories in detail. Rather, we are concerned with capturing the systematic and long-term changes that, in our opinion, will result from convergence. Therefore, with regard to convergence effects we will focus on their contribution to the growth or decline in total expenditure (measured in % of GDP).

The first group of expenditures where convergence effects may arise is public investment. The projection assumes a gradual reduction in the contribution of public investment to GDP to about 3.4% of GDP in 2068. This relationship is based on analyses carried out on a sample of EU countries indicating an inversely proportional relationship between a country's level of economic development and the ratio of public investment to GDP. Less developed countries generally spend a higher percentage of their GDP on public investment. There are clearly a variety of reasons for this. First, in the case of less advanced but converging countries, a role may be played by efforts to upgrade infrastructure (such as motorways, railways and urban infrastructure) and the ensuing higher level of public investment. Another possible reason is the higher relative price level of investment goods in less developed countries (this is true for the Czech Republic; see section 3), which leads directly to a higher investment rate. The higher relative price of investment may be due to the laws of economics (the different capital, labour and technology positions of less developed economies), but the cause may also be a lower standard of public administration, as indicated by quality of governance indexes, for example.[18] Our projection foresees both of these effects fading away as the level of economic development rises. In the case of the Czech Republic, this will lead to a decline in the share of public investment from the average of 4.6% of GDP recorded over the period 2006–2017 to 3.4% of GDP at the projection horizon.

However, convergence will affect the remuneration of employees in the general government sector in the opposite direction. It records modest but systematic growth in our projection. This is due to an assumed gradual increase in the costs of activities performed by organisations in the general government sector. Growth in labour productivity and a rise in the share of compensation of employees in the private sector will give rise to wage

[18] See, for example, World Economic Forum (2018): Global Competitiveness Index 2017–2018.

pressures, which will inevitably spill over to the general government sector. However, the activities in this sector are mostly services, moreover services of such a kind that the wage growth cannot be entirely offset by growth in labour productivity (e.g. education, public administration, justice and internal security). As a result, the costs will rise even if the services produced by government employees are kept on the same scale, so their relative share in GDP will also increase. This is a manifestation of the Baumol-Bowen effect – goods which are produced with no increase in labour productivity in the long run (if they are to be provided in the same quality) necessarily become relatively more expensive due to wage growth in other sectors. Our simulation assumes that this effect will gradually increase and will represent an additional 0.6 percentage points of GDP on the expenditure side at the end of the projection period.

In the case of defence expenditure, there are no convergence effects in the sense of such expenditure increasing as a result of the convergence of the Czech economy, but our projection nevertheless assumes that the Czech Republic will honour its NATO commitments and thus be spending 2% of GDP on defence by 2030 at the latest. The medium-term outlook for the Ministry of Defence budget heading envisages expenditure of just above 1.3% of GDP in 2020, so we assume an additional expenditure requirement that will increase linearly and reach an additional 0.6% of GDP compared with the present after 2030. Likewise, besides convergence effects we also assume growth in payments to the EU, which would foster a rise in expenditure of 0.1% of GDP compared with the present as from 2028 (see Box 4.3 for more detailed information on payments to/from the EU).

Table 4.4.1 Non-demographic expenditure and additional convergence effects (% of GDP)

	2020	2030	2040	2050	2060	2068
Other expenditure – baseline scenario	20.4	20.4	20.4	20.4	20.4	20.4
Convergence-related changes in other expenditure	0.0	0.8	0.8	0.9	0.9	1.0
- public investment	*0.0*	*-0.1*	*-0.2*	*-0.2*	*-0.3*	*-0.3*
- defence expenditure	*0.0*	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*
- growth in costs of general government sector	*0.0*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*
- growth in payments to EU	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Other expenditure including change effects	20.4	21.2	21.2	21.3	21.3	21.4

Source: CFC calculations

Box 4.2 Potential impacts of change in education expenditure

The sustainability of public finances will also be significantly influenced by the level of public expenditure on education. This currently represents around 4% of GDP. Public expenditure on education currently accounts for about one-seventh of total state budget expenditure. The average registered converted number of employees in the education sector exceeds 5% of all employees in the Czech Republic, but the ratio of compensation of employees to GDP is only about 2%. Although we did not simulate growth in wage costs in the education sector separately in the long-term projection (education workers are included among other state employees), it is clear that if the pledges to raise pay levels in education (such as the Government Programme Statement of 27 June 2018) are to be honoured, public expenditure on education will be another factor that will affect the expenditure side of the state budget in the long-term projection.

So, there are reasons to believe that growth in education expenditure will be higher than what we assume for expenditure on state employees as a whole (our projection is thus generally on the conservative side from this point of view). Although we keep the estimate for state employees as a whole in the expenditure-side projection, for reasons of caution we additionally perform a separate simple sectoral simulation focused on education. In this simulation, we consider public expenditure on education only. We start with our demographic projection and continue with the parametric share of persons who are participants in the educational process provided by public educational institutions.

For the period 2018–2021, we chose a level of wage growth that ensures that the average wage in the education sector in 2021 is 1.5 times the average wage in the Czech Republic in 2017 (as implied by the Government Programme Statement of 27 June 2018). In the following period up to 2068, we expect wage growth in public education to follow the same path as the overall wage growth index as defined in our projection. As for non-wage expenditure in the education sector, we assume identical dynamics to that of the consumer price index (i.e. 2% inflation).

The higher wage growth in public education will play a crucial role with respect to state budget expenditure. The share of wages in public expenditure on education will gradually increase from the current level of 50% to approximately 55% by around 2050. It will then fall slightly. This would lead to an increase in the ratio of public expenditure on education to GDP from the current level of 4% to almost 5.4% of GDP in 2068. The share of public expenditure on education in total state budget expenditure would increase proportionately, from the current one-seventh to about one-sixth. It is clear from the projection of public expenditure on education up to 2068 that this sector will play an important role on the expenditure side of the state budget.

4.5 Revenue in the long-term projection

As in the case of expenditure items, revenues will be subject to interlinked demographic and convergence effects in the long-term projection. For our purposes, we will split government revenues into the following categories: revenue from personal and corporate income taxes, statutory social security contributions, revenue from consumption taxes and other revenue (e.g. property income, income from the sale of goods and services and revenue from the EU).

In the projection of personal income tax revenue, we assume that such revenue depends mainly on compensation of workers. As a result, the convergence effect will manifest itself here, since according to our assumptions the ratio of compensation of employees to GDP will gradually increase and so, proportionately, will the share of this tax in GDP. This effect will thus outweigh the fact that the share of employees (and the share of workers) in the overall population will decline for demographic reasons. Nevertheless, according to our macroeconomic projection, wages will grow fast enough to more than offset the drop in the number of workers. Note, however, that here we deviate partially from making our projection strictly in accordance with the current legislation. Tax regulations often include deductions and discounts or thresholds in nominal terms. Growth in nominal wages and other earnings can thus, ceteris paribus, lead to an increase in the average rate of taxation. This means that without any changes to the legislation, there is erosion of the real value of deductible items, migration into higher tax bands and related taxation at higher rates, and so on. However, we abstract from this and similar effects in our projection. We thus implicitly assume that the tax legislation will be amended so that the very fact that earnings are rising secularly does not lead to a change in the effective tax rate and to a change in such tax features as the degree of progressivity (the effects described above reduce the degree of progressivity). The projected growth in personal income tax revenue from the current 4.5% of GDP to 4.9% of GDP at the end of the projection is thus in fact the result of convergence alone.

