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Forecasts of the public debt for the Czech Republic

Bachelor thesis

Prague 2013

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Year of defense: **2013**

Bibliografický záznam

SENTIVANY, Daniel. *Forecasts of the public debt for the Czech Republic.* Praha, 2013. 42 s. Bakalářská práce (Bc.) Univerzita Karlova, Fakulta sociálních věd, Institut ekonomických studií. Vedoucí bakalářské práce Petr Janský M.Sc.

Abstract

Main goal of this thesis is to forecast future trajectory of the public debt level of the Czech Republic when taking into account ongoing fiscal reforms of the government and the aftermath of the global financial crisis. A short survey of existing literature concerning fiscal austerity is presented in the first part, followed by the further motivation for the forecasting of the public debt level. Second part of thesis focuses mainly on the most important question, which is sustainability of the debt. We found out, that the public debt of the Czech Republic is clearly unsustainable, we also calculated so called fiscal gap to determine the amount needed to sustain it.

The last third part contains numerous scenarios showing the future development of the public debt of the Czech Republic starting the year 2003, up to the year 2060. According to our results when assuming that no strict fiscal reforms will be introduced by the government in the following decades, we found that the level of the debt in the year 2060 will exceed 260% of GDP.

Keywords: public debt; fiscal gap; public deficit; public budgets; public debt forecast; sustainability; debt consolidation; debt management

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Abstrakt

Cílem této práce je předpovědět budoucí vývoj veřejného dluhu České republiky s ohledem na probíhající fiskální reformy české vlády a dopad světové finanční krize. V úvodní části je prezentován krátký přehled existující literatury o daném tématu, dále jsou pak představeny důvody k předvídání úrovně státního dluhu. Druhá část teze je zaměřena na tu nejdůležitější otázku, kterou je udržitelnost dluhu. Zjistili jsme, že český dluh je zaručeně neudržitelný, vypočítali jsme také takzvanou fiskální mezeru abychom zjistili, kolik je třeba na udržení jeho úrovně.

Třetí část obsahuje řadu scénářů budoucího vývoje veřejného dluhu České republiky od roku 2003 až do roku 2060. Z našich výsledků jsme zjistili, že za předpokladu, že vláda nepředstaví v dalších desetiletích striktní fiskální reformy, úroveň dluhu v roce 2060 přesáhne 260% HDP.

Klíčová slova: veřejný dluh; fiskální mezera; veřejný deficit; veřejný rozpočet; odhadování veřejného dluhu; udržitelnost; konsolidace dluhu; management dluhu

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Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

I further declare that the thesis has not been used previously for obtaining any university degree.

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Acknowledgment

I would like to express my gratitude to Petr Janský M.Sc. for his patience, time, valuable notes and guidance.

Prague, May 15, 2013

Signature

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1 Introduction

Public debt is a topic frequently discussed these days especially when associated with the aftermath of the global financial crisis. The levels of debts of European countries rise sharply above wildest expectations and limitations, the ability to pay them off diminishes along the way with credibility of the indebted countries.

This thesis does not concern itself with European situation explicitly, though it can't be omitted since dealing with the ongoing crisis among other things shifts significantly budget planning and debt management also in the Czech Republic, despite the fact that the country itself is not considered amongst the most indebted in Europe nor among the worst struck by the global financial crisis. The financial crisis itself together with the political cycle roughly intercepted the much needed mechanism of newly formed government reforms and therefore the long-term fiscal sustainability is in question. Of course, we can see an attempt of reforming (e.g. Czech pension system), but as we will see for ourselves, there is a desperate need for more radical solution in order to cut expenses related to ageing and other socio-demographic factors.

And so the one and only important question rises: Is the current Czech fiscal path sustainable? And if not, what sort of measures should be taken to achieve it?

This problem is nowadays mainly associated with the level of the debt itself, with the structure of revenues and expenditure. Well, in fact it plays an important role, at least partly, but low debt level is not sustainable by itself. That is where interest rates on the debt, future expenses and possible revenues associated with demographic development of the country and factors influencing growth come into play.

To understand these complicated issues, certain closure is needed. The most important thing is to properly understand the term "debt" itself, to comprehend its structure and dynamics and to properly address the issues concerning revenues and expenditure side of the government budget - the origin of the debt itself.

This work is structured into three substantially different parts. In the first part we introduce the concept of the public debt not only from the point of view of the Czech Republic, but we also engage in a broader discussion concerning existing literature in the field of fiscal policy and austerity measures.

Second part of thesis is dedicated to sustainability of the debt, which is discussed using data from Czech Statistical Office and Czech Ministry of Finance. We calculate the level of needed intervention to Czech budget in order for the debt to reach sustainable path. Then we calculate so called fiscal gap, which shows us in a similar fashion how much is needed to sustain the debt level at its current level. In the last part of this work we forecast level of public debt for the year 2060 taking into account various demographic and economic analyses issued by MFCR and OECD and then of course describe results of our calculations.

2 Theoretical basis

Firstly, we shall define precisely the fundamental elements of modern debt policies. We are going to pose the essential questions which we hope to answer in this work and start looking for answers in existing literature concerning given issues. We address both modern and classic literature and then discuss the motivation for this thesis.

2.1 Austerity in modern literature

We decided to present the theoretic part of this thesis very differently, to associate it with a literature survey. To answer some basic questions such as "what is debt itself, where does it come from, what does it consist of and how is it repaid, more importantly what is sustainable path and is there indeed one?" we engage in a broader sort of debate.

This work relies from the most part (along with the fiscal policy makers of the 2010s) on a paper of Carmen Reinhart and Kenneth Rogoff "Growth in a Time of Debt" (2010a) where Reinhart and Rogoff presumably "showed us" on data back to the year 1946 that when countries have had debt of at least 90 per cent of GDP, growth tended to be lower during these periods. It therefore shows us that higher debt causes lower growth. In other words that in long-run austerity causes higher growth. This paper provided the first valid argument for fiscal tightening which is being introduced in government austerity measures in order to consolidate the long-term fiscal projections of countries struck by the global financial crisis. If we set aside the error in Excel averaging (it only reduced growth average by 0.3%), we can say that the result itself does not tell us much (see Irons & Bivens, 2010). The obvious correlation between growth and debt is always there since in recession the debt levels tend obviously to rise and in times of high growth the debt ratios fall. The most off thing about their paper is the obvious skewness of their results and lack of justification (at least in literature) for their methodology. Despite that, their work was used a lot.

But generally cutting the budget and rising taxes is not good for growth, we all know that. At least we used to, until it suddenly changed. We are speaking now about the 90 per cent ratio which according to Reinhart and Rogoff (2010a) starts to influence negatively growth. Now the austerity measures are justified and so is the whole sustainability and consolidation through tightening approach.

But what if it simply isn't true, what does it then imply for this work and the whole new approach? Let us start by presenting the basics about the debt.

The debt is present in economy whenever the country lives beyond its means and therefore has to borrow from domestic or foreign sources. It is derived directly from each years deficit (either the government's intertemporal budget or the household constraint). The only way to set it right seems to be the way of fiscal austerity, but that kind of measures only force people to work for less money and so it widens the country's potential output gap.

Is then austerity good for the economy? Alesina and Ardagna (2009) tried to prove that it's good even in short-run and we can say that generally they proved nothing much. There are too many issues with their work (especially when it comes to finding when it didn't apply at all since they found only *several* cases when their hypothesis seems to work) that it simply can't be ignored and acknowledged even though authors were careful to comment on their results where they claim that spending cuts are more effective than tax increases in stabilizing the debt and avoiding economic downturns, at least in several cases.

What about the long-run effect? As we already mentioned, the ultimate prove was assumed to be the work of Reinhart and Rogoff (2010a). This thesis also finds justification for itself in it, until a mistake in the calculation of the authors was found and among other issues (discussed earlier) it became clear, that the implications made by Reinhart and Rogoff stood on inconclusive results and that no actual negative correlation between growth and debt level was found.

From the first paper it was clear, that for the economy that doesn't find itself in crisis and cuts expenditure rather than pose taxes, austerity is a means of growth. Although this just by itself is very restrictive and does not apply to the current situation in the Czech Republic or Europe, we can say that implications of Alesina and Ardagna (2009) can justify Czech fiscal policy (high GDP growth and expenditure cuts rather than taxation, attempt to lower budget deficits) in the last decade as we can see in the last section in reports issued by the Ministry of Finance of the Czech Republic even though the whole "deficit" approach is a disguised irresponsible fiscal policy since the deficits themselves serve only as an accounting method of labeling incomes and payments. This claim is presented by Kotlikoff (1989) suggests using rather the fiscal balance rule than the arbitrary balanced budget rule, so we can see that the previously mentioned works and discussions are far from the point of view of classical literature sources and this thesis find the classical arguments most resourceful and focuses (when forming forecasts and implications) rather on particular policies and strategies than on arbitrary rules.

Although, to give Reinhart and Rogoff some credit, they did find one very interesting relationship in their "From Financial Crash to Debt Crisis" (2010) between banking crises and sovereign debt crises which proved also to be right and showed us the importance of sovereign debt management. Probably the most interesting conclusion or prediction is that serial default is not dead and when facing a possible future financial crises, policymakers might be very surprised by what may happen since they are now overly cheered and underestimate the current situation.

Consequently, the only topic which remains unclear is probably the motivation for this thesis which we discuss separately later.

2.2 Fiscal sustainability in modern literature

Since the fiscal austerity is viewed as an only option to live up to the country's potential and stop overreaching itself, the fiscal sustainability is the most presently discussed issue. It is even often being said, that the global financial crisis is the

ultimate proof that we keep living beyond our means. We discuss this issue in the following section called "Sustainability" using work of Willem Buiter (2010), we provide the full definition and theoretical derivation of the formula as well.

In this part we want to stress out that this paper is used merely as a demonstration of one approach to the sustainability issue though the sustainability condition is derived directly from the government budget constraint itself. That poses financial constraint on government spending and can be expressed rather *ex post*. But nevertheless, for our purposes, this point of view allows us to address this issue to certain extent, to point out the obvious about projected Czech fiscal path.

The assumptions of this approach are completely another thing. We mention this again in corresponding section, but it is also needed to discuss it here, so we can state clearly the purpose of this work - servicing of the debt must be according to Buiter (2010) offset by budget surpluses. Which essentially doesn't make any sense in case of sovereign countries (such as the Czech Republic), which can either expand the monetary basis or the debt can be simply overcome by the GDP growth (the debt ratio would fall) considering that central bank can issue short-term debt bonds at given interest rate.

As for the GDP growth, to complete our analysis in either way, we finally in the last part of the last section use growth projections made by OECD and forecast the fiscal trajectory until 2060. This computation will suffice to show us the importance of growth in fiscal scenarios. Thorough discussion of further austerity measures is part of the forecast as well.

2.3 Motivation for this thesis

We would rather not address the marxist approach the austerity issue, but it is important to mention that the main topic of this thesis is seldom a problem of capitalism. Marx (1861-3) already pointed out 150 years ago in a section called "Ricardo's Wrong Conception of the Relation Between Production and Consumption under the Conditions of Capitalism" that more of a particular commodity may be produced than can be consumed of it; but this cannot apply to all commodities at the same time. Because the needs, which the commodities satisfy, have no limits and all these needs are not satisfied at the same time. On the contrary. The fulfilment of one need makes another, so to speak, latent. Thus nothing is required, but the means to satisfy these wants, and these means can only be provided through an increase in production. Hence no general overproduction is possible.

