A System Dynamics Approach to Macroeconomic Policy Evaluation - The Case of the German Debt Brake

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Abstract

In the aftermath of the expansive fiscal policy stimuli dealing with the consequences of the world financial crisis of 2007/2008 the public indebtedness around the world has increased dramatically. As a consequence the world-wide interest in policy measures to limit and reduce public debt has increased drastically. In Germany the parliament has altered the constitution which encompasses now a new article regarding a seemingly tight debt rule. In many member states of the EU and around a political discussion has started whether the German debt rule could serve as a guideline. This article explains the German rule and analyses its effects by employing system dynamics methods. The mainly qualitative analysis demonstrates that the German debt rule has important shortcomings and that there are severe "side effects" which have to be addressed by public policy.

Keywords: Debt rule, system dynamics, policy evaluation.

JEL classification: E6, H6, H7

1. Introduction

As a reaction to the global and financial crisis of the years 2008 and 2009, governments around the world switched to massive expansionary fiscal policies. These expansionary fiscal policies encompassed tax decreases, tax rebates, and increases of government expenditures.[1] As a result of these policy measures and the sharp decrease in tax revenues (due to the global depression) the often already high government debt in most industrialized countries increased dramatically. The increase of government debt triggered the so-called Euro-crisis of 2010. The Euro-crisis raised doubt regarding the sustainability of the European Economic and Monetary Union. It was the turmoil of this discussion about the future of the Economic and Monetary Union that focused the attention of the media and the public on the problem of high and fast increasing government debt.[2]

In Germany, the governing parties argued in favor of a sharp consolidation policy. In addition to the requirements of the Stability and Growth Pact they pointed to the debt rule enacted in 2009 that enforces an even tighter debt policy. The key aspect of the German debt rule is that it aims to take away discretionary leeway from the political decision process and to enforce a steady decline of national debt in the long run.[3]

As most industrialized countries around the world see high and increasing public indebtedness, the German debt brake is regarded as a possible example in other countries of the European Union. Therefore, it is of interest to analyze the operation, the effects and the "side effects" of the German debt rule in order to learn whether it may, in fact, serve as a desirable model.

Despite of its novelty, there is a growing body of literature discussing the new rule. Most of this literature consists of juristic and economic contributions. To the best of my knowledge, there exists no paper dealing with the German debt rule from a system dynamics point of view. As feedbacks play an important role in the dynamics of national debt and as the German debt rule itself rests on feedback mechanisms, additional insights in the operation, the effects, and the side effects can be gained by employing system dynamics methods.

Obviously, the problem of public debt and its effects is not a central theme of the system dynamics literature. Only few studies pick up the problem. Most closely

[1] The expansionary fiscal policies were accompanied by expansionary monetary policies of the central banks.
[2] In 2010 most of the member states of the Eurozone did not fulfill the requirements of the Stability and Growth Pact, which states that the annual budget deficit must not be higher than three percent of Gross Domestic Product (GDP) and that the public debt must not exceed sixty percent of GDP.
[3] The German debt rule has an antetype: the Swiss debt brake.

related to the spirit of our analysis are the papers of Ansah (2010a, 2010b, 2006), Burns and Janamanchi (2007), Radianti (2004) and Arenas (2003). But none of the papers deals with a debt rule. Ansah (2010a) models the vicious cycle of poverty, economic performance, and debt. Ansah (2010b) examines in a case study of Ghana the mechanisms that generate government debt. Ansah (2006) focuses on the side effects of structural adjustment programs. The paper of Burns and Janamanchi (2007) concentrates on the demographic aspects of the debt problem. Radianti (2004) deals with the effects of external debt financing on the sustainability of Indonesian fiscal policy. Finally, Arenas (2003) analyzes the sustainability of public debt referring to Colombia.