Corporate income tax revenue usually fluctuates, as it is sensitive to the business cycle. Also, the construction of the tax base makes this tax hard to predict. However, in the long-term projection we abstract from cyclical effects and for reasons of logical consistency we project such revenue on

the basis of net operating surplus. It should explain this tax revenue better than GDP, because it is net operating surplus, rather than GDP, that is the macroeconomic counterpart of net operating profit before tax. We again abstract from the effects of inflation (these would manifest here in erosion of the real value of tax depreciation of the fixed capital of firms and in the valuation of inventories). As with personal income tax, convergence effects will be apparent, but this time with the opposite consequence. Growth in the ratio of compensation of employees to GDP will necessarily lead to a decline in the share of gross operating surplus in GDP. The share of net operating surplus (i.e. after consumption of fixed capital is taken into account) in GDP will in turn decline even more significantly, as we assume that the share of fixed capital consumption in GDP will remain constant. As a result, the ratio of corporate income tax revenue to GDP will fall by a quarter from 3.2% at the beginning of the projection to 2.4% at the end.

We assume a fixed share in GDP for other current taxes. Their share in GDP has long been stable, and with the given tax policy setup we are not aware of any reasons for it to change.

Mandatory social security contributions comprise pension contributions (including the systems of the Ministry of Defence, the Ministry of Interior and the Ministry of Finance), public health insurance contributions excluding state insurees, payments for state insurees and other monetary social security contributions (sickness insurance and contributions to the state employment policy). As in the case of personal income tax, all these payments are linked by construction to compensation of employees in our projection. Here again, the convergence effect is present – the ratio of these payments to GDP grows in equal proportion to the ratio of compensation of employees. In the case of revenue for state insurees (see section 4.2), we took into account the demographics of the categories that state insurees jointly form (especially growth in the number of old-age pensioners). We linked the payment per state insuree to the average wage. Recall that in the general government sector, payments for state insurees are both a revenue (to health insurance companies) and an expenditure (for the state budget). As a result, they do not have any impact on the sector's balance. We nevertheless present them separately, since they affect the data on the structure and size of the general government sector.

Table 4.5.1 General government revenues in selected years (% of GDP)

	2020	2030	2040	2050	2060	2068
Personal income taxes	4.5	4.6	4.7	4.8	4.9	4.9
Corporate income taxes	3.2	2.9	2.8	2.6	2.5	2.4
Other income taxes and taxes on property transactions	0.2	0.2	0.2	0.2	0.2	0.2
Social security contributions	15.4	15.8	16.2	16.7	17.0	17.0
- pension insurance	*8.4*	*8.6*	*8.8*	*8.9*	*9.0*	*9.1*
- public health insurance	*5.7*	*5.9*	*6.1*	*6.4*	*6.6*	*6.6*
- other	*1.2*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
Taxes on production and imports	11.8	11.8	11.8	11.8	11.8	11.8
Property income	0.5	0.5	0.5	0.5	0.5	0.5
Other revenue	4.6	4.6	4.6	4.6	4.6	4.6
Total revenue	**40.1**	**40.5**	**40.8**	**41.2**	**41.4**	**41.4**

Note: The totals in the table may be subject to inaccuracies due to rounding.
Source: CFC calculations

Taxation of consumption (taxes on production and imports) consists primarily of revenue from VAT and selective excise duties. This tax revenue is simulated by the share of the final consumption expenditure of households in GDP, which represents an approximation of the largest part of the tax base for consumption taxes. According to our macroeconomic projection, this share is constant (a change in the structure of pensions in favour of compensation of employees does not necessarily translate into a change in the structure of use of pensions), so consumption taxation revenue will maintain a constant share in GDP. Again, we diverge slightly here from strict conformity with the legislation, as some excise duties are constructed as a nominal figure for a given amount of goods. We therefore assume that the legislation will change over the long term in such a way that the revenue from this class of taxes evolves as if all the rates were constructed as ad valorem.

Property income is made up mainly of dividends and shares in the profits generated by state-owned enterprises. In this case again, we assume a constant share in GDP, as we have no information indicating that the share of profit in GDP will change. We also assume that the state will not change its holdings in the major firms it (co-)owns. Given the way the Treasury operates, interest revenue on investment of surplus liquidity is not included. Other revenue consists mostly of income from the sale of goods and services and income from the EU. The share of income from the sale of goods and services is essentially constant, so its ratio to GDP is fixed for the long-term projection, just like in the case of property income. Finally, we assume that income from the EU will form a constant percentage of GDP as well. Here, however, we emphasise that this only concerns general government income from the EU, not the total income from the EU for all entities in the Czech Republic. We believe that total income from the EU will decline as a percentage of GDP (see Box 4.3 for more details).

Box 4.3 Income from and payments to the EU

The Czech Republic has been a net recipient of EU funds ever since it joined the European Union. Payments to the EU budget include traditional own resources, the resource from VAT and the resource based on gross national income (GNI). Payments from the EU budget include, or have included, payments for structural projects, agriculture, payments from EU programmes and previously also pre-accession instruments and compensation. Between 2004 and the end of 2017, the Czech Republic paid almost CZK 516 billion into the EU budget and received CZK 1,211 billion from it. Its "net position" – the difference between income from and payments to the EU budget – was thus close to CZK 700 billion at the end of 2017 (see Chart B4.3.1).

For our medium-term and long-term estimates of income and payments of Czech public budgets from/to the EU, we start with an increase in payments to about 1.1% of GNI starting from 2028 (see, for example, EU Budget for the Future, 2018). In the Czech Republic, however, GNI has long been lower than GDP, because a large part of the economy is under foreign control and, for example, the profits of foreign owners do not fall under GNI. Given the difference between GDP and GNI in the Czech Republic over the past three years, we can estimate payments to the EU at around 1.0% of GDP from 2028 onwards.

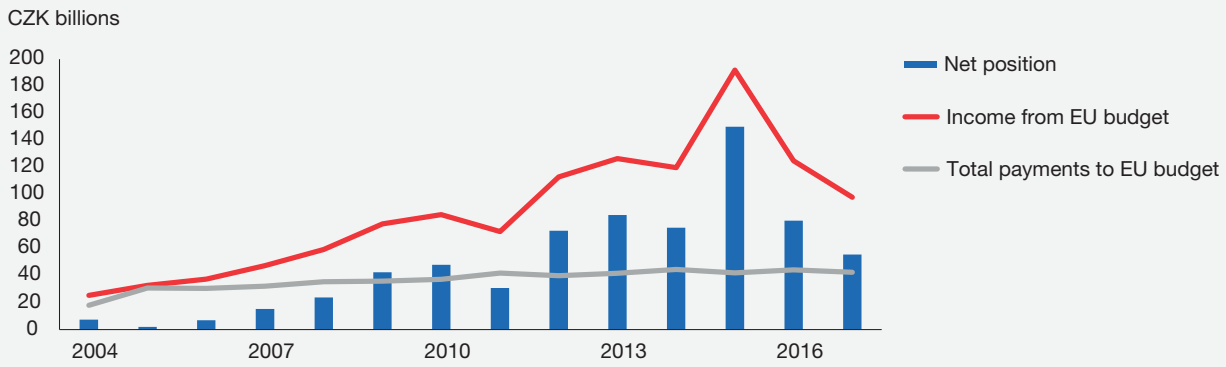
The Czech Republic's total income from the EU expressed as a percentage of GDP will probably fall in the future for several reasons. First, there may be Brexit related effects. We also assume that the long-running decline in the share of Common Agriculture Policy funds will continue. Other potential reasons include a gradual decrease in the share of expenditure on economic, social and territorial cohesion policy and, conversely, an increase in the size of spending programmes under which the Member States will have to compete for funds rather than receiving amounts fixed in advance.[19] In the case of these programmes, however, entities from the Czech Republic are already lagging behind in their ability to come up with

[19] Zahradník, Petr: Kohezní politika Evropské unie [Cohesion Policy of the European Union]. Praha: C. H. Beck, 2017.

potential projects, and in this respect we do not foresee any major change going forward. The main reason why the Czech Republic can expect to record a decreasing net position vis-à-vis the EU budget in the future is its gradual increase in wealth relative to the other Member States. This will limit the ability of some regions to obtain funds. The Czech Republic's net position may also be worsened in the future by other new criteria being incorporated into the indicators for the pre-allocation of expenditures for individual Member States. Examples include the approach to migration, youth unemployment and environmental investment.