In other words, we can say that "supply brings forth its own demand". Why this is a problem of capitalism? The problem is that majority of wealth is owned by a minority of population (that applies everywhere on the globe) and the weight of austerity measures is carried mostly by the worker class who have to work more for less money and therefore can afford to buy less.

This thesis addresses the austerity issue and forecasts the debt level mainly because this approach has to be satisfied by the Czech government due to the fact that Czech Republic is a member of the European Union and is soon to lose its

sovereignty and is therefore expected to have a problem managing its public debt and place it in the primary markets, especially since it is expected to rise steeply. All together, this is one of the most crucial issues, which the European Union has to face. The ultimate goal is to maintain fiscal rules throughout the whole Eurozone and so to solve the current situation and declare it "sustainable". This approach is shared by the Czech government (as we can actually see from the Convergence Reports) and also taken up in this thesis and developed further, especially in the next section. If the current situation is not resolved, there is a high risk of sudden rise of interest rates (investors can start demanding higher yield for holding government bonds) and consequently it would be harder for the central bank to control inflation, the second key element in the sustainability of government debt.

The main motivation is not to forecast the debt level alone or to decide whether the Czech fiscal path is sustainable or not. It is also to determine whether the fiscal policy of the last 10 years was responsible according to both Maastricht convergence criteria for adopting Euro as the new Czech currency and the long-term EU fiscal policy rules (we consider the fiscal gap method and the sustainability formula to be a perfect tool for this purpose). The forecasts of the debt level are important mainly when discussing proposed and implemented government measures also in association with recent global financial crisis. As we will see later, the crisis itself is not that much to blame as the actual delay and extent of reforms.

And well, the only question left to answer is, whether it is a good idea to surrender sovereignty and become member of the Eurozone, especially as it is clearly currently on a destructive path and the whole purpose became unclear. The healthy economic indicators were being taken for granted and the only actual concern was for the government not to create too large budget deficits and mainly not to intrude in the healthy state of the economy. Hence we need to discuss in this work, whether it was wise to do so and what further actions were needed and which of these will be needed in the future in order for the Czech Republic to survive economically even without its sovereignty and under the fiscal rule of EU.

3 Sustainability

The first question we are going to address is whether the current Czech fiscal policy is sustainable in long-term. For a moment, we set aside the levels of the debt itself and we also don't take into account future expenses associated with ageing or much needed government reforms and other tendencies to lower budget deficits.

The basic assumption we make is *no Ponzi condition*, which means that government debt must equal all future primary surpluses and any future seigniorage revenue. Existing debt can't be serviced forever by issuing additional debt to cover both interest payments and principal repayments.

Then we introduce so called fiscal gap calculation and discuss few basic scenarios, where we finally take into consideration factors which we set aside for our first analysis. The first sustainability calculations are made simply using economic indicators issued each year by Czech Statistical Office (CSO) marking the economic performance of the country. Fiscal gap is calculated using long-run projections made by Ministry of Finance of the Czech Republic (MFCR). These indicators are obtained via more complex sets of calculations and models, so this method in general has higher predictive value. Nevertheless the arithmetic calculation helps us to prove a point. Obtained results and used debt levels to which we compare our results (we express the debt level as a share of GDP of the corresponding year) are used in the last part of this thesis.

3.1 The arithmetic

Willem Buiter, chief economist at Citigroup and former Bank of England adviser, introduced in his "Sovereign Debt Problems in Advanced Industrial Countries" (2010) the following arithmetic of public debt dynamics:

$$\Delta d = -s + \left(\frac{r-\gamma}{1+\gamma}\right) d \tag{1}$$

where s is government *primary surplus* or government budget surplus expressed as a share of GDP, r the real interest rate on the public debt, γ the growth rate of real GDP and d stands for the starting ratio of debt to GDP.

Using this formula, we can plainly discuss sustainability of public debt, Δd, which represents change in the debt to GDP ratio. We consider any path that increases this ratio ($\Delta d > 0$) as unsustainable or explosive and therefore it needs to be altered in order to assure that debt levels in the Czech Republic will eventually seize to grow and won't lead to country's default or hyperinflation.

In order for the debt ratio to remain constant, government surplus must satisfy the following equation:

$$s = \left(\frac{r-\gamma}{1+\gamma}\right) d \tag{2}$$

To be able to answer the original question whether current debt level of the Czech Republic is sustainable in long-term, we will assume, that computed budget surplus can be achieved repeatedly, so certain level of debt can be sustained. Formally this condition can be written as:

$$\bar{s} \geq \left(\frac{\bar{r} - \bar{\gamma}}{1 + \bar{\gamma}} \right) d \tag{3}$$

where $\bar{s}, \bar{r}$ and $\bar{\gamma}$ mean permanent level or expected long-run average. These long-term values do not change so our calculation unfortunately reflects only the current economic situation in country (which means that we take for our calculation only data based on a prediction made in one certain year and do not change the prediction during the given period). For example, if there is a wave of rising inflation or lower GDP growth which symbolizes the aftermath of the financial crisis, then the whole future period is necessarily described darkly in the future prospects. This applies also to the opposite case. The optimistic forecasts are no more valid when stretched to fit a period of hundred years. This can be partially adjusted by doing yet another calculation by using different assumptions about long-term values, i.e. not using the current values prolonged for next decades.

Consequently the minimum value of primary surplus which will ensure solvency is given by:

$$\bar{s}^{min} = \left(\frac{\bar{r} - \bar{\gamma}}{1 + \bar{\gamma}} \right) d \tag{4}$$

This relation has one obvious interpretation - any country whose real interest rate on the public debt exceeds the long-run growth rate of real GDP will in future have to run government surpluses at least on average.

3.2 Fiscal gap

In this section we again merely take over a term previously defined and calculated, though this analysis may (and certainly will) as well bring us interesting results when applied directly on the Czech economy.

We will use for example definition of Alan J. Auerbach (2011). According to him, a fiscal gap over a horizon from the current period, t, through a terminal period, T, would equal the required increase in the primary surplus relative to those projected under current policy that would be needed to maintain the debt-GDP ratio at its current value.

We can express this definition by a formula:

$$\Delta = \frac{B_{t-1} - (1+r)^{-(T-t)} B_{t-1} \dfrac{Y_{T+1}}{Y_t} + \displaystyle\sum_{s=t}^{T} (1+r)^{-(s-t+1)} D_s}{\displaystyle\sum_{s=t}^{T} (1+r)^{-(s-t+1)} Y_s} \tag{5}$$

where B_{t-1} is debt at the end of year *t-1*, that is at the beginning of year t, r is relevant interest rate, Y_t is GDP in year t and D_t is the primary deficit in year t.

Δ represents the gap, the level of annual consolidation needed in order for the debt level in year T to remain the same as is the one in the beginning year t.

To understand this problem, we consider useful to present government's intertemporal budget constraint for the case when $T \to \infty$, which says again according to Auerbach (2012) that the stock of government debt carried over from the past year B_{t-1} plus the present value of primary deficits D_s must equal zero:

$$B_{t-1} = \sum_{s=t}^{\infty} (1+r)^{-(s-t+1)} D_s = 0 \tag{6}$$

The key assumption of this calculation is that the trajectory of interest rate on debt and GDP growth has to be consistent with our previous experience and following projections. Our calculations incorporate the long-term forecasts of government bonds yield and growth rate made by MFCR.

If intertemporal budget constraint is not satisfied, it is useful to decompose this gap (5) to three components: (a) past deficits, i.e. accumulated stock of debt, (b) current deficits, constant over time and expressed as debt to GDP ratios, (c) the projected growth of deficits expressed as a share to GDP.

Budget rules are usually focused mainly on the first two, but the third is the most important source of the fiscal gap. Czech Republic with its debt level of 43.4% of GDP doesn't belong to highly indebted countries, but still we need to look at the projected growth of deficits for the answer to the long-term sustainability issue, which is clearly supported by the European Commission (2009b) who states that the cost of ageing for the relevant group of countries is estimated as more limited, but still very high, ranging from 4 p.p. to 7 p.p. of GDP with the Czech Republic being the one reaching the 7 p.p. bound (study is dated before Czech pension reform, of course).

3.3 It's all about interest rate

In the first case of our arithmetic we clearly depend very much on the two variables r and γ - interest rate and growth rate. In case of reaching sustainable level of debt by running budget surpluses (at least on average), there are two possible states of the intertemporal budget constraint.

In case when $r > \gamma$, we can say that the ratio of debt to GDP is fixed inside the budget constraint because the rate of GDP growth will be lower than the interest rate. But this path can also easily become an explosive one as we can see in the present situation when sustainability condition is not met. The higher the difference between growth and interest rate is, the larger the required structural surplus must be to maintain stable level of debt to GDP.

But in case when $r < \gamma$, there is another option for the government. It can engage in a Ponzi-finance scheme. That would violate our assumption that future debt can't be serviced forever, nonetheless Czech Republic still controls its own currency and therefore it controls both the short-term rate and the maturity structure of the

public debt, and so can issue as much short debt at a near-zero rate as it needs to. For further discussion regarding sovereignty see Galbraith (2011).

This very interesting fact is pointed out in Lejour, Lukkezen, & Veenendaal (2010). The authors reminded that Bohn (1998) showed us in his work that under uncertainty an attempt to issue debt and roll it over forever without ever running a positive primary surplus has a positive probability. Conversely, if there is a positive probability that future interest rates will exceed the growth rate, a zero primary surplus is not sustainable.

The second case - fiscal gap calculation - shows us the same problem, but it is not visible at first glance as in the first case. Accumulation of debt contributes to slower economic growth (let us suppose so under the assumption of no extraordinary economic performance of the country or extremely positive situation in the region) and simultaneously this higher debt is more difficult to manage as the interest rates rise along with it (that was already discussed and can be supposed at a certain level), so it is much harder to achieve a sustainable fiscal path. This relationship is very difficult to capture though, therefore it is nearly impossible to predict the timing when this could happen. Although it can become easily the cause for crisis in short-run as investors don't perceive future far beyond a few weeks horizon.

It is about time to mention the biggest flaw of both our calculations. The sustainability formula assumes all variables to be constant (which is fine when calculating the amount needed from a one year data) or to be "long-term values". The latter is very much unrealistic in terms of both our estimates and the calculation itself since the variables change over time and therefore the amount needed to achieve sustainable debt level must also change. The first calculation symbolizes the amount needed taken into account current state of economy or a long-term average state.

The fiscal gap calculation involves the forecasting of the debt level itself and therefore we can comment now on both. The forecast assumes constant interest rate on debt over the years, which is of course unrealistic. We can say that for a fiscal gap calculation (or at least for the consolidated part) it can be justified since the level of the debt will not exceed the level in the beginning year.