There is a wide and diverse body of economic literature dealing with fiscal rules in general. Examples are Corsetti, and Roubini (1996), Poterba and Rueben (1999a), and Poterba and Rueben (1999). Corsetti and Roubini (1996) compare the European and American perspectives on balanced-budget rules. Poterba and Rueben (1999 and 2001) look at fiscal rules and public borrowing at the state. In addition, there is an increasing number of papers, mostly published in German, that analyze the German debt brake. But neither the economic literature nor the system dynamics literature deals with the debt brake from a system dynamics perspective.

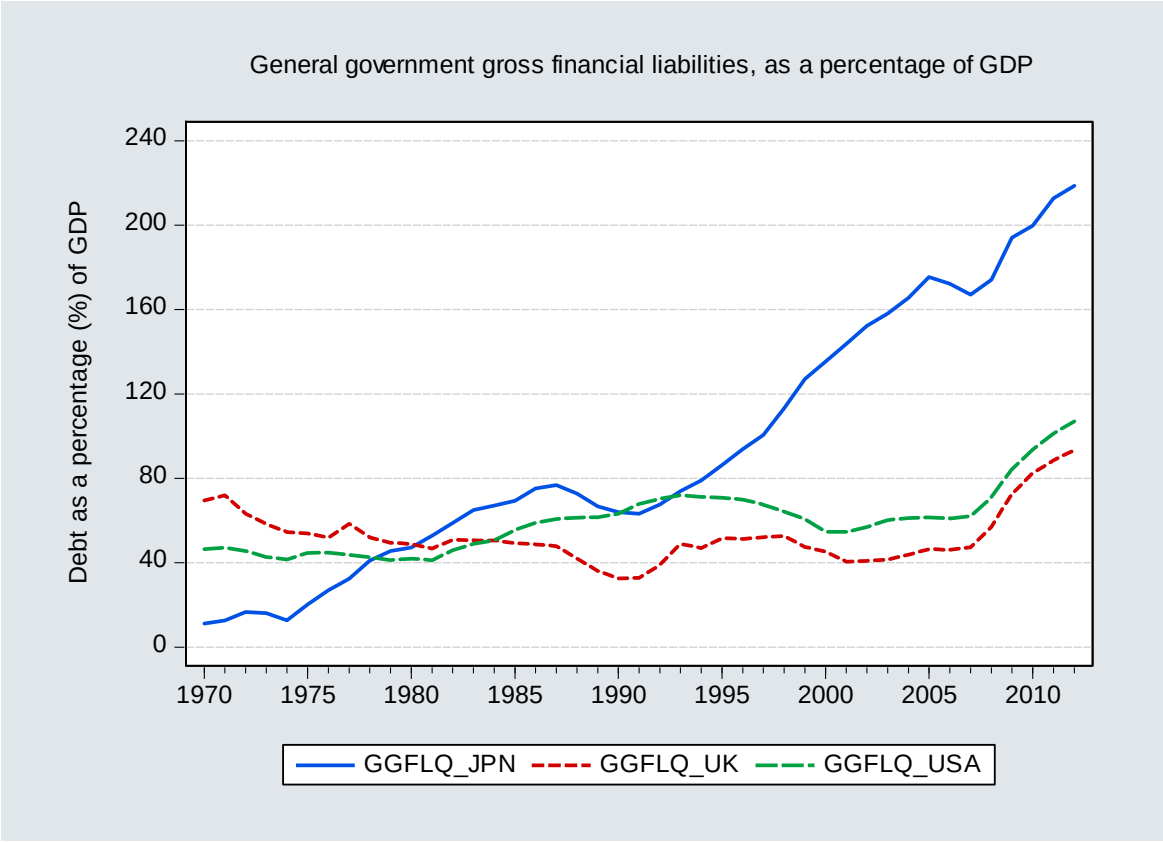
This paper aims at supporting economic policy by pointing to side effects of the debt rule neglected in the discussion so far. It concentrates on two aspects: First, on demonstrating that the German debt rule is less transparent than claimed. Second, and even more problematic, there are effects to some of the German states ("Bundesländer") which are economically devastating – unless the debt rule is altered or abolished.