Nevertheless, we assume structural changes in the use of income from the EU (such as increasing expenditure on public transport investment and education) that will lead to the general government sector maintaining its current level of income from the EU (in % of GDP) over the entire period despite the decline in total income from the EU. However, other entities that do not come under the general government sector will have to expect a correspondingly larger relative decrease in EU funding.

Chart B4.3.1 Total income from and payments to the EU



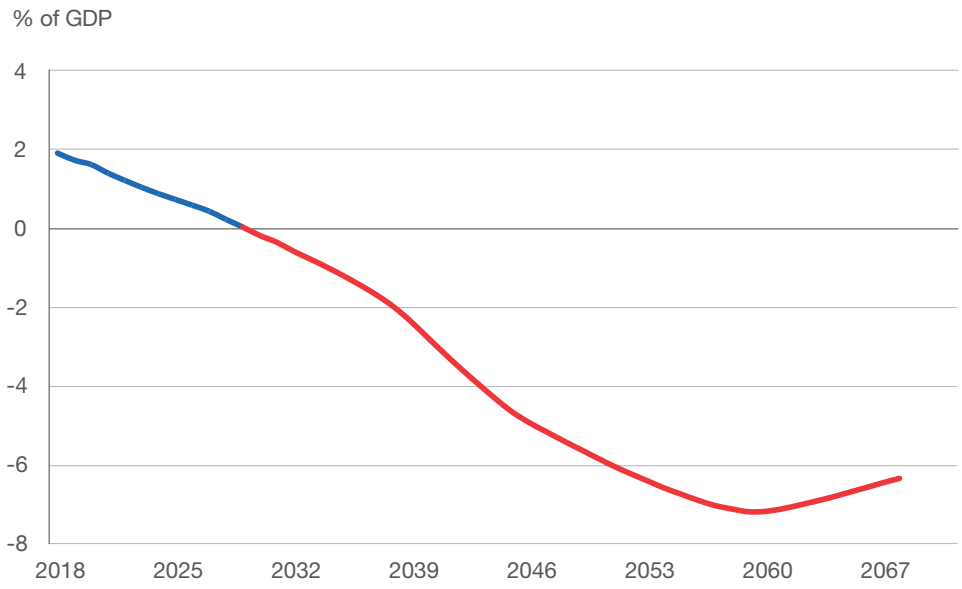
Source: MF CR: Position of the Czech Republic vis-à-vis the EU budget

5 Overall general government balance and debt

5.1 Primary balance

The projections of the individual revenue and expenditure items allow us to prepare a projection of the primary structural balance of the general government sector. Two periods can be distinguished for this balance. During the first period, which begins with the present and lasts approximately until 2030, the balance is positive. Beyond that year, though, it gets into a deficit and, according to our projection, remains there permanently (see Chart 5.1.1). The reason for the switch from surplus to deficit is unequivocally the expenditure side, which grows mainly for demographic reasons. Recall that in the 2030s there will be a more pronounced decline in the pension system due to a combination of two pension-relevant factors – first, the increase in the statutory retirement age will halt, and second, the baby-boomers born in the first half of the 1970s will gradually start entering old-age retirement. After 2060, the primary deficits will fall, because by then the baby-bust cohorts will have started to enter old-age retirement, but the annual deficits will remain significant until the end of the projection period. The budget revenue side will increase only moderately over the projection period, as a result of growth in the ratio of compensation of employees to GDP, which is taxed more heavily than net operating surpluses. However, the growth on the revenue side is far from able to offset the growth on the expenditure side.

Chart 5.1.1 Primary general government balance



Source: CFC calculations

5.2 Interest costs

To obtain a comprehensive picture of the general government balance, we still need to complement the path of the primary balance with interest expenditure related to the general government debt. So far, we have expressed both expenditure and revenue items as a share of GDP, so the rate of inflation has been irrelevant to them. In the case of interest expenditure, however, this is no longer possible. Interest expenditure is generally determined by the nominal interest rate, which already contains the inflation rate (in the long run, in which we work). This is because the nominal interest rate is the sum of the real interest rate and the inflation rate, with the real interest rate itself being determined by real factors such as the marginal productivity of capital and the time preferences of economic agents.[20] The long-run inflation rate thus has an effect, via the nominal interest rate, on the share of interest expenditure in GDP and hence also on the total share of general government expenditure in GDP. Recall that in the macroeconomic section we assumed 2% inflation. It is this value that enters our simulation of nominal interest expenditure. If we were to work with a higher (lower) inflation rate, the share of interest expenditure in GDP would be permanently higher (lower), although this would (apparently paradoxically) have no effect per se on the debt-to-GDP ratio.[21]

The general government debt of the Czech Republic consists mainly of the state debt (which has long accounted for more than 90% of the total), and we will focus on it in our simulation. We will therefore assume that the interest costs on the remaining part of the general government debt (e.g. municipal debts) will behave similarly. In reality, general government debt is financed by a whole range of instruments, ranging from non-marketable borrowings to a wide palette of debt securities with various maturities, coupon yields and denominations.[22] In the simulation, we are therefore forced to simplify and split the total general government debt into two parts – short-term debt (i.e. debt maturing within one year) and long-term debt. We assume that the short-term debt is financed at the short-term rate and has to be refinanced each year at the current rate. By contrast, we assume that the long-term debt is financed using bonds with a ten-year original maturity and a coupon that equals the ten-year nominal interest rate (ten-year maturity was chosen because it is the longest maturity for which we have a sufficiently long time series and which is internationally comparable). We keep the shares of short-term and long-term debt in the total debt constant at 20% and 80% respectively. This is approximately equal to the present maturity distribution of the state debt and is in line with the Ministry of Finance's current plans for the term structure of the state debt.[23]

We model total interest costs as the product of general government debt and the implicit nominal interest rate, which is de facto a weighted average of the nominal interest rates paid on the short-term and long-term portions of the debt. The weight of the short-term interest rate in the implicit interest rate is identical to the share of the short-term debt, i.e. 20%. We will consider the short-term interest rate in our projection to be constant at 2.1% p.a. This figure corresponds to a real short-term interest rate of 0.1% p.a. (the average real three-month interest rate over the period 2000–2017) plus inflation of 2%.[24] The interest on the long-term portion of the debt analogously has a weight of 80% in the implicit interest rate. In this case, however, we assume for the sake of simplicity that the interest rate on the long-term portion of the debt is equal to the ten-year moving average of the ten-year interest rates in individual years.[25] In the baseline version, we simulate the ten-year nominal interest rate at 3.33% p.a., 1.3 percentage points of which is the real interest rate (again, the average for the period 2000–2017) and the rest is the rate of inflation. These assumptions together lead to a gradual increase in the modelled implicit interest rate over ten years to 3.08% p.a., where it stays constant.[26] Although this procedure is only approximate, we verified on the data for the past ten years that it led to a satisfactory simulation of actual interest costs.

[20] The nominal interest rate is the sum of the instantaneous real interest rate and the instantaneous inflation rate. When working with rates in the more usual per annum terms, the said sum additionally includes a term arising from the product of the two rates.