As for the forecasted level itself, that is not so clear. The constant interest rate on debt is unrealistic since the interest rate depends very much on the state of the market (not only on the one of the Czech Republic since it is relatively small and mainly open economy) and on the composition of the debt itself. The share of long-term bonds increased tremendously over the past decade and the interest rate on bonds with 10-year maturity decreased. Still it is hard to forecast the interest rate especially if the debt level is to rise sharply over the next decades and is likely to become the main problem when discussing sustainability of the debt (higher debt level may temporarily increase interest rate and it can be transferred to other countries, especially in Europe), although it is important to mention that historically it is not true that highly indebted countries with low growth can't issue government bonds with very low interest rate.

3.4 Case of the Czech Republic

Now we are going to perform two sets of calculations. Firstly we will apply Buiter's formula (2) on the data for the Czech Republic for the last year provided by CSO and MFCR. Then after an analysis and thorough discussion of our findings, in order to address this issue properly, we will calculate also fiscal gap using data from the same sources.

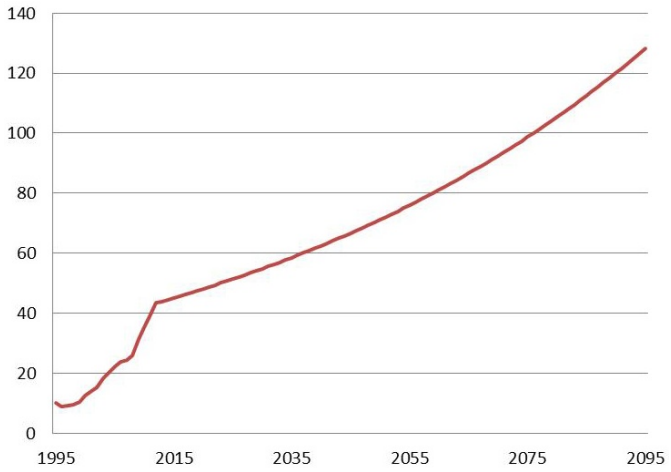
The economic indicators for the Czech Republic for the year 2012 are very interesting. Even at the first glance we can see, that applying formula (2) for negative growth (-1.3%) and inflation rate of 3.3% will be complicated. We begin by the debt level itself. The debt to GDP ratio increased by 4.4%, which is caused also by previously unexpected expenses that increased this year's budget deficit as well. Previously planned cutting of yearly deficits unfortunately turned into one of 3.4% in 2012, which is even by 0.1% worse than in the previous year. This is mainly due to 59 billion CZK paid as a financial compensation to churches, which was added to fiscal review by accrual accounting method. We incorporate this amount in our formula since the one year result has to reflect the severity of the situation and the long-term result is interpreted as "what is the amount needed when the Czech Republic repeatedly achieves the same budget deficit and when the GDP grows repeatedly by the same rate". It is only a scenario and not a prediction of what is to come. When we match the actual debt expenses with its level (debt of 1449 billion CZK and expenses of 41 billion CZK), we obtain the 2.74% interest rate on debt. When taking into account the violently high last year's inflation of 3.3%, we can express real interest rate on debt r= -0.56%. GDP was lower by 1.3% than in 2011.

After substituting to our formula (2), we can say that primary surplus of 0.32% is needed, which means that government would have to find 142.9 billion CZK for this year's budget. Just to imagine the scale of needed consolidation, we can compare it to this year's expenses of Czech Ministry of Education, Youth and Sports or the ones of Ministries of Defense, Interior and Transport combined. But is truly ever any fiscal path sustainable with inflation rate over 3% and with negative GDP growth? We need to prolong Buiter's assumptions to find out. We used the firstly described method where we just stretched the values from one year up to the year 2100. The result is given in Figure 1.

Projected fiscal path can't be sustained even after satisfying the sustainability formula. Given the negative GDP growth, Czech Republic would disappear from the map of this world long before the end of the century regardless its level of debt. Having public debt of 1 667 billion CZK means that to pay off its interest is to produce primary surplus, though this only by itself accomplishes nothing when GDP doesn't grow.

In order to produce a relevant study of the long-term sustainability using Buiter's formula, we need to come up with better set of data, one absolved of the impact of the global financial crisis (we won't be using anymore just the data from current year and stretch it, we try to use long-run values). We will use the long-term inflation target of Czech National Bank, i.e. 2%, then we will use GDP growth projected

Figure 1: Projected debt level (as a share of GDP) trajectory after adjusting the government budget each year by s, which is obtained by plugging the data for the year 2012 into the sustainability formula. Given path is clearly unsustainable.



Source: CSO, MFCR, author's calculations

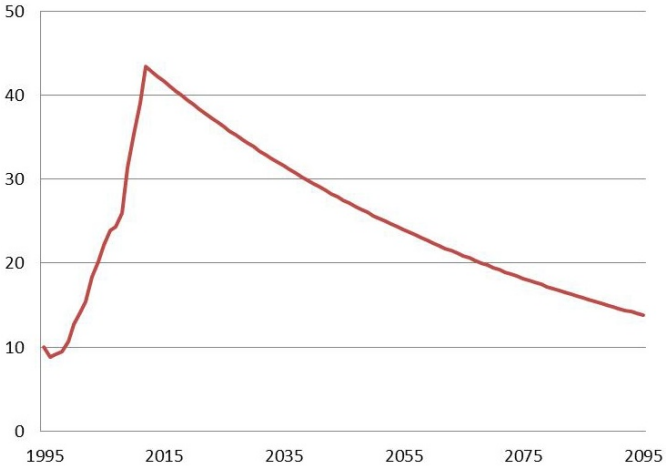
by MFCR in their Convergence Programme issued in April 2012 and average it, i.e. 1.4% (that is actually very inaccurate and serves merely as a demonstration, this approach can actually be recommended rather to be used each year separately, to adjust the budget by different amount each year though the only issue in this case is associated with the growth projection which can differ very much anyway and can be adjusted each year). Everything else remains the same for now and to see the long-run development, we stretch these values up to the year 2100. Result of this calculation is shown in Figure 2. We can see that the level of debt has dramatically decreased and projected path is indeed sustainable.

Again, it is all about interest rate. This time, it's also about growth as we saw in the two previous examples. We can see that if we keep inflation at a modestly low level accordingly to the interest rate and achieve at least some healthy grow along with introducing responsible fiscal policy (in this case running slight surpluses), we can indeed achieve sustainable path. In other words, we are able to pay off the interest on debt and through surpluses contribute to its diminishing.

What level of primary deficit can we afford in this case in order for the debt level to be stable? After absolving government budget of the debt expenses, we can run, during the given period, structural deficits of 0.6% as can be proven by a simple computation (all other values remain as they were for the very first calculation for the year 2012). Our result is given in Figure 3.

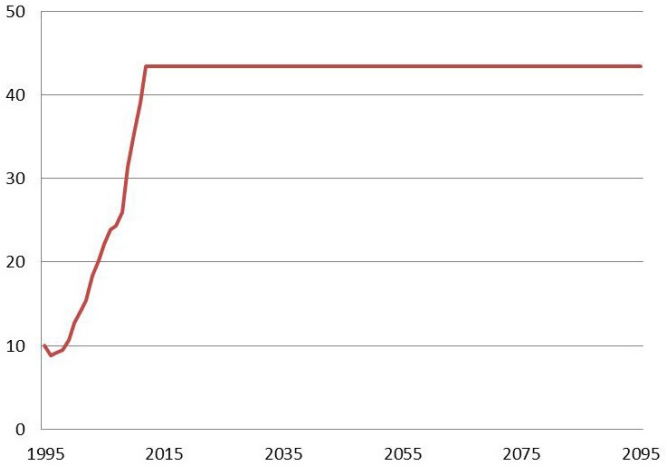
Has it always been so? Has the Czech Republic always needed, if nothing else, around 142.9 billion CZK to its yearly budget in order to run responsible and sustainable policy? To answer this question, we need to repeat our steps a few more times and use data for each of previous years. As we can see, if we omit for a second data for the year 2009 we can say that GDP growth was very healthy in recent years and so was the inflation rate. But even that these indicators give us very optimistic

Figure 2: Projected debt level (as a share of GDP) trajectory after adjusting the government budget each year by $\bar{s}$, which is obtained by plugging values estimated for the long-run into the sustainability formula. Given path is considered sustainable.



Source: CSO, MFCR, author's calculations

Figure 3: Projected debt level (as a share of GDP) trajectory after adjusting the government budget each year by $\bar{s}$, which is obtained by plugging values estimated for the long-run into the sustainability formula and allowing for the largest possible primary deficit of 0.6% in order for the debt level to remain sustainable

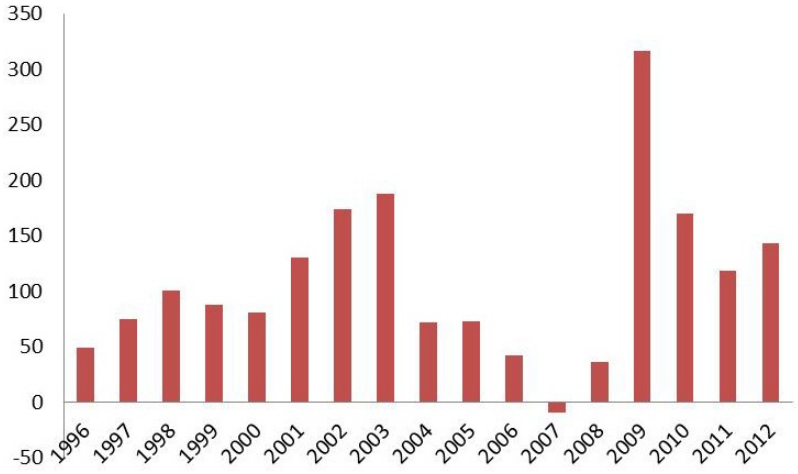


Source: CSO, MFCR, author's calculations

notion of growth and prosperity, the government wasn't able to ensure primary budget surpluses though we can say that in this past era, any kind of strict fiscal policy was probably much more possible to run and pleasant to endure than it is now in the prospect of the following decades. The level of needed fiscal consolidation including the result for the year 2009 is shown in Figure 4. Results were obtained once again by plugging data for the corresponding year into the sustainability formula. The amounts represent the resulted amount s needed to reach sustainability for the

corresponding year.

Figure 4: Estimated fiscal consolidation needed (in billion CZK) in order for the debt level trajectory to become sustainable obtained by plugging the data from each year into the using the sustainability formula. Resulted consolidation is expressed as a sum of the primary deficit (d) of the corresponding year and calculated primary surplus (s) needed.



Source: CSO, MFCR, author's calculations

There is one exception amongst our results that surely stands above the others. Results for the year 2007 are actually so good that there was no fiscal consolidation needed and the fiscal policy of the Czech Republic was being set in a way which ensured that level of the government debt was potentially sustainable. Data from this one certain year support it. But as we can see, it was only a glimpse of hope. And what's more, this calculation does not consider needed structural reforms in order to cope with ageing and related expenses. We can say that the brighter years occurred on expense of the previous economically successful ones.

Unfortunately, there were no steps made in order to achieve better fiscal stability and sustainability that could be considered actually effective. This fact is visible from the figure. In the year 2008, a year before the global financial crisis struck, 35.6 billion CZK was again needed in order to make Czech budget, following deficit and finally the debt level itself sustainable.