The remaining part of this paper is structured as follows. The following section gives a brief overview over the debt situation in several industrialized countries in order to recall the international relevance of the problem. According to its goal the paper places a special emphasis on some member countries of the Eurozone. In this section also the view of the economic profession on causes and consequences of public indebtedness is briefly touched as this paper addresses itself not only to professional economists. The next section explains the modus operandi of the German debt rule (also called: German debt brake). Qualitative system dynamics analysis is used to map the complexity of the rule and to identify neglected but important side effects. Thereafter, the paper turns to an especially important side effect which regards the German states. Besides employing qualitative system dynamics analysis a quantitative simulation model is developed for the "Saarland". The model demonstrates that the Saarland will run under the debt brake into insolvency unless the law is changed or the Saarland is offered new financial assistance. The main reason for this finding is

the fact that the debt rule and the accompanying measures neglect the deeper structural causes for the public deficit of the Saarland.[4] Finally, the paper draws some conclusion.

2. Economic Background

The following Figures show the development of national debt and the development of the ratio of national debt do Gross Domestic Product (GDP) for selected countries.[5] The data are from the OECD and from the IMF, respectively. Note that the time series differ in length due to the availability of data provide by both institutions. The longest time series available is for the United States. Figure 1 shows the development of public debt for the United States, the United Kingdom, and Japan.[6]



Source: OECD (2011)

Figure 1: Debt-GDP ratio of Japan, the UK, and the US

[4] Even for people with a quite limited training in system dynamics it is hard to believe that the underlying structures of a dynamic system are completely ignored. But this is what obviously has happened in the political process.

[5] It is common to evaluate and compare the national debt by looking at ratios. Due to the differences in the size of the economies a cross-country comparison of the nominal or real value of debt is not meaningful.

[6] The Economic Outlook (OECD 2011) provides data for the time period 1970 – 2012. The data for 2011 and 2012 are estimates.

Japan sticks out: In 1970 the Debt-to-GDP ratio was as small as 11 percent. In the mid-1970th this ratio started to increase more or less steadily. Leaving the development following the global economic crisis aside there is no clear tendency of a permanent increase of the debt ratio in the US or the UK. From 1960 to the 1981 the ratio decreased in the US from 62 percent to 42 percent. From 1982 to 1993 it increased to a value of 72 percent. Largely attributable to the economic growth during the rest of the 1990th the ratio declined again, reaching its minimum in 2000/2001 with a value of 55 percent. Following the recession of 2001 the debt ratio increased in the following two years to a value of slightly above 60 percent, where it stood until the financial market crisis hit the United States and the global economy. Until the global depression the development in the UK stands in stark contrast to the development in Japan. Starting with a high value of nearly 90 percent the debt-GDP ratio declined until 1990 to slightly above 30 percent. In the aftermath of the 1990/1991 recession the ratio started to increase quite sharply to about 50 percent. At the end of the 1990th the ratio declined within three years to approximately 40 percent. Following the 2001/2002 recession the ratio increased to 47 percent in 2007. Then the British economy was hit by the global crisis. In 2008 the debt ratio climbed to 57 percent, in 2009 to 71 percent, and in 2010 to 83 percent. For the year 2011 the OECD estimates a 94 percent. The increases of the debt-GDP ratio observed after the global economic crisis are unprecedented in the time after World War II.

The figure points to several important facts:

- There are remarkable differences between the developments in the considered countries.
- There are time periods with a slow increase (or even a decline) of the ratio (even though there are only rarely time periods with a decline in the debt level). In general, these are periods of significant above average economic prosperity.
- The data reveal a pattern of increases in public debt following extraordinary events (like the first and second Iraq war or severe recessions) that are not followed by a symmetric decline of the ratio thereafter.
- In all countries the debt problems are regarded as important issues not only in the sphere of economic theory and economic policy but also in the public and the media. Public debt has become a major political and societal issue.
- The sharp increase of the debt ratios in the years following the financial crisis will keep public consciousness at a high level – especially because there seems to be no way to decrease the ratios within the next years.