[21] This is because of the debt dynamics equation. Higher interest expenditure resulting from higher inflation leads to higher annual deficits, but the higher inflation leads, ceteris paribus, to higher nominal GDP growth, so the debt-to-GDP ratio is not affected by inflation per se.

[22] For more details, see MF CR: State Debt Management Report of the Czech Republic in 2017.

[23] See, for example, MF CR: Strategy for the Financing and Management of the State Debt of the Czech Republic 2018

[24] CNB data. We used the GDP deflator to convert to the real interest rate.

[25] We use this approach to account for the fact that the current interest rate is not relevant to the servicing costs of ten-year bonds already issued; all that matters is the interest rate at the time of issue.

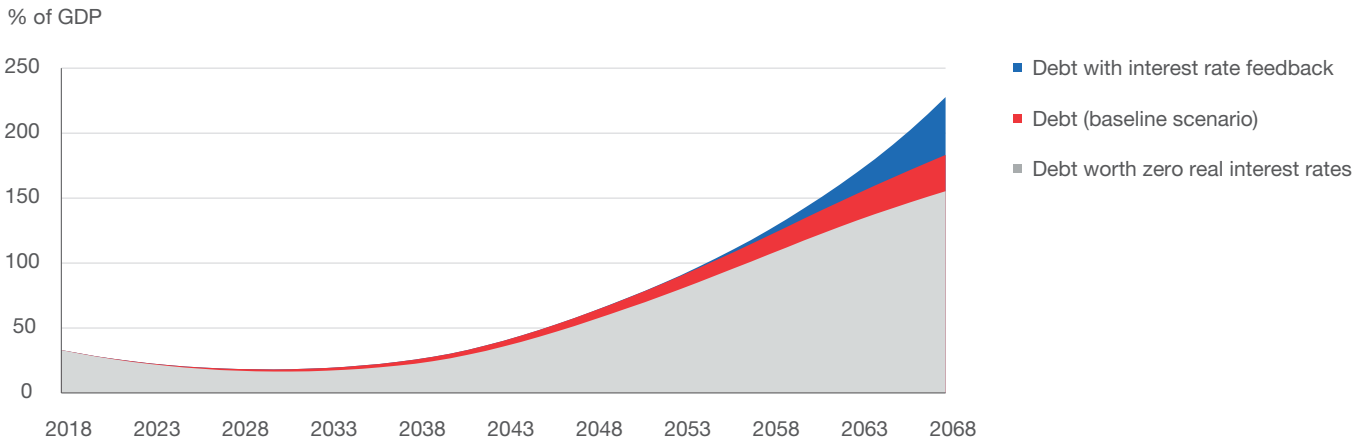
[26] The only gradual increase in the implicit interest rate is due to the fact that for the long-term portion of the debt we apply the moving average of actual long-term rates over the last ten years, so until 2026 this average includes some of the actual rates prior to 2018.

5.3 Debt

Interest costs enter the calculation of the overall general government balance on the expenditure side and thus increase the annual deficits. Those deficits accumulate further in the general government debt, and the growing debt in turn again generates rising interest costs (see Table 5.3.1 for data for selected years). We regard the simulation of interest expenditure in this form as conservative, as international institutions recommend using higher real interest rates, which would make the results even worse.[27] Even so, over the 50-year horizon the cumulative general government debt is heading towards approximately 180% of GDP by 2068. However, this is due mainly to the evolution of the primary balances in the second part of the projection period, not to our model of interest costs. Even if we were to assume (unrealistically) that both the short-term and long-term real interest rates were zero over the whole projection period, the debt would still head towards roughly 155% of GDP (see Chart 5.3.1).

Besides the baseline version of the interest expenditure simulation, we also carried out a projection in which we take into account the relationship between the size of the debt relative to GDP on the one hand and the level of real interest on the other. If the debt-to-GDP ratio rises significantly, it is likely that investors will require a risk premium for being willing to hold such a large volume of debt paper and to further increase the share of such paper in their portfolios and thus expose themselves to a rising risk of borrower default. Interest rate feedback thus arises between the debt and interest expenditure above a certain debt level. This is a loop in which a high level of debt leads to growth in the real interest rate; that in turn increases interest expenditure, fostering growth in the debt, which further increases the real interest rate, and so it continues.

Chart 5.3.1 General government debt



Source: CFC calculations

Of course, there remains the question of the debt level at which this feedback begins to emerge. In the projection, we opted for a threshold of 55% of GDP, because this is the value of the debt brake.[28] If the general government debt were to break through this threshold and continue to rise, it would undoubtedly be a signal for investors that the deficit reduction measures referred to in the Act are insufficient, and market interest rates would very likely increase.[29] Another question is how intensely the real interest rate would respond to the growth in debt. Given that in modern history the debt-to-GDP ratio in the Czech Republic has never reached the aforementioned threshold, we used a sensitivity level derived from the differences in yields on the ten-year government bonds

[27] See, for example, European Commission: The 2018 Ageing Report: Underlying Assumptions and Projection Methodologies

[28] See Section 14 of the Act.

[29] However, the change in market interest rates would also depend on the fiscal situation in other countries, since bonds are to some extent substitutes for each other – a sharp increase (decrease) in the indebtedness of other countries would reduce (increase) the growth in Czech interest rates.

of euro area countries.[30] In the simulation, we assume that each percentage point of the debt-to-GDP ratio above the 55% threshold leads to an increase in the current ten-year real interest rate of 0.039 percentage points (we leave the interest rate on the short-term portion of the debt unchanged). Under these assumptions, the debt growth will accelerate at the end of the projection period compared with the baseline scenario without feedback (see Chart 5.3.1). The implicit nominal interest rate in our projection with interest rate feedback will exceed 6% and the debt-to-GDP ratio heads towards 230%. Annual interest costs alone represent approximately 14% of GDP each year at the end of the projection, and the economy finds itself in a practically hopeless debt trap.

Table 5.3.1 Interest costs and total budget balances (in % of GDP) in selected years

	2020	2030	2040	2050	2060	2068
Interest costs (baseline scenario)	0.6	0.5	0.9	2.1	3.9	5.4
Interest costs with interest rate feedback	0.6	0.5	0.9	2.1	6.0	14.0
Total balance (baseline scenario)	1.0	-0.7	-3.6	-7.7	-10.8	-11.5
Total balance with interest rate feedback	1.0	-0.7	-3.6	-7.8	-13.0	-20.1

Source: CFC calculations

5.4 Public finance sustainability indicator

The s1 indicator is used as an overall indicator of the sustainability/unsustainability of public finances. It is generally defined as the number of percentage points of GDP by which the primary structural balance would have to change every year over an entire given period for the debt to reach a given level by the end of that period.[31] In our case, we will therefore select a 50-year period and ask how many percentage points of GDP the primary balance would have to be above our projection each year for the general government debt to be at 55% of GDP, i.e. the debt brake level, at the end of the projection period. We will refer to the s1 indicator constructed this way as the public finance sustainability gap. However, let us emphasise that this merely an indicator, one intended primarily to allow a quick comparison in the future of whether public finance sustainability is improving or worsening. It is not a recommendation that the balance should improve by the given figure each year in reality.

According to our simulation, the public finance sustainability gap currently stands at 2.86. This means that if the primary deficit was 2.86 percentage points of GDP lower (or the primary surplus was the same amount higher) each year, the debt would head towards 55% of GDP in 2068. Given that in such case the debt path would never exceed the debt brake, there would be no feedback between the real interest rate and the debt. Improving the primary balances by the above figure would, however, result first in full repayment of the entire general government debt (approximately by 2026) and then in the creation of a sizeable buffer that would gradually be released in later years as increased expenditure.