And what was so different about the years 2004-2007? Well, it is actually no surprise since the GDP grew by 4.7 to 7 per cent, the inflation rate was being kept bellow 3 per cent and so were the government budget deficits.

It is even said by the Ministry of Finance that these good times just masked the lack of budgetary discipline, all was wasted and government reforms again postponed. This was not only the case of the Czech Republic, majority of member states of European Union entirely neglected the reformed Stability and Growth Pact (see Mazur, 2007).

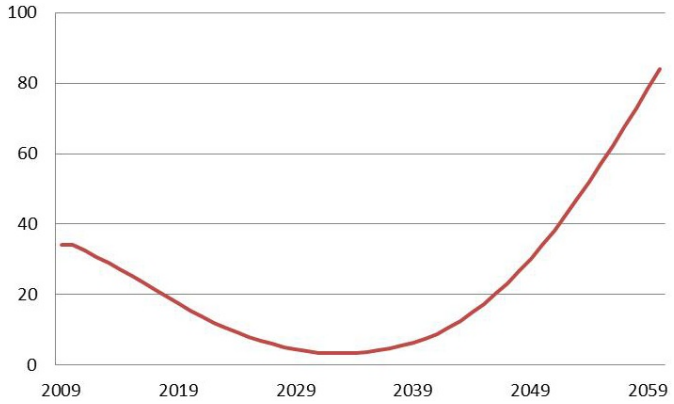
We can see that the variety of data actually supports our calculations. In years of higher growth, lower or none fiscal consolidation was needed for the debt level to be sustainable and in years of crisis, or let's say lower growth, the amount needed

is much higher.

As for the second approach to the sustainability issue, we will calculate fiscal gaps based on yearly forecasts of MFCR and then discuss our results when taking into account government reforms and the cost of waiting that was not previously discussed although it also plays an important role when calculating the needed consolidation since it grows substantially each year. Consequently we will also discuss why those predictions differ and how it can influence our calculated fiscal gaps.

We will calculate fiscal gap for the year 2050 which will describe the needed budget consolidation in order for the debt level to remain the same as in the beginning year. Let's start with the year 2009 which can be considered catastrophic in terms of economic indicators.

Figure 5: Projected debt level (as a share of GDP) trajectory after closing the fiscal gap (adjusting government budget by the calculated amount) obtained by plugging data from the year 2009 into the fiscal gap calculation formula resulting in the same level of the debt in the year 2050 as in the starting year



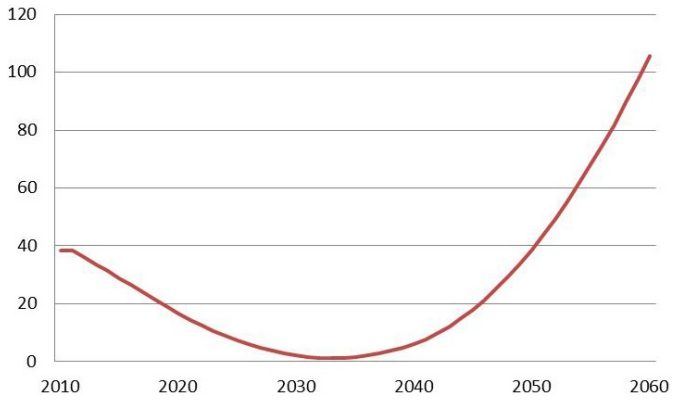
Source: CSO, MFCR, author's calculations

Let us begin by taking the available data from the Convergence Programme of the Czech Republic published in January 2010 and extend projections of MFCR by the actual data from CSO for the year 2009. That gives us all we need to project GDP growth and debt level. We also had to calculate the interest rate on debt from 2009 to absolve the expenditure side of that much. For the calculation itself, we use the equation (5) given in previous sections where t is the year of calculation and T is for the first calculations 2050 (the year which marks the given period). The calculated fiscal gap for the year 2009 is 1.46% of GDP. Meaning that government would have to modify each year's budget by 1.46%, i.e. 55 billion CZK in the year 2009 to maintain the same debt to GDP ratio in the year 2050. The resulted debt level trajectory is shown in Figure 5.

Fiscal gap for the year 2010 is calculated nearly in the same way since MFCR in their Convergence Programme issued the same long-term projection. The result is 2.16% which is worse than in the previous year as could be expected. In this case, the government would have to add 82.2 billion CZK to its budget in order for the

debt ratio to be the same in the year 2050. The resulted trajectory created using the data from this particular year is shown in Figure 6.

Figure 6: Projected debt level (as a share of GDP) trajectory after closing the fiscal gap (adjusting government budget by the calculated amount) obtained by plugging data from the year 2010 into the fiscal gap calculation formula resulting in the same level of the debt in the year 2050 as in the starting year



Source: CSO, MFCR, author's calculations

For this year, we have an unique opportunity to compare our results to the Short study of IDEA (2012). Our calculated fiscal gap differs from the one in the study by 0.04% of GDP which is caused by an error in averaging data for calculating the gap itself for the last 10 years of the given period. It is a similar type of error as in case of Reinhart and Rogoff (2010a). Implications in this case were not that serious, the error was "only" about 1.5 billion CZK.

Conclusion from these two years is that despite the significantly different interest rate on debt (in 2010, we calculated 3.02% which is lower by 1.4% than in 2009), the result can be very similar (in relative terms of course, it always differs by billions). In this case, the difference is 27.2 billion CZK for each year's budget, i.e. hundreds of billion CZK over the next decades.

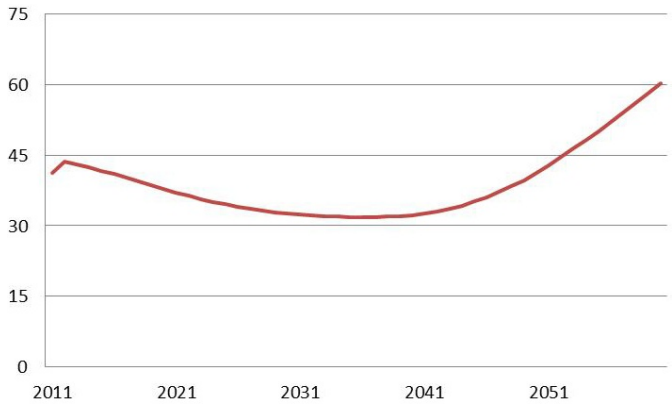
Another conclusion from these two years might be that the needed consolidation doesn't depend as much on the starting year and the interest rate (year 2009 was the worst in years) as on its delay. More about this later.

Plainly, as we can see, closing the fiscal gap does not ensure the debt trajectory to become sustainable. We set aside the assumptions about sustainability from the first part and mind only the actual level of public debt. This approach can be also justified since in the first case we didn't take into account the actual level of debt itself and the willingness of investors to finance it. If the level itself does not exceed the current level, it can be assumed that the interest rate on debt will slightly decrease or at least will not rise at all. This assumption can't be fulfilled in the previous analysis though as we already mentioned in the previous section.

In order for the debt level to become permanently sustainable, it would be needed to ensure that all the remaining economic indicators would remain within reasonable values, i.e. to ensure healthy growth, productivity of work, high participation rate

and low inflation rate. Or as much of it as possible since our model is built on the path forecasted by MFCR and we can say that the prospect is not one with a healthy GDP growth rate and steady participation rate accompanied with steady pension and health-care expenditure.

Figure 7: Projected debt level (as a share of GDP) trajectory after closing the fiscal gap (adjusting government budget by the calculated amount) obtained by plugging data from the year 2011 into the fiscal gap calculation formula resulting in the same level of the debt in the year 2050 as in the starting year



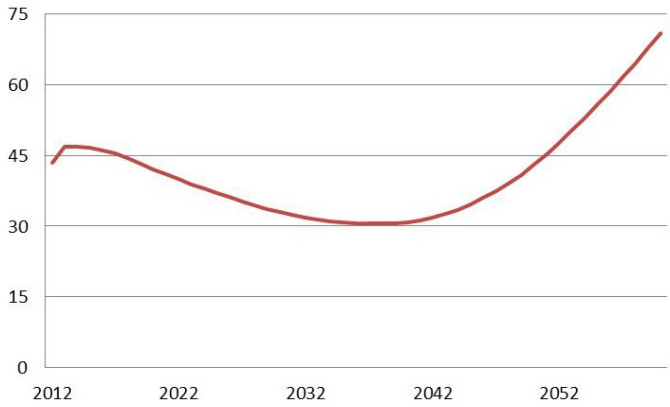
Source: CSO, MFCR, author's calculations

Projections about long-term sustainability of public finance made by MFCR in their Convergence Programme for the year 2011 are more positive than the ones made for the previous period. Even though in long-term (meaning when reaching year 2050) the real growth is forecasted to be higher and government deficits to be lower, fiscal gap widened to 2.98% of GDP, which is 113 billion CZK. Somehow the new forecast doesn't seem so optimistic - it is likely to be more realistic. Also we have to realize that we try to sustain the debt over shorter period than in the original case meaning that the government would have to create greater surplus more pressingly. Projected debt level trajectory after consolidation can be seen in Figure 7.

The latest data for the year 2012 shows us a little more positive path concerning government revenues and expenditure since MFCR states in their latest Convergence Programme (2013) that positive fiscal efforts were transformed to the fiscal stimulus, predominantly at the end of the CP horizon. This gives us a better long-run fiscal outlook. Fiscal gap widened though due to the current situation further to 3.2% of GDP, which is 122.8 billion CZK. Result is shown in Figure 8.

Just for the sake of the argument, the last gap we are going to compute is the one for the year 2003 from the first Convergence Programme - it was the year that Czech Republic joined the European Union and had to start sending these reports to Brussels (since Czech Republic is not member of the Eurozone). The substantial deficit for the year 2003 could not be countered by this long-term fiscal consolidation. As a result, we can see a spike of debt level in Figure 9 (GDP growth

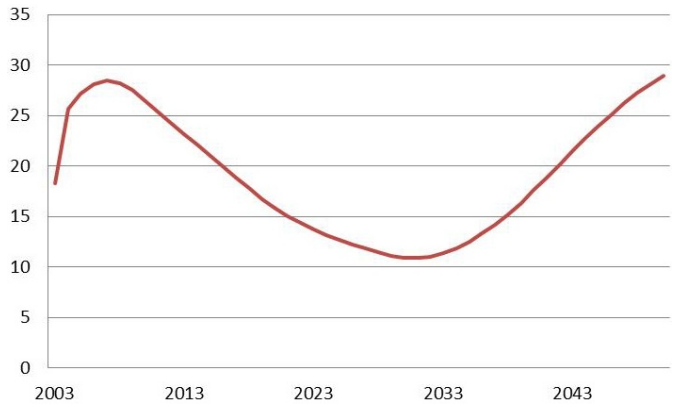
Figure 8: Projected debt level (as a share of GDP) trajectory after closing the fiscal gap (adjusting government budget by the calculated amount) obtained by plugging data from the year 2012 into the fiscal gap calculation formula resulting in the same level of the debt in the year 2050 as in the starting year



Source: CSO, MFCR, author's calculations

can't overcome the deficits in the beginning of the horizon). Though to make our forecast more precise and relevant to the others, we computed the gap only for the year 2040. The each year's consolidation needed for the level of the debt to remain the same after 37 years is 1.32% of GDP, i.e. 35.5 billion CZK. That could be expected considered the economic indicators and the period taken.