We will now briefly look at two groups of EU countries. The first group is the group of the major economies in the EU (excluding the UK). It consists of Germany, France, and Italy. The second group is the group which came especially under fire in the aftermath of the financial crisis. This group consists of Ireland Spain, and Greece. In addition, to allow for comparison, the development of the 15 countries of the Euro zone is shown.

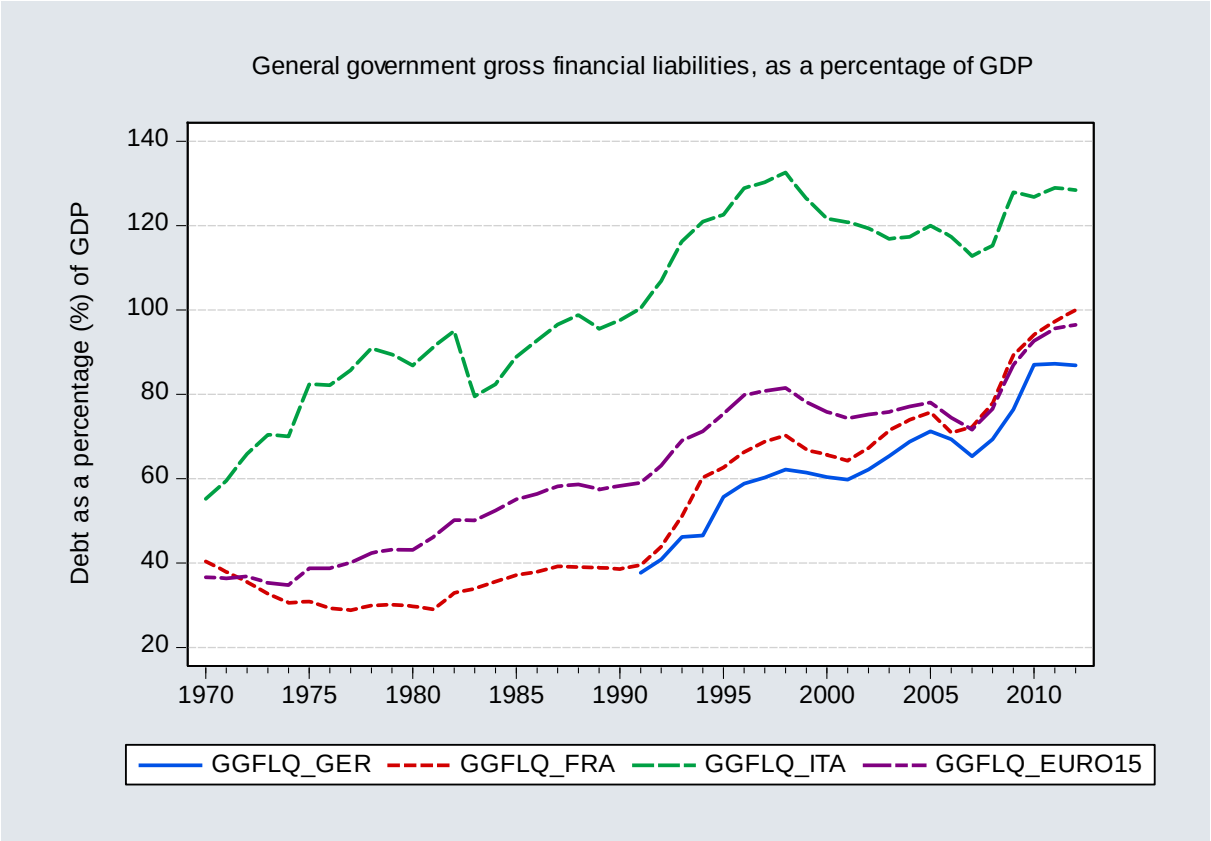


Figure 2: Debt-GDP ratio of Germany, France, Italy and Euro zone (15 countries)[7]