[30] We derived the sensitivity of the interest rate on the basis of the relationship between the debt-to-GDP ratios of the 12 euro area member states as the explanatory variable and the ten-year government bond yield as the explained variable. We used a panel regression for the period 2009–2017 for the estimation. The lower estimate, which we favour, is an increase in the interest rate of 0.039 percentage points for each additional percentage point in the debt-to-GDP ratio.

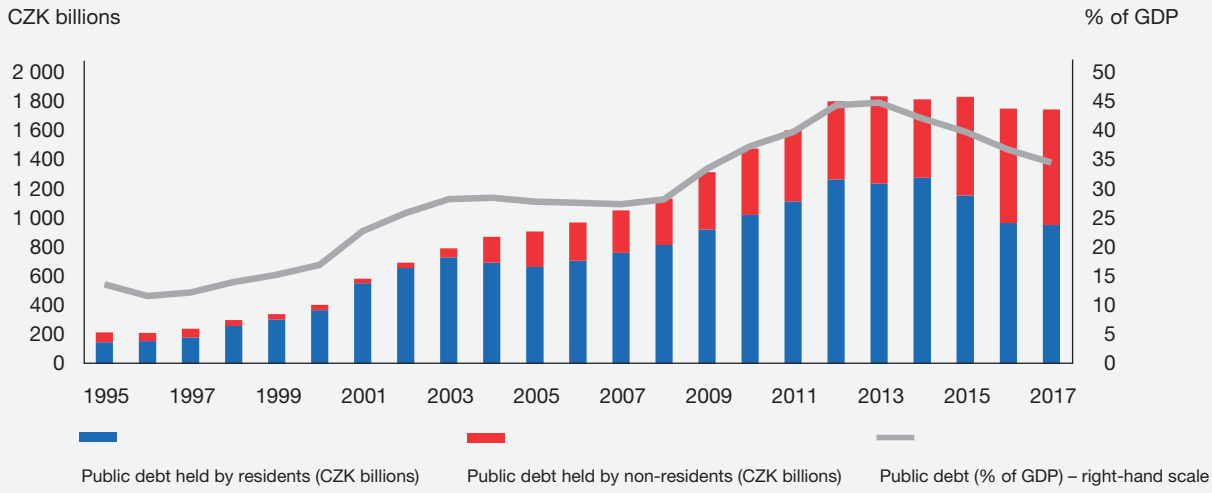
[31] For a more detailed description, see European Commission: Debt Sustainability Monitor 2017. Institutional Paper 071.

Box 5.1 Public debt holdings of domestic and foreign entities

The starting point for assessing the sustainability of public finances is the evolution of the general government debt, or public debt for short. The volume of public debt fell slightly between 2015 and 2017, from CZK 1,836 billion to CZK 1,749 billion at the end of 2017. The public debt ratio likewise decreased from 44.9% of GDP in 2013 to 34.7% of GDP at the end of 2017 (see Chart B5.1.1).

Over the past ten years, however, there has been a considerable change in the structure of public debt in terms of the distribution of debt holdings between domestic entities and non-residents. While in 2008 domestic entities held 71.8% of the Czech public debt, by the end of 2017 the figure was only 54.6%. This means that almost half of the Czech Republic's public debt is currently owned by non-residents (see Chart B5.1.1). The debt held by non-residents amounted to around 16% of GDP.

Chart B5.1.1 Public debt held by residents and non-residents

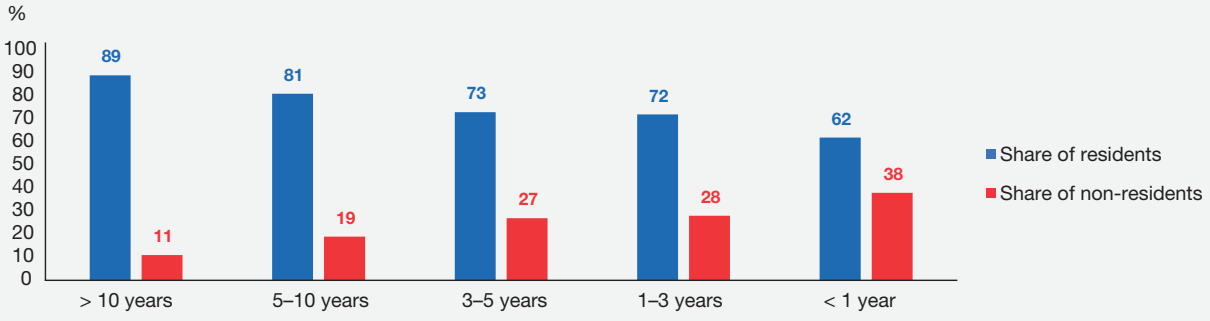


Source: CNB, ARAD, August 2018

This change is related to a decline in holdings of Czech government bonds by domestic banks and other financial institutions (see Chart B5.1.3). At the end of 2014, these banks held public debt amounting to CZK 725.5 billion, or 40% of the total public debt. Between 2015 and 2017, however, the volume of government bonds held by domestic banks fell by more than a quarter. As of the end of 2017, only 27% of the public debt of the Czech Republic was held by domestic banks. The decline in domestic banks' interest in holding Czech government bonds was due mainly to the low remuneration on these assets, which led to them being sold to foreign investors. Despite the low returns, foreign investors still showed interest in Czech government bonds, probably because they also counted on making profits on the expected appreciation of the Czech koruna following the discontinuation of the CNB's foreign exchange interventions. The maturity structure of the debt holdings is shown in Chart B5.1.2, which shows clearly that foreign investors primarily hold Czech government debt securities with shorter maturities.

The change in the structure of Czech public debt holdings has several contradictory impacts from the perspective of future risks. On the one hand, the sovereign exposure concentration risk in the domestic financial sector has decreased. This risk was one of the major factors aggravating the situation in the euro area following 2010, when the worsening fiscal position of the state was passed on to banks as government bond holders. Although the banking sector problems in some countries were the primary factor underlying the deterioration in public finances, they were not the only reason, as public finances were stressed by a deterioration in the real economy. Contagion from general government to banks was regarded as a more serious problem than contagion from banks to general government.[32]

Chart B5.1.2 Czech government debt securities by maturity and ownership (residents vs. non-residents) at the end of 2017



Source: CNB, FSR 2018

There is currently also a risk of banks suffering market losses in the future when government bond yields rise to their normal level (from the historical point of view). In 2015, the central bank identified credit institutions' exposures to the Czech public sector as systemically significant.[33] In 2015, the share of domestic government bonds in bank assets was 14%, an above-average level by international comparison (the comparable ratio for the EU as a whole was approximately 4%). The decline in domestic government bond holdings to less than 8% at the end of 2017 thus reduced the interconnectedness of the risks of the domestic banking sector and the general government sector.

On the other hand, a risk has emerged in connection with the rising share of non-residents in domestic asset holdings. This primarily concerns the risk of external shocks spilling over to the domestic financial system, as a sell-off of domestic debt by foreign investors would probably trigger high volatility in the market prices of Czech government bonds. In line with international practice, the CNB considers 35% to be the critical threshold for the proportion of government debt held by foreign entities. This threshold has been constantly exceeded since 2015.

A related issue is the average maturity of the domestic public debt. The average maturity of government bonds at the end of 2017 was five years. This is approximately two and a half years less than the EU average.[34] As the debt maturity rises, or the share of debt maturing within one year falls, the risk of a need to refinance part of the debt under unfavourable conditions increases.