Figure 9: Projected debt level (as a share of GDP) trajectory after closing the fiscal gap (adjusting government budget by the calculated amount) obtained by plugging data from the year 2003 into the fiscal gap calculation formula resulting in the same level of the debt in the year 2040 as in the starting year



Source: CSO, MFCR, author's calculations

For this moment we don't have to concern ourselves with taking higher expenditure into account as this is done by MFCR in their Convergence Programme. We can see that projected expenses related with ageing are adjusted in the new reports as well as the actual share of population above the age of 65. We observe the pro-

jected participation of men in the age 15-64 to fall slightly only to rise again and be replaced by the rising participation rate of women of the same age category, we also observe forecasted interest rates going through the roof. But as we already said, that does not concern us since we do not examine the debt level itself yet (the interest rate will not concern us anyway, as we already mentioned), we merely try to answer the question whether it is sustainable or whether the level itself can be sustained, in which case the suggested fiscal gap consolidation is only the start as we can see from our projections. What follows after the year 2050 is clearly an explosive path hence further adjustments in the Czech fiscal policy are needed anyway. We will discuss this more closely in the last part of this work.

The only expense we would like to discuss further in this part is the cost of waiting - what if the current government decides to leave the further preparations of fiscal reforms to the next election period? We can calculate its real cost just by leaving the first four years "unconsolidated". This is not precise, of course, but it serves merely as a demonstration. Results can be seen in Table 1. We only employed calculated models for each year and "unconsolidated" the first 4 years, then widened the fiscal gap in order for the debt level in the year 2050 (2040 in case of the year 2003) to remain the same as before.

Table 1: The cost of waiting (in billion CZK) in case when closing the fiscal gap is delayed by one year

Year of provided data	2003	2009	2010	2011	2012
Cost of waiting	4.8	9	11	16.7	16.5

Source: Author's calculations

Based on our calculations, if the government decides to wait another 4 years, the consolidation needed in order for the debt level to be the same in the year 2050 is each year very high, depending on reforms which are planned to be introduced by the government, and can be expected to be still rising (it actually is since the cost of waiting for example for the year 2012 is increased already by one year of waiting - the cost of waiting for the year 2011). 4 years of delay cost the Czech Republic on average 53.2 billion CZK (taken from the last 4 years) considering that the Czech Republic would even at some point want to maintain its debt level at current level through a period of time.

Both arithmetic calculation and fiscal gap quantified the needed consolidation for the debt to become sustainable. Though arithmetic considers all indicators to remain constant in long-term, resulting surplus can be held at least on average and if the real indicators finally meet our long-term projection, the debt level will be sustainable no matter how high it will be.

Fiscal gap calculation considered forecasted values of economic indicators hence it is supposed to bring more realistic results when introduced to budget planning.

Though as we have seen earlier, the debt level itself will be sustained only through our given period and not further.

If we compare the budget consolidation needed in order for the two approaches to take effect, we can see that permanent sustainability promised by the arithmetic approach would on average require larger surpluses. But as we can derive from the results if we consider the indicators to steady themselves over time, fiscal gap eventually requires even larger surpluses since the cost of waiting has to be also included. This is mainly due to the fact that fiscal gap is calculated for a given time period T whereas in case of arithmetics it stands that $T \to \infty$.

4 Forecasts of the public debt

On the following pages of the third and last part of this thesis, we will closely discuss the projected level of the public debt itself. Some of these projections were made earlier as they were parts of calculations used to determine whether the debt is sustainable. After computing the forecasts, we will compare them and analyse further.

4.1 Data

We start by discussing the data used for our forecasts. We used data yearly available on the web page of Ministry of Finance of the Czech Republic known as Convergence Programmes. Its definition comes from the same source.

"The document specifies the basic aggregate fiscal data and the forthcoming most important measures in the form of medium-term budgetary impacts of the government's fiscal strategy."

More importantly, this is the only document issued by the government to contain relevant long-term fiscal predictions crucial for this work. These predictions appeared for the first time in the first Convergence Programme issued in May 2004. If it wasn't for the Council Regulation No. 1466/97, which establishes for non-participating Member States the obligation of presenting a Convergence Programme, these predictions would most likely not be presented at all. Even though the long-run projection is published at the very end of the document.

We will divide our forecasts according to these issued projections, then discuss the results and factors which influenced Ministry of Finance when predicting indicators. We can also discuss retrospectively whether their projection was precise or not even though MFCR itself claims that it is more accurate than projections made by certain world organizations. We set aside this claim together with the main purpose of the Programme and use simply only the long-run projections.

In order for us not only to forecast the level of public debt but also to propose some solution to the problem and analyse the revenues and expenditure and the factors which influence it, we will expand our analysis and offer more scenarios and also use another projection (though already highly consolidated one), then discuss the forecast we will make using its data. For this purpose, we will use "Long-Term Growth Scenarios" (OECD, 2013).

In each of the documents or studies used to obtain data, we mainly focus on projected revenues and expenditure and GDP growth (for example OECD study predicted only deficits and was mainly focused on projecting growth scenarios).

4.2 Forecasting using MFCR projections

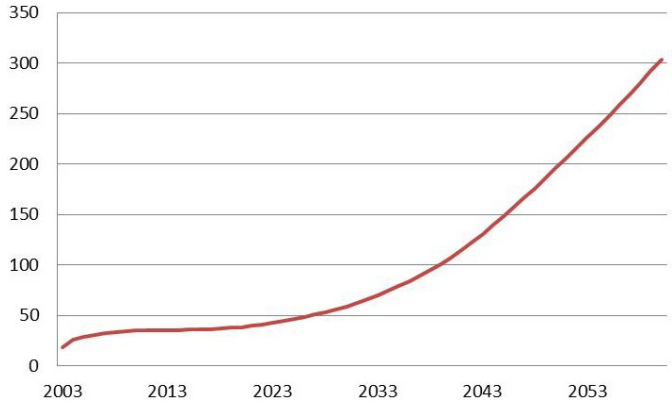
The first forecast is done using the projection from the very first Convergence Programme issued in May 2004. In our first forecasts, we use the data for the year 2050 again for the next decade to suit better the forecasted period (it is of course

inaccurate, but not that far off, as we will see later). MFCR (2004) emphasizes that Czech Government has so far not been able to satisfy either the reference fiscal deficit set by the Protocol on Excessive Deficit Procedure, or the requirements of the Stability and Growth Pact for the medium-term objective of a budgetary position close to balance or in surplus, due to the current fiscal situation and fiscal burden. These problems will be solved by the Government through a multi-annual programme of fiscal consolidation.

The prepared fiscal consolidation obviously applied mainly to the revenues of the government budget. It is understandable since government was mainly concerned about the extremely high budget deficit though as we can see from our forecast, the long-term effect of such reforms doesn't even begin to remotely resemble to a sustainable debt level.

Our estimate shows that the level of the public debt in the year 2060 was expected to breach 300% of that year's GDP. That would mean almost 26 trillion CZK. Czech Republic would default long before that. Our forecast is shown in Figure 10.

Figure 10: Forecasted level of the public debt (as a share of GDP) for the years 2003-2060 obtained by plugging the data for the year 2003 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

Results are not very comforting but the projected effect of the multi-annual programme of the Czech government is clearly visible. Would the programme have been supported by another package of fiscal reforms, the nearly sustainable path might have been reached.

From retrospective point of view, we can say that the consolidation was not large enough and that this process was interrupted by the global financial crisis, though the main concept was positively influenced by the period of rapid GDP growth and probably would not hold against rougher conditions since the consolidation was mainly made on side of revenues and expenditures remained untouched and saved by growth of GDP.

Our forecast proved to be right since MFCR issued in November 2004 an updated version of their Convergence Programme with an updated long-run projection.

Despite newly expected cuts in expenditures, the projection makes no notable difference and the result is nearly the same as in the previous Programme. This time we can't blame the expenditure side but we can finish our analysis of this year with the previous conclusion that additional fiscal consolidation over the next decade would be needed or at least highly recommended in order for the sustainable scenario to be maintained.

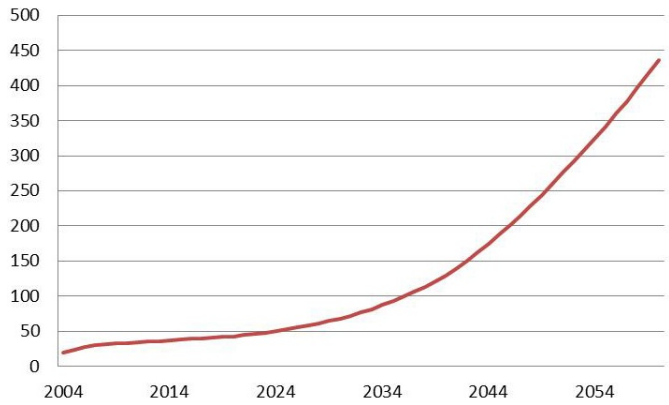
Projection of the Programme issued in November 2005 tells us a different story. Our forecast based on data of MFCR estimates that the debt level will reach 435.9% of GDP in year 2060. That is far worse forecast despite the higher predicted growth for the first 36 years. Then growth completely stops and expenses rise beyond our previous expectations.

The short-term goal of government is clear. With adopted Conception of Public Finance Reform, the government reduces the public finance deficit so it doesn't exceed 3% of GDP in 2008 according to the Convergence Programme. But even the most dedicated reader can't find any word about long-term consolidation or strategy. From the Czech point of view, the position for making medium and long-term strategy consistent with Stability and Growth Pact has not been reached yet.

The new need of reforming the Czech fiscal policy becomes, according to the projection for the year 2004, grievously urgent. Our forecast changes by approximately 150% of GDP which is tremendous for one year difference in data. What's behind this dramatic change?

We would say that the cause is once again on the expenditure side since revenues remained nearly the same but as we go farther in time expenditures rise as if there was no programme of fiscal consolidation even planned, resulting in over 20% deficits beyond the year 2050. Forecasted debt level can be seen in Figure 11. There is no need to say that country can't finance a debt this large.

Figure 11: Forecasted level of the public debt (as a share of GDP) for the years 2004-2060 obtained by plugging the data for the year 2004 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

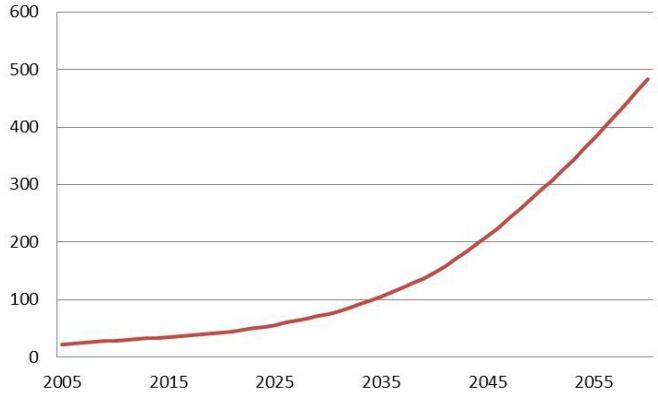
The new government in the following Convergence Programme (CP) from March

2007 openly states that it can't fulfill fiscal targets for 2007/2008 defined in last year's CP and that it commits itself to medium-term fiscal targeting - further reducing of the public finance deficit should continue. The following sentence which appeared in the CP (MFCR, 2007) fully characterises our conclusions made so far.