The data of Fig. 2 reveal a "twin" development of the debt to GDP ratio in France and Germany. Only the future development forecasted by the OECD shows a significant difference between both countries in that the increase of the ratio triggered by the global crisis is significantly more pronounced in France.[8] The increase in the German debt ratio until 1996 can be traced back to the financing of the German unification. As the economic performance during most of the 1990s was weak in Germany (and in France as well) the ratio remained at about 60 percent during this decade. Around the turn of the millennium the economic growth became stronger – and the debt ratios declined somewhat. The recovery

[7] The Economic Outlook (OECD 2011) provides data for the following time periods. France, Italy, and Euro zone (15) 1970 – 2012; Germany 1991 – 2012. The data for 2011 and 2012 are estimates.
[8] One explanation for this divergence is the fact that Germany has gained competitive advantages within the Euro zone as unit labor costs in Germany have declined relatively to most other members. This decreased the relative price of German export goods. The improved competitiveness allowed the German economy to recover much faster. The stronger economic growth is reflected by a flatter time path of the debt ratio.

was interrupted by the recession of 2001/2002. Until 2005 the ratios increased to about 65 percent. Due to the economic upswing the debt to GDP ratios of Germany and France declined thereafter – until the world was hit by the financial crisis and its long lasting effects. Italy is another case. Until the middle of the 1990s the debt ratio grew to about 120 percent. Thereafter it declined quite steadily to somewhat over 100 percent 2007. The economic crisis brought the debt ratio back to the level of 120 percent.