The CFC will continue to monitor the above risks. Nevertheless, the analysis of the current situation already shows that any further increase in public debt would lead to an increase in one of the two risks mentioned above. If the increase in debt were financed by domestic banks, sovereign exposure concentration risk would increase, and if it were financed by foreign investors, the risk arising from foreign ownership of domestic debt would increase further. The positive assessment resulting from the Czech Republic's relatively favourable situation may thus be misleading in this respect and does not reflect the fact that the Czech Republic is a debtor with a relatively short history and a shallow financial market among the developed market economies and as such is unable to absorb public debt to the same extent as countries with developed financial sectors. Therefore, the Czech Republic's debt should not be compared with those countries.[35]

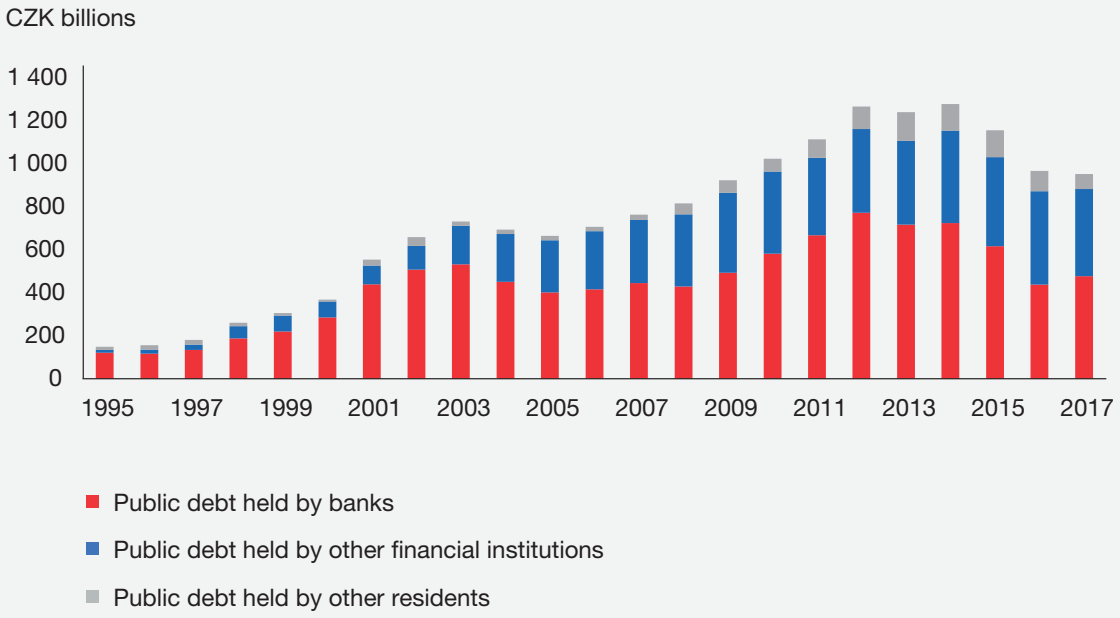
[32] See, for example, Erce, A.: Bank and Sovereign Risk Feedback Loops, 2015, or Angeloni, C., Wolff, G. B.: Are Banks Affected by Their Holdings of Government Debt? 2012.

[33] See, for example, Financial Stability Report 2015/2016, CNB.

[34] See Financial Stability Report 2017/2018, p. 83, CNB.

[35] The ratio of financial sector assets to GDP is approximately 160% in the Czech Republic, while in Western Europe it is usually double that figure (more than 300% of GDP).

Chart B5.1.3 Public debt held by residents



Source: CNB, ARAD, August 2018

6 Conclusion and assessment

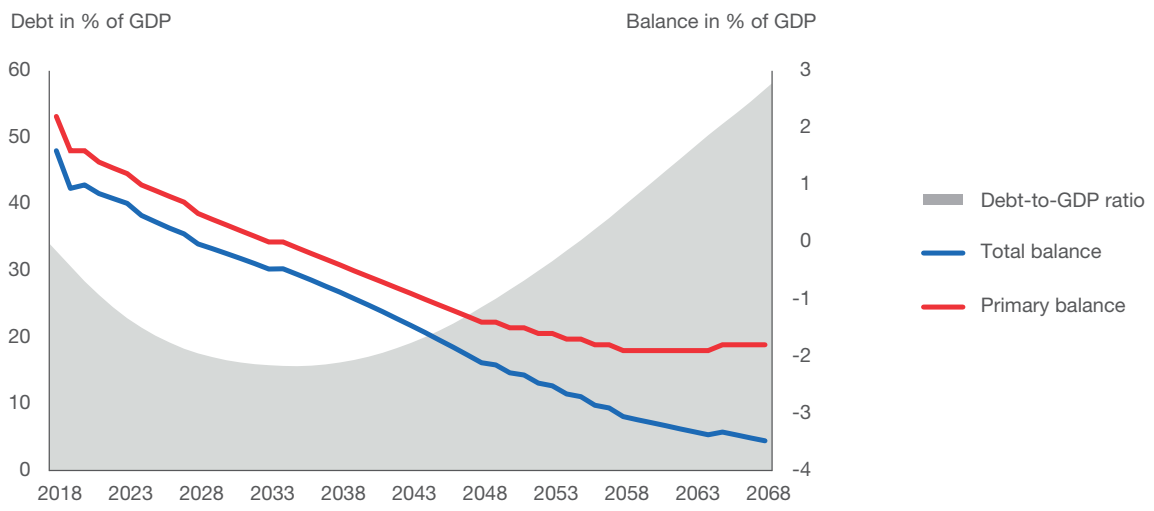
Although the Czech Republic is doing very well in terms of general government debt by international comparison, any future rise in the debt ratio will entail relatively significant risks. Unless the financial market deepens significantly, growth in public debt will lead either to a further increase in the share of foreign investors in Czech government bond holdings or to a further increase in sovereign exposure risk. The involvement of domestic banks and the share of foreign entities in Czech government bond holdings are meanwhile already high and both represent risk factors. Moreover, in an environment of rising interest rates, the relatively high proportion of short-term state debt also poses a risk.

The results of the simulations presented in the previous sections show unambiguously that Czech public finances are unsustainable in the long term under the current legislation. General government debt would be growing explosively at the end of the 50-year projection. Interest rates on the general government debt and the associated costs of servicing it would probably also be rising quickly and further increasing the debt. The country would thus find itself in a debt trap. Nevertheless, recall again that our simulation is not a prediction of the actual debt path. It is a simulation of what would occur without changes to tax and spending policies.

Althoug the projection results contain many factors that cannot be entirely separated from one another in a reliable way, in this case we can still conclude that the main cause of the long-term unsustainability of Czech public finances is the mismatch between the current legislation on the one hand and the expected demographic trends on the other. Experimentally, we carried out a simulation that differed from the baseline projection only in that we assumed ad hoc that the pension system is balanced each year. This means we assumed that the imbalance in the pension system is eliminated without affecting other public sector expenditure or revenue items and without having macroeconomic impacts on, for example, the ratio of compensation of employees to GDP and the final consumption expenditure of households. The main aim was to estimate what weight the pension system has in the total long-term unsustainability of Czech public finances.

It turns out (see Chart 6.1) that the future imbalance in the pension system is indeed central to the unsustainability of public finances. Without this imbalance, the growth in debt would be much more moderate. By the end of the 50-year period, it would only be approaching 60% of GDP. So if, among the problems facing Czech public finances, we were only to choose the one for which finding a solution has the highest priority, it would undoubtedly be the pension system.