"The Czech Republic is one of the countries with the least favourable long-term fiscal outlook."

We can say that the forecast didn't change much, but the forecasted debt level rose to 484% of GDP in the year 2060. The assumption about growth has been adjusted as well as expenditure side. Revenues changed only slightly. Our forecast can be seen in Figure 12. We can observe that the trend which was present in previous forecasts disappeared and now the debt level doesn't seem to be sustained even from the very beginning.

Figure 12: Forecasted level of the public debt (as a share of GDP) for the years 2005-2060 obtained by plugging the data for the year 2005 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

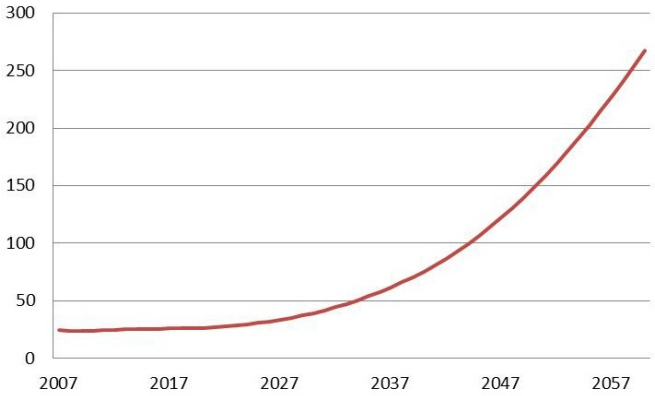
There were two Programmes issued in 2007, we will use the latter issued in November to calculate forecast starting from the year 2006. When putting aside the part related to the past development and focusing on the part describing fiscal measures concerning the medium and long-term objectives, we consider given proposals to be very reasonable and much needed (lowering expenditures, supporting investment, direct taxation).

Thanks to the cuts in expenditures and relatively preserved growth and revenues, the forecasted debt to GDP ratio for the year 2060 lowered to 475% of GDP. Resulted graph looks nearly the same as the previous one, there is no need to present it at this moment.

In the year 2007, the Czech economy was in the strongest part of the economic cycle, so the government achieved its primary goal when all resources were used on reducing the primary deficit. Our forecast is notably lower than in previous years mainly due to the optimistic projections of expenditures and revenues.

Forecasted debt level decreased to 267% of GDP in year 2060 as we can see in

Figure 13: Forecasted level of the public debt (as a share of GDP) for the years 2007-2060 obtained by plugging the data for the year 2007 into the government's inter-temporal budget constraint

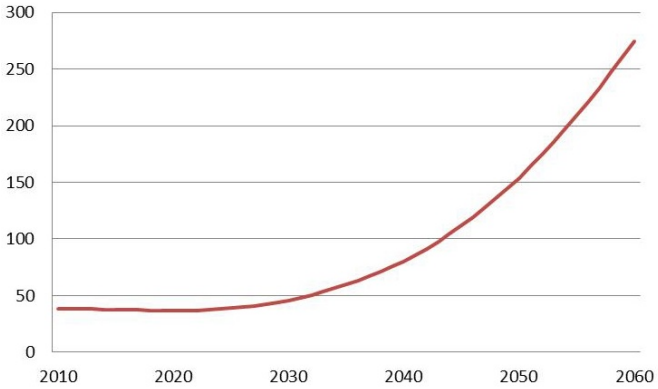


Source: CSO, MFCR, author's calculations

Figure 13.

The three following Convergence Programmes offer us the same long-run projection therefore we forecast the debt level for the year 2060 starting from the latest year 2010 and capturing all the previously given levels since there is no need to present the same forecast with different starting year.

Figure 14: Forecasted level of the public debt (as a share of GDP) for the years 2010-2060 obtained by plugging the data for the year 2010 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

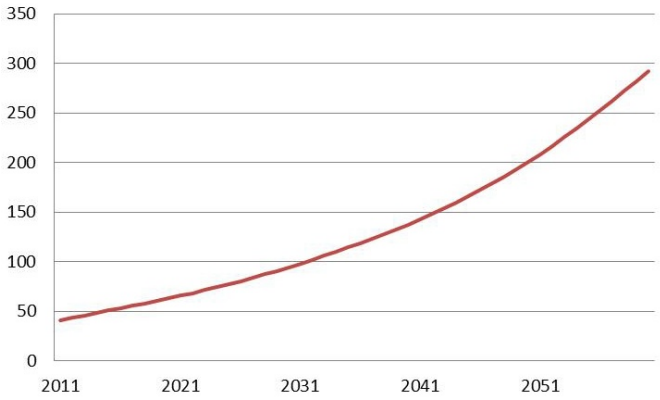
Our forecast (shown in Figure 14) estimates the level of the public debt in year 2060 to 275% of GDP which fairly corresponds with the previous one. The expectations about macroeconomic and socioeconomic development of the country did not change much as we can see, the only real change is that the government was forced to run large primary budget deficits therefore the starting debt to GDP ratio increased greatly.

Data from the CP issued in April 2011 fully support the following statement made in the CP one year before.

MFCR describes it in its CP (2010) in a way that the Czech economy at the turn of 2008 and 2009 was in a recession phase. In 2009, GDP fell well below its potential level, and thus a positive output gap was overturned into negative values. Considering the slow economic recovery, we expect the negative output gap to deepen also in 2010 and to see gradual and only very slight improvement in 2011 and 2012.

In other words all the good years of fiscal tightening and budget deficit targeting were turn into negative values during the strike of the global financial crisis though the expectations in long-term development essentially don't change.

Figure 15: Forecasted level of the public debt (as a share of GDP) for the years 2011-2060 obtained by plugging the data for the year 2011 into the government's inter-temporal budget constraint



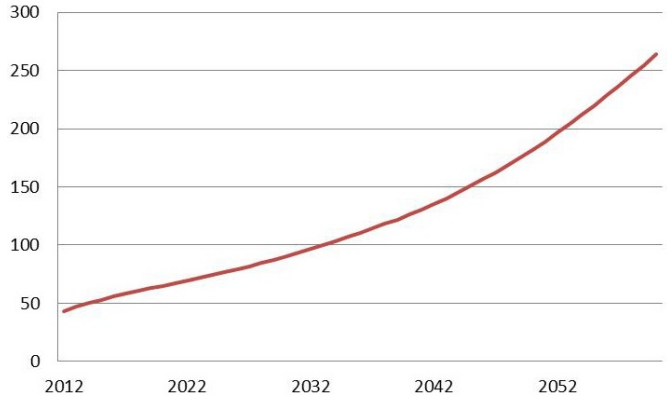
Source: CSO, MFCR, author's calculations

What changed significantly were the medium-term projections, expecting higher expenditures and lower real GDP growth. Financing of budget deficits was also being carried in a different way - by rising taxes and lowering wages in public sector, the medium-term deficit targets were again quite challenging. Due to these changes, our forecast shows us a little different starting development than in the previous years, see Figure 15. Forecasted level of the public debt increased to 292% of GDP in 2060.

Despite the expectations, the year 2012 ended with a very high budget deficit since it was increased by church compensations. Otherwise it would continue to diminish (it would be 2.5% of GDP) to an acceptable level (we included this deficit in section 3, now it plays no role at all since the starting debt to GDP ratio doesn't influence the level for the year 2060 in any crucial way, the effect actually diminishes). And so we can say that the short-term targets are being met and the government continues to address the medium and long-term fiscal outlook, which we consider much wiser since the budget deficits prove to be well handled and unpredictably influenced by each year's political and economical situation. We can see that fiscal

stimulus at the end of the CP horizon helped considerably to lower the forecasted public debt level even though the present situation is not a favourable one. The debt level is forecasted to be 263.7% of GDP in 2060 (see Figure 16), which is about 1.1 trillion CZK lower than expected in the previous forecast.

Figure 16: Forecasted level of the public debt (as a share of GDP) for the years 2012-2060 obtained by plugging the data for the year 2012 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

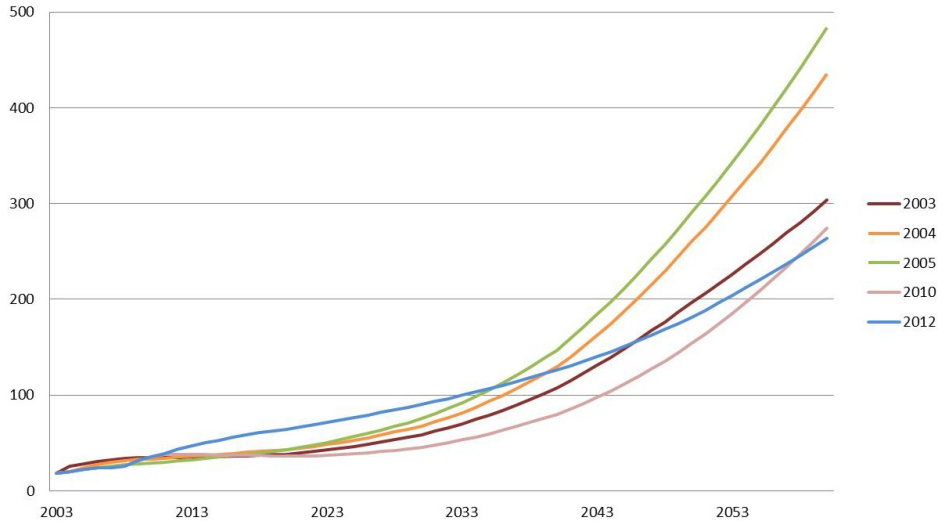
There is also one very important thing worth noting. The projections made in time depend mostly on the projected GDP growth. Projections of growth made by MFCR of course incorporate most of demographic factors such as: fertility rate, life expectancy, net migration, labour force assumptions (working age population share in total population, participation rate, average effective exit age, employment and unemployment rate). Even though that the main part of these projections is published actually by European Commission in their "Ageing Reports" (2009,2012), these projections are made by MFCR and we consider it eligible for our purposes, therefore there is no need to make a new inference about growth rate (save for the study of OECD in the following subsection).

MFCR takes into account expenditure projections made using the "AWG reference scenario", which basically means that the projection is in the middle between the optimistic scenario and the pessimistic one. The issue with future expenditure related to every part of structural budget is, that we are quite perfectly able to specify and quantify these demographic and demand-side factors. But what really offsets the expenditure are the supply-side factors. Especially innovations of technology, institutional settings and individual behaviour represent the upward-risk factor in future public expenditure. The estimated increase in health-care expenditure of the Czech Republic due to these non-demographic factors is 55%, i.e. 1.8% of GDP difference in the year 2060. That would be 150 billion CZK, based on our forecast for the year 2011 (debt is expressed as a share of GDP therefore it is very simple to compute the GDP). This effect is at least partially offset by the well estimated demand-side factors as we have already mentioned. In order to produce relevant

results, we will consider the "AWG reference scenario" for projecting future public expenditure as a probable one and not pursue the other catastrophic scenario any further. Further forecasting of the supply-side factors goes beyond the scope of this work (for details see OECD, 2012).