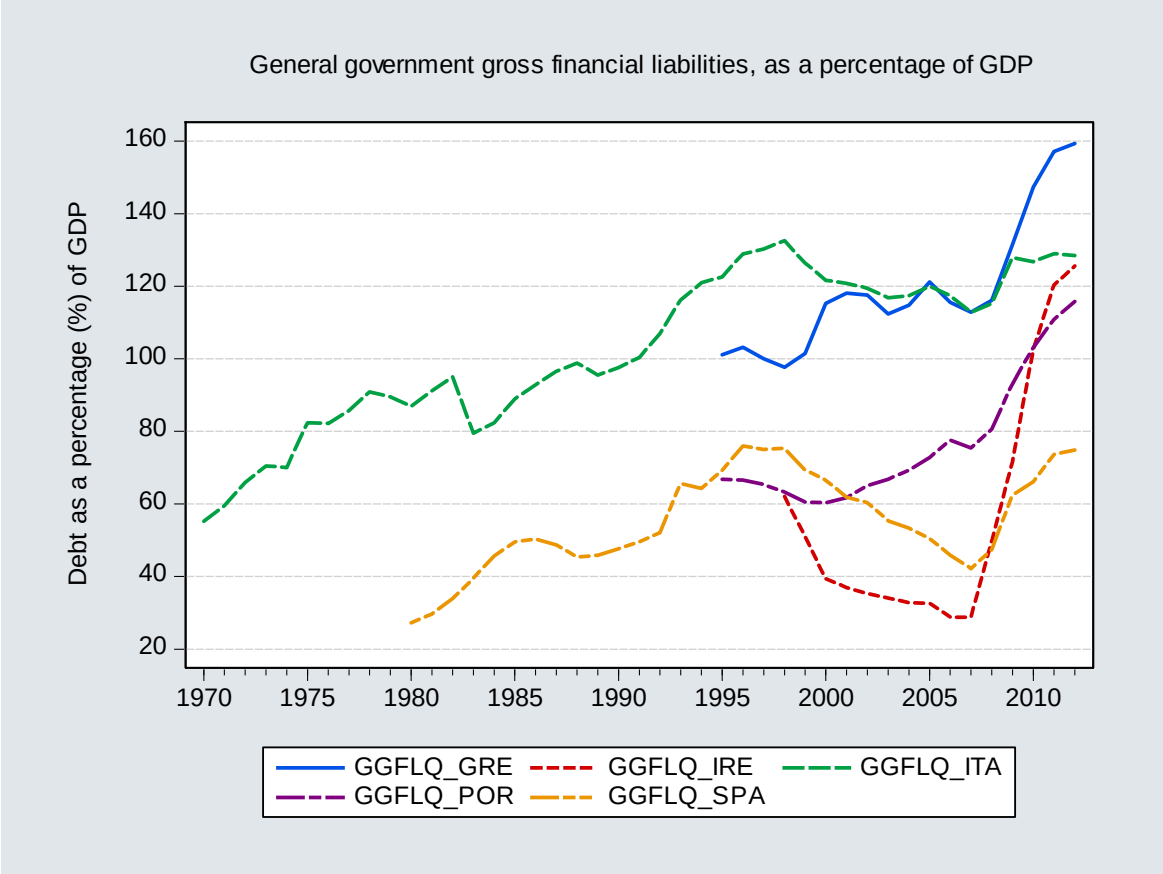


Figure 3: Debt-GDP ratio of Euro zone countries hit by the debt crisis[9]

Fig. 3 shows the developments in the "crisis countries" of the Euro zone. The debt ratio of Greece started in 1980 with a small value of somewhat more than 20 percent (not shown in the figure). Until the middle of the 1990s this number climbed steadily to a value of about 120 percent where it remained until 2007. Spain and Ireland managed to bring their deficit ratios down from quite high to quite low values. When these countries were hit by the global crisis their ratios were 36 percent (Spain) and 25 percent (Ireland), respectively. Mainly attributable to the fact that in both economies (as in the United States) housing price bubbles burst, both countries experienced a dramatic increase in the debt ratio.

[9] The Economic Outlook (OECD 2011) provides data for the following time periods. Greece 1995 – 2012; Ireland 1998 – 2012; Italy 1970 – 2012; Portugal 1995 – 2012; Spain 1980 – 2012. The data for 2011 and 2012 are estimates.

We turn now briefly to some basic aspects of the accumulation of national debt. The most fundamental aspect of "debt mechanics" is captured in the causal loop diagram shown in Fig. 4.

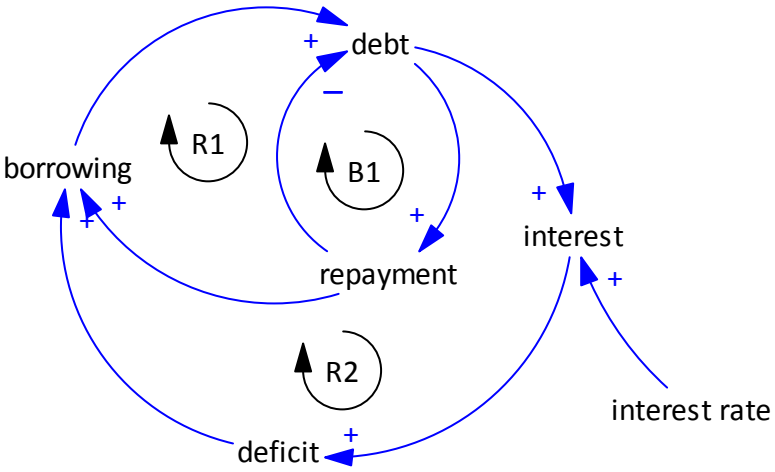


Figure 4: Fundamental debt mechanics

There are one balancing and two reinforcing loops. The balancing loop, labeled B, comprises the fact that mature debt has to be repaid. An increase in debt leads, ceteris paribus, to a higher repayment which in turn decreases the debt below the value it would otherwise have had. On the other hand, repaid government debt is often financed by new borrowing. Therefore the polarity of the arrow from repayment to borrowing is positive. And a higher borrowing increases the national debt. This closes the reinforcing loop R1. For the purposes at hand, let us assume that the interest rate is exogenous. Then an increase in debt leads to a higher interest obligation. The higher interest increases ceteris paribus the deficit which in turn decreases borrowing and debt. The polarity signs of the loop labeled R2 are all positive which means that it is a reinforcing loop. If we assume that all repayment is financed by borrowing the effects of loop B1 and loop R1 cancel each other out. Hence, the important determinant of the dynamics of national debt in the CLD of Fig. 4 is the reinforcing loop R2.