Chart 6.1 Simulation of general government debt (left-hand scale) and budget balances (right-hand scale) with a balanced pension system



Source: CFC calculations

Appendices

D.1 Summary of general government expenditure and revenue in selected years (% of GDP)

	2020	2030	2040	2050	2060	2068
Revenue						
Personal income taxes	4.5	4.6	4.7	4.8	4.9	4.9
Corporate income taxes	3.2	2.9	2.8	2.6	2.5	2.4
Other income taxes and taxes on property transactions	0.2	0.2	0.2	0.2	0.2	0.2
Social security contributions	15.4	15.8	16.2	16.7	17.0	17.0
- pension insurance	*8.4*	*8.6*	*8.8*	*8.9*	*9.0*	*9.1*
- public health insurance	*5.7*	*5.9*	*6.1*	*6.4*	*6.6*	*6.6*
- others	*1.2*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
Excise duties	11.8	11.8	11.8	11.8	11.8	11.8
Property income	0.5	0.5	0.5	0.5	0.5	0.5
Other revenue	4.6	4.6	4.6	4.6	4.6	4.6
Total revenue	40.1	40.5	40.8	41.2	41.4	41.4
Expenditure						
Pensions	8.4	9.0	10.9	13.3	14.3	13.7
Health care (public health insurance system only)	5.5	5.9	6.4	6.7	6.8	6.8
Other monetary social benefits	2.3	2.3	2.5	2.8	2.9	2.8
Payments for state insurees	1.3	1.4	1.5	1.7	1.9	1.8
Long-term care outside the public health insurance system	0.6	0,7	0.9	1.0	1.0	1.0
Other expenditure – baseline scenario	20.4	20.4	20.4	20.4	20.4	20.4
Changes related to convergence and other changes	0.0	0.8	0.8	0.9	0.9	1.0
- public investment	*0.0*	*-0.1*	*-0.2*	*-0.2*	*-0.3*	*-0.3*
- defence expenditure	*0.0*	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*
- growth in general government costs	*0.0*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*
- payments to EU	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Total expenditure excluding interest	38.5	40.6	43.5	46.8	48.3	47.5
Primary balance	1.6	-0.1	-2.70	-5.6	-6.9	-6.1
Interest – baseline scenario	0.6	0.5	0.9	2.1	3.9	5.4
Interest with interest rate feedback	0.6	0.5	0.9	2.1	6.0	14.0
Total expenditure – baseline scenario	39.1	41.2	44.3	48.9	52.2	52.9
Total balance with interest rate feedback	39.1	41.2	44.3	48.9	54.4	61.5
Total balance – baseline scenario	1.0	-0.7	-3.6	-7.7	-10.8	-11.5
Total balance with interest rate feedback	1.0	-0.7	-3.6	-7.8	-13.0	-20.1
General government debt – baseline scenario	28.2	18.2	30.3	73.0	127.7	183.2
General government debt with interest rate feedback	28.2	18.2	30.3	73.0	142.1	227.8

D.2 Definition of the general government sector

The general government sector (S.13, see ESA 2010) is one of the five resident institutional sectors (along with non-financial corporations, financial corporations, households and non-profit institutions serving households) which, under the national accounts methodology,[36] make up the national economy. Each sector is defined as a grouping of resident institutional units that have the same (or similar) type of economic behaviour. The economic behaviour of each institutional unit is clearly determined by its principal economic function and the nature of its activity. An additional criterion for the allocation of institutional units to sectors is the category of producers to which the unit belongs and the sources of financing of its activity. Most sectors are divided into smaller units – subsectors. Sectors are decomposed into subsectors according to criteria specific to each sector so that homogeneous subgroups are created within the sector.

Institutional units are statistical units, i.e. units for which statistical data are collected. Institutional sectors are used for publishing data in the national accounts.

The general government sector contains all institutional units whose principal economic function is the provision of non-market services and/or the redistribution of national income and wealth, as well as units managing social security funds. The main sources of financing of units in sector S.13 are compulsory direct and indirect payments (taxes and social contributions) made by units belonging to other sectors. The institutional units belonging to the general government sector are non-market producers whose output is intended for individual and collective final consumption. This sector consists mainly of the state and all authorities with general and specific competences which are directly controlled by the state. It also contains social security authorities, local governments and various institutions directly controlled by them. These are primarily organisations that have legal personality, keep closed accounts (i.e. are independent institutional units) and are financed primarily from public sources (central or local budgets).

The units of the general government sector mainly provide non-market services, although units producing goods and market services also rank among the institutional units belonging to this sector. However, the share of market production is insignificant compared with the share of non-market production. The economic significance of the general government sector as measured by its share in GDP is generally between 10% and 20% in the EU. The relatively large differences between EU countries are due to differences in the scope of non-market production created and provided for the benefit of society as a whole. Traditional “social” states such as France and the Nordic countries report high shares (around 18%). The share of general government in the Czech Republic has long fluctuated around 12% of GDP, broadly in line with the average for both the euro area and the EU-28.

The general government sector is the third-biggest sector of the national economy as measured by its share of GDP. Its principal sources of financing are compulsory payments from other sectors, i.e. taxes and social contributions. The state uses them

- to finance its activity, which is reflected mainly in the indicators of intermediate consumption and compensation of employees,
- to redistribute income by providing operating and investment subsidies and social benefits,
- to perform the role of the state as the entity ensuring the functioning of the national economy by investing in infrastructure, the environment, research and development, defence and security,
- to finance health care, education, culture, sport and so on, which is reflected in the indicators of expenditure on final consumption.

The results of the economic behaviour of the general government sector are recorded on the general government account. This account records general government revenue under the resource side and general government sector expenditure under the use side, both on an accrual basis. The difference between general government revenue and general government expenditure, which is recorded on the general government account as the non-financial account balance (i.e. net lending or net borrowing), is referred to as the general government deficit when expenditure exceeds revenue and the general government surplus in the opposite case. Its annual value in relation to GDP is one of the Maastricht criteria. Another Maastricht criterion is the general government debt criterion, the value of which is based on data in the consolidated closing balance sheet of the general government sector.

The general government sector[37] is divided into the following subsectors:

- central government (S.1311),
- state government (S.1312 – not applicable in the Czech Republic; relevant in Germany, for example),[38]
- local government (S.1313),
- social security funds (S.1314).

Before 1989 (and even for a short while after the introduction of national accounting in the Czech Republic), the term “public administration” was used for this sector in the Czech language.

Central government

The central government subsector (S.1311) consists of units with nationwide competence. It includes

a) *central budgetary organisations* (state organisation units, state universities and the State Land Office) and *state extra-budgetary funds* (the State Fund for the Promotion and Development of Czech Cinematography, the State Fund for Culture, the State Fund for Housing Development, the State Fund for Transport Infrastructure, the State Fund for the Environment and the State Agricultural Intervention Fund),

b) *other (extra-budgetary) central government institutions* (state contributory organisations, public financial institutions such as ČEB, ČMZRB, the Deposit Insurance Fund and EGAP, non-profit institutions such as public universities, public research institutions and other institutions such as the Farming and Forestry Support and Guarantee Fund and the Railway Infrastructure Administration).

Local government

The local government subsector (S.1313) consists of units with local competence and linked to local budgets. It includes

a) *local budgetary organisations* (regional and local authorities, voluntary associations of municipalities and regional cohesion councils),

b) other (extra-budgetary) local government institutions (e.g. local contributory organisations, non-profit institutions providing services to local government such as the Association of Regions and the Union of Towns and Municipalities, public hospitals established by local budgetary organisations and public enterprises providing services in the area of culture and sports).

Social security funds

The social security funds subsector (S.1314) consists of units managing general (compulsory) health insurance and units providing services to those health insurance companies. It includes

a) health insurance companies,

b) the Association of Health Insurance Companies and the Centre for International Reimbursements.

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[36] See ESA 2010.

[37] *Institucionální sektory a podsektory v národních účtech České republiky* [Institutional sectors and subsectors in the national accounts of the Czech Republic] (classification, freely available at www.czso.cz) and *Přehled metod, postupů, zdrojů použitých při sestavení deficitu a dluhu založených na sestavení sektoru vládních institucí podle ESA 2010* [An overview of the methods, procedures and sources used in the preparation of the deficit and debt based on the general government sector according to ESA 2010]. CZSO 2015 (freely available at www.czso.cz).