At the end of this section, we shall offer comparison of our results. As we can see in Figure 17, the forecasted debt level was initially about the same as past years, but then it rose as a result of government's failed attempts to lower primary budget deficits. The last two forecasts show us though that the projected trajectory of its growth steepened especially in the beginning of considered period as the actual debt levels exceeded the projected ones in earlier Programmes. All together, the long-run prospect is a ghastly one full of disappointment from the recent path. Even though the forecasts for the year 2060 start to look a little better, the forecasted debt level is still unthinkable in the current point of view.

Figure 17: Forecasted levels of the public debt (as a share of GDP) for the years 2003-2060 obtained by plugging the data for the years 2003, 2004, 2005, 2010 and 2012 into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

4.3 Forecasting using OECD projections

In this part, we will use the latest OECD growth projections and forecast the level of the public debt based on them. We don't have to take care explicitly about ageing or changes on the side of revenues or expenditure related to structural reforms since it was included in the latest "Long-Term Growth Scenarios" published by OECD (2013). We will just discuss the assumptions about the economic development which were used for projecting growth. Then we combine the projected growth scenario with long-term fiscal outlook for the Czech Republic (all the data are provided in the OECD study) and plug it into our forecasting model (inter-temporal budget constraint with extended expenditure and revenues sides) introduced earlier.

As we have already mentioned in this work, we noticed the long-term upward trend in female participation and a decline in male participation rate. The first assumption is that this phenomenon leads to a downward trend. And what is more, we can actually see that when compared to other European countries, the share of population older than 65 as a share of population aged 15-64 in the Czech republic will steeply rise from the year 2030 to 2060 as unfortunately the share of the population aged 15-64 in total population (where the Czech Republic stands now among the countries with the highest share) will dramatically decline. Though the total population itself is not expected to decline since this effect is fully offset by migration, the foreign-born partially offset even the decline in the share of population aged 15-64.

The next assumption is associated with ongoing pension reform and concerns the effective old-age retirement. The normal retirement age will be increased in order to maintain the economically active proportion of person's lifetime. This alone does not ensure the constant labour force participation rate, that depends also on the relative weight of the different age groups in the population.

One among the very first steps to be taken is the consolidation of the Czech budget, achieving stabilization of the debt to GDP ratio. In the light of rising public spending on health-care and social benefits, there is substantial space for further fiscal and structural reforms.

What we consider more interesting is that the ageing of population is expected to have in long-term no effect on unemployment what so ever, but there is of course certain unpredictability. According to OECD (2013), some evidence suggests that average worker turnover may decrease as older workers display lower entry and exit rates into/from unemployment, which in turn may increase the risk of cyclical unemployment becoming structural. On the other hand, lower turnover among older workers may decrease transitory unemployment.

Unlike the other projections, this work is mainly focused on induced growth. This GDP per capita growth is driven by the efficiency improvements (the global rate of technological progress, trade openness, strength of domestic competition, product market regulation) along with improvement of human capital and (as we discussed earlier) is a very important determinant of the future public debt level.

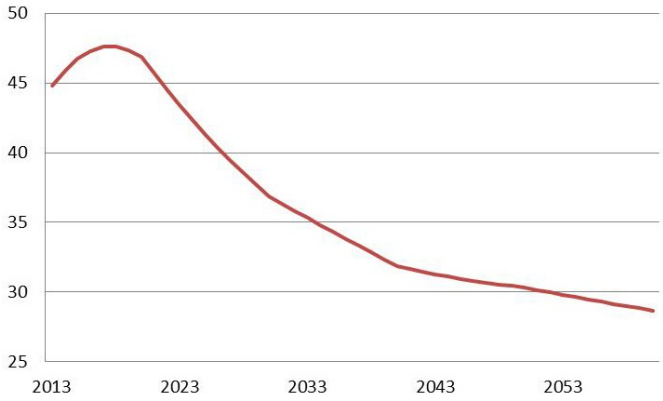
There are few more fiscal and monetary policy assumptions. The interest rate continue to normalize as the gap between real and potential output diminishes. This allows for a potential growth of the economy. Fiscal primary balance gradually increases each year through a combination of reduced government spending and higher revenues in order to stabilise the debt to GDP ratio, which contradicts in long-term (at least we can say looking back at actual economic performance compared to promised by the government) with current government plans. The government balance does not undergo any other exceptional losses e.g. compensations for churches.

One of the very most important assumptions is that the effect of population ageing on public budget and also the effect of rising health-care expenditure are not included explicitly. This means that they are included, they are just completely offset by government reforms, spending programmes and budgetary measures. This

assumption can actually prove to be the most important and unrealistic at the same time as it is much more imaginable for the Czech government to lower the primary budget deficits or even produce a surplus than to implement an effective reform or spending programme, especially when taking into account current political situation. We believe that the annual Convergence Programmes of the Czech Republic prove as much. Though this excluding of the whole factor might seem unrealistic, it is really the only choice in order to present comprehensive projection with a real and imaginable ending state. Our previous forecasts prove that all the mentioned measures which we have taken for granted are absolutely vital for the Czech economy.

Results of our calculations using data from the recent OECD study (given in Figure 18) are not quite surprising given our bold assumptions. Sustainable debt to GDP has been achieved and the GDP growth is expected to be indeed remarkable compared to our previous forecasts. The growth rate projection itself is doubled in the following decades and country is expected to run just slight budget deficits (0.5% at most). Debt level in the year 2060 is to be only 28.7% of GDP (OECD itself assumes way higher interest rates and their forecast is two times higher, which would in case of MFCR forecasts construct a complete doomsday scenario).

Figure 18: Forecasted level of the public debt (as a share of GDP) for the years 2012-2060 obtained by plugging the consolidated OECD data for the year 2012 into the government's inter-temporal budget constraint



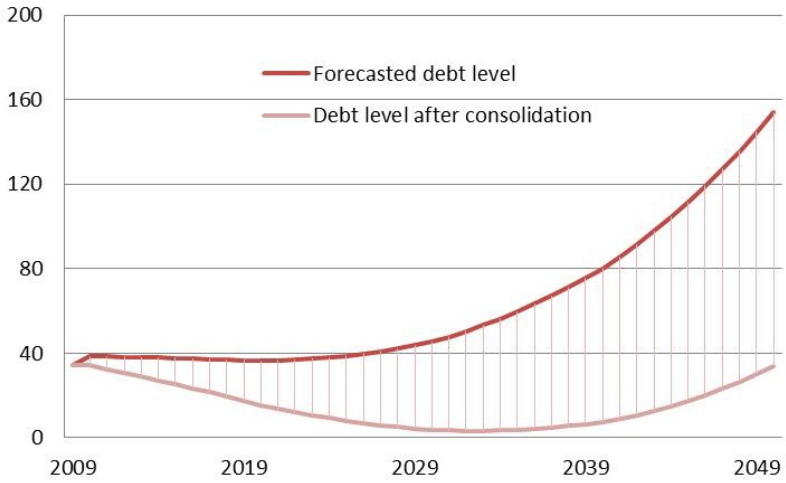
Source: OECD, author's calculations

We can conclude that the only thing the global financial crisis showed us when comparing our two forecasts is that the debt level can't be currently outrun by GDP growth - as we can see in the last forecast, debt level is expressed as a share of GDP and therefore has two main parts, numerator and denominator, both equally important. Historically we would not even bother by the excessive debt level since it was always outrun by the years of high GDP growth during the top of the business cycle.

Now that we have forecasted the public debt level for the year 2060 from the point of view of rather ambitious fiscal consolidation and real GDP growth and also from the point of view of the MFCR (which was not optimistic due to the long-term

fiscal outlook), we can apply our analysis on the fiscal gap calculation and see for ourselves the real consequences of our proposed measures. We set aside the forecast made using OECD study and show the consequence of irresponsible fiscal policy using our previous results. One can surely grasp the meaning of the expression "fiscal gap". Well, if not, the gap has been marked in Figure 19.

Figure 19: Forecasted level of the public debt (as a share of GDP) for the years 2009-2050 without consolidation compared to the trajectory after closing the fiscal gap (maintaining the same debt level as in the year 2009). Forecasts were obtained by plugging the same data into the fiscal gap equation and the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

Our last remark concerns the extensions of our model. As we have already discussed in the previous section, we can extend our model by involving different forecasts of demographic scenarios. We would just have to adjust the revenues and expenditures associated. In our model, we used the most probable AWG reference scenario, but if any other proves to be more realistic or any new one is introduced, the change on either side can be easily introduced to our model (it would only mean a change in public deficits).

We can also extend our model by adding an interest rate forecast which is a complicated issue when associated with the extreme debt levels that we forecasted. The behaviour of markets can be hardly predicted at this point though, especially if Czech Republic will lose its sovereignty. But even so, the change of interest rate on debt can be easily added to our model as a change of debt expenses.

The denominator of the debt ratio can also change. We showed, that including a different forecasts of growth in our model or using different assumptions and factors influencing it, is also possible.

Of course, we can always extend the horizon for which we forecast the debt level. The only thing preventing us from doing so, is that the projections of the key indicators are very hard to compute as well. The main idea of the model is that it is not restricted to our projected period, but can be estimated again any time.

5 Conclusion

We began by a brisk debate on importance of austerity and sustainability. After short reviewing of both classic and modern literature we moved on to stating the main goal of this thesis so it was completely clear from the beginning and later specified separately in its own part. We wanted to point out that even though he global financial crisis struck hard and we do not have actual evidence that austerity is good for growth and economy as a whole, there is a way to elude the destructive path of accumulating excessive deficits and therefore leading the county straight to default.

This was shown by forecasting the level of the public debt for the year 2060. We can say that given forecasts were properly commented in chapter 4 where we analysed data from all available Convergence Programmes, though there can be some issues about the data, steps taken during our estimations and the actual adjustments. This part is handled in Appendix A, so the main text can remain only a comprehensive presentation of our results.

When studying the Convergence Programmes, we found out that the main problem seems to be that the Czech government failed in creating surpluses in times of high economic growth, to reduce deficits in years of slower growth and more importantly to implement much needed structural reforms that would enhance the revenues and lower the government expenditures (this part is of course highly speculative a we can never truly observe the separated effect of introduced reforms or economic downturns).

This work consisted mainly from two separated sections - theoretical and empirical - with special focus on the latter. The first empirical part - Case of the Czech Republic - pointed out that the Czech public debt is clearly unsustainable and that further consolidation of 142.9 CZK billion (in terms of the year 2012) of each year's budget is needed in order to sustain it. After comparing the amounts needed and showing for a change a sustainable path, we calculated the fiscal gaps up to the year 2012. Our results show us that in order for the government to maintain current debt level at least up to the year 2050 (2040 in case of data from the year 2003), large intervention in each year's budget is needed. The last calculated fiscal gap for the year 2012 was 3.1% of GDP, i.e. 119 billion CZK. The amount rises for each year of delay.

Forecasting the debt level showed us the need of further fiscal consolidation (rather in form of cutting expenses of public sector than taxation since growth is extremely important factor) regardless the approach taken concerning this issue. Even though there is no actual evidence that excessive debt level will affect negatively the economic performance of the Czech Republic, the forecasted levels are so high that the country would be extremely vulnerable to speculative attacks and would have serious trouble recovering even from minor crises.

Our forecasts are based again on all government Convergence Programmes. We began by using the very first Programme, our forecast of the public debt level in

the year 2060 is 303.7% of GDP (taking data from the year 2003). Forecast for the following year was much worse - it climbed up to 435.9% of GDP. The following year was even worse than that (484% of GDP), until the forecasts started to finally look more optimistic as the government started to focus more on the medium and long-term fiscal planning. The forecasted level of the debt in the year 2060, estimated using data from the year 2012, is 263.7% of GDP. Even this "better" forecast leads country to the most difficult situation that we would rather never experience.

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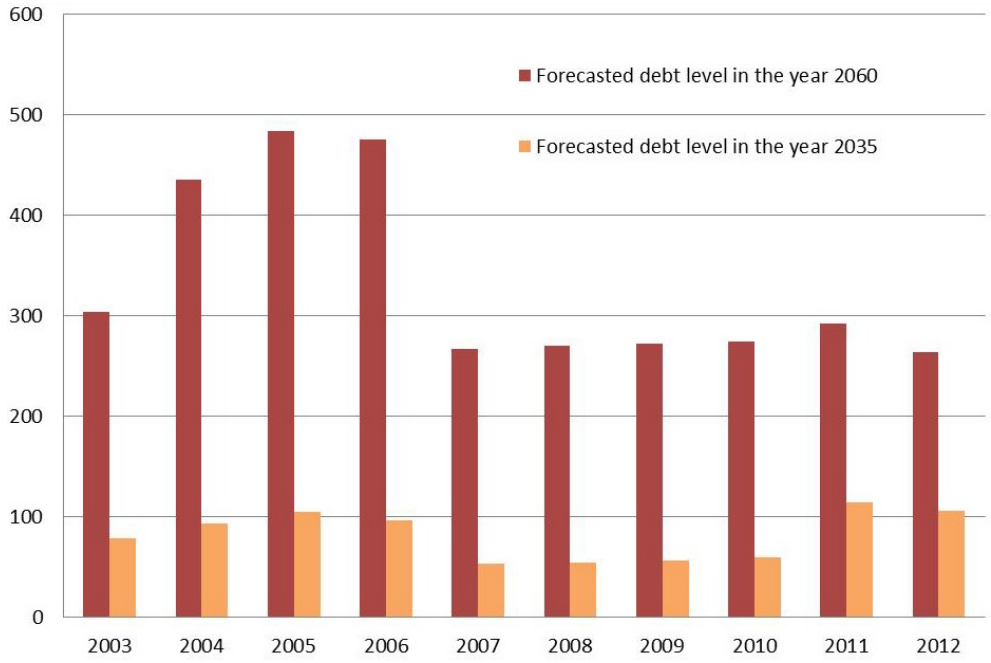
Appendix A

Figure A.1: Forecasted levels of the public debt (as a share of GDP) for the data from the years 2003-2012. We can compare forecasts for the year 2035 and for the year 2060. Forecasts were obtained by plugging the data for the corresponding year into the government's inter-temporal budget constraint



Source: CSO, MFCR, author's calculations

Table A.1: Calculated interest rate on debt r used in our forecasts

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
r	5.39	5.42	4.27	4.56	4.23	4.2	4.41	3.02	3.34	2.46

Source: Author's calculations

Table A.2: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2003. Based on this data, we also estimated the year 2060 in order to suit our forecasted period

Year	2003	2005	2010	2020	2030	2040	2050
Total expenditure	6.2	53.1	50.4	51.1	53.1	57.0	60.5
Total revenue	49.9	49.5	49.1	49.1	49.1	49.1	49.1
Real GDP growth	2.9	3.1	3.9	2.3	1.7	0.6	1.1

Source: MFCR

Table A.3: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from updated Convergence Programme for the year 2003. Based on this data, we also estimated the year 2060 in order to suit our forecasted period

Year	2003	2005	2010	2020	2030	2040	2050
Total expenditure	54.5	45.8	40.9	41.6	43.4	47.2	50.5
Total revenue	41.9	41.1	39.7	39.7	39.7	39.7	39.7
Real GDP growth	3.1	3.6	3.9	2.3	1.7	0.6	1.1

Source: MFCR

Table A.4: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2004. Based on this data, we also estimated the year 2060 in order to suit our forecasted period

Year	2000	2005	2010	2020	2030	2040	2050
Total expenditure	42.1	45.9	43.0	43.3	45.8	51.2	57.6
Total revenue	38.5	41.1	40.9	40.9	40.9	40.9	40.9
Real GDP growth	3.9	4.8	3.6	2.5	1.9	0.4	0.8

Source: MFCR

Table A.5: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from updated Convergence Programme for the year 2005. Based on this data, we also estimated the year 2060 in order to suit our forecasted period

Year	2005	2010	2020	2030	2040	2050
Total expenditure	44.0	42.5	43.3	46.2	52.0	59.2
Total revenue	40.4	40.3	40.3	40.3	40.3	40.3
Real GDP growth	6.1	3.6	2.5	1.9	0.4	0.8

Source: MFCR

Table A.6: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2006. Based on this data, we also estimated the year 2060 in order to suit our forecasted period

Year	2006	2010	2020	2030	2040	2050
Total expenditure	43.6	39.4	39.8	42.7	48.4	55.5
Total revenue	40.7	37.1	37.1	37.1	37.1	37.1
Real GDP growth	6.4	5.3	2.5	1.9	0.4	0.8

Source: MFCR

Table A.7: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2007

Year	2007	2010	2020	2030	2040	2050	2060
Total expenditure	42.4	41.1	40.1	41.8	44.6	49.5	54.5
Total revenue	41.4	39.6	39.0	39.0	39.0	39.0	39.0
Real GDP growth	6.6	4.4	2.5	1.4	0.9	0.7	1.1

Source: MFCR

Table A.8: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2008

Year	2007	2010	2020	2030	2040	2050	2060
Total expenditure	43.1	41.9	41.4	43.7	47.6	53.5	59.8
Total revenue	42.0	41.0	40.1	40.0	40.0	39.9	39.9
Real GDP growth	5.2	3.0	2.5	1.4	0.9	0.7	1.1

Source: MFCR

Table A.9: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2009 and 2010

Year	2007	2010	2020	2030	2040	2050	2060
Total expenditure	43.1	41.9	41.4	43.7	47.6	53.5	59.8
Total revenue	42.0	41.0	40.1	40.0	40.0	39.9	39.9
Real GDP growth	5.2	3.0	2.5	1.4	0.9	0.7	1.1

Source: MFCR

Table A.10: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2011

Year	2007	2010	2020	2030	2040	2050	2060
Total expenditure	43.1	45.4	44.5	46.1	47.9	51.0	54.1
Total revenue	42.0	40.4	40.9	40.9	40.9	40.9	40.9
Real GDP growth	4.1	2.2	2.0	1.8	1.8	1.7	1.5

Source: MFCR

Table A.11: Projected revenue, expenditure (as a share of GDP) and GDP growth (in %) taken from Convergence Programme for the year 2012

Year	2010	2020	2030	2040	2050	2060
Total expenditure	45.3	38.6	40.0	41.9	45.0	47.9
Total revenue	40.4	35.3	35.6	35.8	35.9	36.1
Real GDP growth	2.3	1.8	1.7	1.5	1.1	1.2

Source: MFCR

Table A.12: Projected fiscal balance (as a share of GDP) and potential real GDP growth (in %) taken from OECD for the year 2012

Year	Avg 2000-7	2010	2013	2020	2030	2040	2050	2060
Fiscal balance	-3.9	-4.8	-2.2	-0.4	-0.5	-0.4	-0.5	-0.5
Potential real GDP growth	3.7	1.9	1.9	3.6	2.8	2.0	2.3	2.2

Source: OECD

Bachelor Thesis Proposal

Author: Daniel Sentivany
Supervisor: Petr Jansky, M.Sc.
Proposed topic: Forecasts of the public debt for the Czech Republic

Topic characteristics:

Public debt is nowadays one of the most important things in economic policy. Sustainability of government debts of countries as the largest part of public debt is carefully watched, compared and ranked by investors and debt management offices. Economic and fiscal policies are being designed to influence future development of debt.

What is the current level of public debt and what does it consist of?
In this thesis, I will begin by analyzing level of public debt of Czech Republic as a result of its fiscal deficits and include other factors such as remaining statistical adjustments compiled under the deficit-debt adjustment (DDA) or change in the value of debt denominated in foreign currency. I will express it as a ratio of its GDP, which will show the size of debt in relation to the size of Czech economy. Then I will focus on its composition with respect to the type of financial instrument, the currency composition, its holder, and residual and average maturity.

Is the Czech government able to pay off its debt and what is the sustainable level?
According to ECB Occasional Paper Series No. 132 (2011) a government is solvent in the period t if the discounted value of its current and future budget balance surpluses is higher than the sum of the initial stock of debt and the discounted value of future budget deficits. I will use data from CSO to estimate the point, where Czech government won't be able to pay off its debts and consider any "better" state with respect to ongoing crisis (some European countries are already considered to be on the wrong side of the Laffer curve for capital income taxation) and its liquidity as sustainable path. This will be done using government intertemporal budget constraint (current government debt plus the net present value of all future expenditure should be equal to the discounted value of all future revenues). Though it seems that debt could be sustained anytime using fiscal policy recent studies show that as government debt levels and tax rates rise in time of fiscal stress, the population's tolerance of taxation declines and the probability of reaching the fiscal limit increases.

What are the other components of public debt?
Besides the government debt, public debt consists also of the obligations of indi-

viduals, business firms, and nongovernmental organizations (i.e. health-care institutions). It is estimated, that it exceeded 1.5 trillion CZK.

How to measure fiscal imbalance?
I will calculate so called fiscal gap for the year 2050 and further, then express it as a share of GDP. As defined, for example, in Auerbach (1994, 1997), a fiscal gap over a horizon from the current period, t, through a terminal period, T, would equal the required increase in the primary surplus relative to those projected under current policy that would be needed to maintain the debt-GDP ratio at its current value. This surplus will be calculated to reach multiple goals in debt management (i.e. 25,50 or 75% of GDP). I will assume that pension and health spending remain the same over next decades (as a share of GDP) and that public revenues and primary expenditures will grow in line with GDP (CSO data actually support these claims). Also it will be assumed that fiscal tightening will be implemented immediately and sustained until debt is stabilized. Then I will study impact of pension and structural reforms and variables that can change in time (this will be a serious issue assuming that population in Czech Republic will grow considerably older and live longer).

What will the level of debt in 2050 be and how can it be sustained?
In the last part of thesis, I will design a model and use it to estimate level of public debt in year 2050 and further with respect to government reactions to economic and demographic factors discussed while calculating the fiscal gap and compare it to OECD and IMF growth projections. I will also consider delay of reforms or raising of retirement age and its impact on consolidation of debt.

Outline:

1. Introduction
2. Structure and estimation of current debt level
3. Solvency of Czech Republic
4. Calculating fiscal gap
5. Designing forecasting model
6. Estimating designed model
7. Conclusion

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