[38] The state government subsector appeared for the first time in the ESA 1995 standard. Before it entered into force, the Land authorities in Germany, for example, were allocated to the central government subsector.

D.3 Glossary

Balassa-Samuelson effect – this refers to the fact that the price level (taking into account the nominal exchange rate) is usually higher in developed countries than in less developed countries. This is explained by the fact that differences in labour productivity between developed and less developed countries are smaller in the sector of internationally non-tradable goods (mostly services) than in the sector of internationally tradable goods.

Baumol-Bowen effect – this refers to the fact that long-run growth in real wages occurs even in sectors where labour productivity is not increasing. The growth in real wages in such sectors is driven by demand for labour in other sectors where productivity is increasing. As a result, the relative price of goods produced by sectors with flat productivity usually rises as well. This effect applies mainly to selected service sectors, such as the state administration, security, education and culture.

Compensation of employees – the total remuneration, in cash or in kind, paid by an employer to employees in return for work done by the latter during a reference period. Compensation of employees is therefore made up of wages and salaries and employers' social contributions.

Cyclically adjusted balance – the general government balance that would occur if the economy was operating at its potential output level. The cyclically adjusted balance is the result of an estimate that takes into account the level of potential output (which is also estimated) and the sensitivity of general government revenue to the phase of the economic cycle. However, it still includes one-off and transitional operations on both the revenue side and the expenditure side.

Debt rule (debt brake) – a rule laid down by law that contains measures to reduce the general government debt and prescribes what should be done, by whom, and under what laws, if the debt exceeds a given threshold. In the Czech Republic, the debt brake is triggered when the relative general government debt (net of the state debt financing reserve) exceeds 55% of GDP. The debt rule is regulated by Act No. 23/2017 Coll.

Discretionary measures – direct interventions by the executive or the legislature in general government revenue or expenditure.

Fiscal effort – the year-on-year change in the structural balance. A positive (negative) fiscal effort is an indicator of year-on-year tightening (loosening) of fiscal policy.

General government debt (according to ESA 2010) – the end-of-year debt of the general government sector arising from currency issued (not applicable in the Czech Republic), deposits received, credit securities other than shares issued (excluding financial derivatives) and loans received. The range of items included in general government debt is set forth in Council Regulation (EC) No. 479/2009, on the application of the Protocol on the excessive debt procedure annexed to the Treaty establishing the European Community. The source of these data is the consolidated/unconsolidated closing balance sheet of the general government account.

General government debt (for EDP purposes) – the consolidated general government debt pursuant to ESA 2010 adjusted for specific items set forth in the rules on reporting debt for these purposes. These include revaluation to market prices, the exclusion of interest, discounts and premiums and adjustments for the difference between the real and nominal values of government bonds held by other units of the general government sector. The size of the general government debt in relation to GDP is one of the Maastricht criteria, according to which the debt should not exceed 60% of GDP.

General government deficit – the difference between general government revenue and general government expenditure under the national accounts methodology (ESA 2010), and at the same time the balance of the general government non-financial (and financial) account. It is the financial result of the general government sector in national accounting terms. Its annual value relative to GDP is one of the Maastricht criteria, according to which the deficit should not exceed 3% of GDP.

General government expenditure – this is derived from the general government non-financial account and contains the values of the following indicators (ESA 2010 codes in parentheses): intermediate consumption (P.2) + compensation of employees (D.1) + taxes on production and imports paid (D.29) + subsidies paid (D.3) + property income paid (D.4) + current taxes paid (D.5) + social benefits in cash (D.62) + other current transfers (D.7) + capital transfers paid (D.9) + gross capital formation (P.5) + acquisitions less disposals of non-produced assets (NP) + market production purchased by government institutions (D.632 – part of social transfers in kind).

General government revenue – this is derived from the general government non-financial account and contains the values of the following indicators (ESA 2010 codes in parentheses): market output (P.11) + output for own final use (P.12) + taxes on production and imports received (D.2) + subsidies received (D.3) + property income received (D.4) + current taxes received (D.5) + social contributions (D.61) + other current transfers received (D.7) + capital transfers received (D.9) + payments for non-market output (P.131).

Gross fixed capital formation – acquisitions, less disposals, of fixed capital expressed in acquisition prices, i.e. regardless of wear and tear. Fixed capital means tangible and intangible fixed assets excluding land. Gross fixed capital formation also includes costs associated with changes in ownership of (produced and non-produced) non-financial assets (notarial fees, payments to appraisers, commissions, payments for installation and assembly, etc.) and investments in existing assets (investments in land – draining of marshes, reclamation of land, construction of dams to improve soil quality, etc.).

Implicit interest rate – a weighted average of the interest rates on individual debt tranches, with the weights corresponding to the shares of the nominal values of the principals of the individual tranches in the total nominal value of all the principals contained in the debt. It corresponds to the ratio of interest costs in the given year to the nominal values of the principals.

Long-term interest rates – in our context, the yield on central government debt securities with ten-year maturity.

Long-term projection of the Czech Fiscal Council – a projection of the main macroeconomic indicators (such as potential GDP, real wages and the demographic structure of the population) over the next 50 years. The long-term projection enters the simulation of the general government balance and the simulation of the general government debt.

Operating surplus (gross/net) – the balancing item of the generation of income account. In general, it is equal to income from production (value added gross/net) plus subsidies received minus compensation of employees and taxes on production and imports. The gross operating surplus is the sum of the net operating surplus and consumption of fixed capital. The operating surplus generated by small entrepreneurs belonging to the households sector is called mixed income.

Output gap – the difference between actual and potential output. It is usually given in per cent of potential output.

Potential output – the level of GDP at which the unemployment rate is at its natural level and production capacity utilisation is optimal and sustainable in the long term without giving rise to inflationary pressures.

Primary balance – the balance before interest expenditure is included.

Primary structural balance – the structural balance before interest expenditure is included.

Public finance sustainability gap – the s1 fiscal sustainability indicator used by the Czech Fiscal Council, in which the period is set at 50 years and the debt limit at 55% of GDP.

Public sector – units controlled by the state, whether or not they belong to the general government sector. *Public sector = general government* (S.13, see ESA 2010) + *public corporations*. Public corporations consist of the subsector of public non-financial corporations and the subsector of public financial corporations (i.e. the central bank and other units controlled by the state belonging to the financial corporations sector). The public sector in the Czech Republic currently comprises about 19,000 entities – around 18,000 entities in the general government sector, 1,200 in the non-financial corporations sector and roughly 10 in the financial corporations sector.

s1 fiscal sustainability indicator – an indicator which says by how much (in per cent of GDP) the primary structural balance would have to change every year over a given period for the debt to reach a given value by the end of that period.

State debt – the debt of central budgetary organisations from the general government sector (more specifically, the central government subsector) in the form of bonds issued by the state, loans received by the state and bills issued as of the end of the year.

State insurees – all persons for whom the state by law directly pays contributions in the public health insurance system. These include dependent children, pensioners, job-seekers, persons on maternity or parental leave and other groups of the population.

Structural balance – the balance arising from the cyclically adjusted balance taking into account one-off and transitional measures. It is therefore the balance that would arise if the economy were operating at its potential output level and there were simultaneously no one-off and transitional measures on the revenue or expenditure sides.

Theory of long-run growth – a branch of economic theory that attempts to explain long-run economic growth using such variables as labour growth, the rate of investment, education and growth in the aggregate productivity of production factors. The theory of long-run growth also attempts to explain real convergence (i.e. convergence of countries' economic levels). Models from the 1950s, especially those of Robert Solow, are regarded as the foundations of the theory of long-run growth.

Notes