From an economic viewpoint, it is important to add two other factors in order to get a more complete picture of the debt dynamics. First, we should include the so-called primary deficit, and, second, as the debt crisis of Greek has emphasized, we should take into account that the interest rate a country has to pay for its debt is not just the world interest rate. Fig. 5 shows a CLD that encompasses these factors. [10]

[10] A similar exposition is given in Ansah (2010).

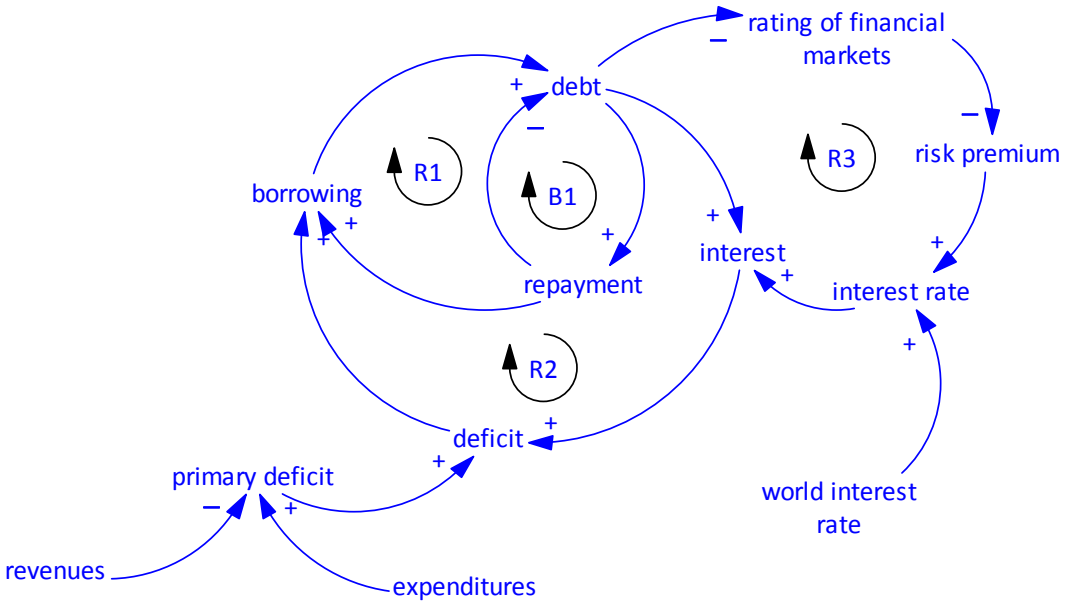


Figure 5: Debt dynamics, risk premium, and primary deficit

In addition to the loops B1, R1 and R2 there is a third reinforcing loop R3. The dynamics described by this loop are the following: An increase in national debt decreases the rating at the financial markets due to an increased risk of default; a lower rating means that potential creditors demand a higher risk premium to compensate for the perceived risk increase; a higher risk premium increases the interest rate, which pushes the interest payments up. The case of Greece has demonstrated that the risk perception and the rating of the financial markets can change quite suddenly due to external factors. Because it is not the purpose of this paper to build a comprehensive model of the financial markets we just point to this issue but do not try to model it.

The second enlargement to be found in Fig. 5 is the inclusion of the primary debts and its two big components: revenues and taxes. If taxes increase the primary deficit decreases ceteris paribus. Similarly, an increase in expenditures pushes the primary deficit up. The (total) deficit will only be zero if there is a surplus of revenues over expenditures which just compensates for the interest.

But in practice, this is often not the case. We have seen that the empirical picture is mixed. There are countries like Japan and Italy that show a long run increase in the debt deficit ratio which is not easily explainable by special events. On the other hand there are countries like the US, the UK or Germany, in which periods of steep increase in deficit and debt in most cases can be attributed to extraordinary situations (like the financing of the Iraq wars or the financing of the German unification, or deep recessions).

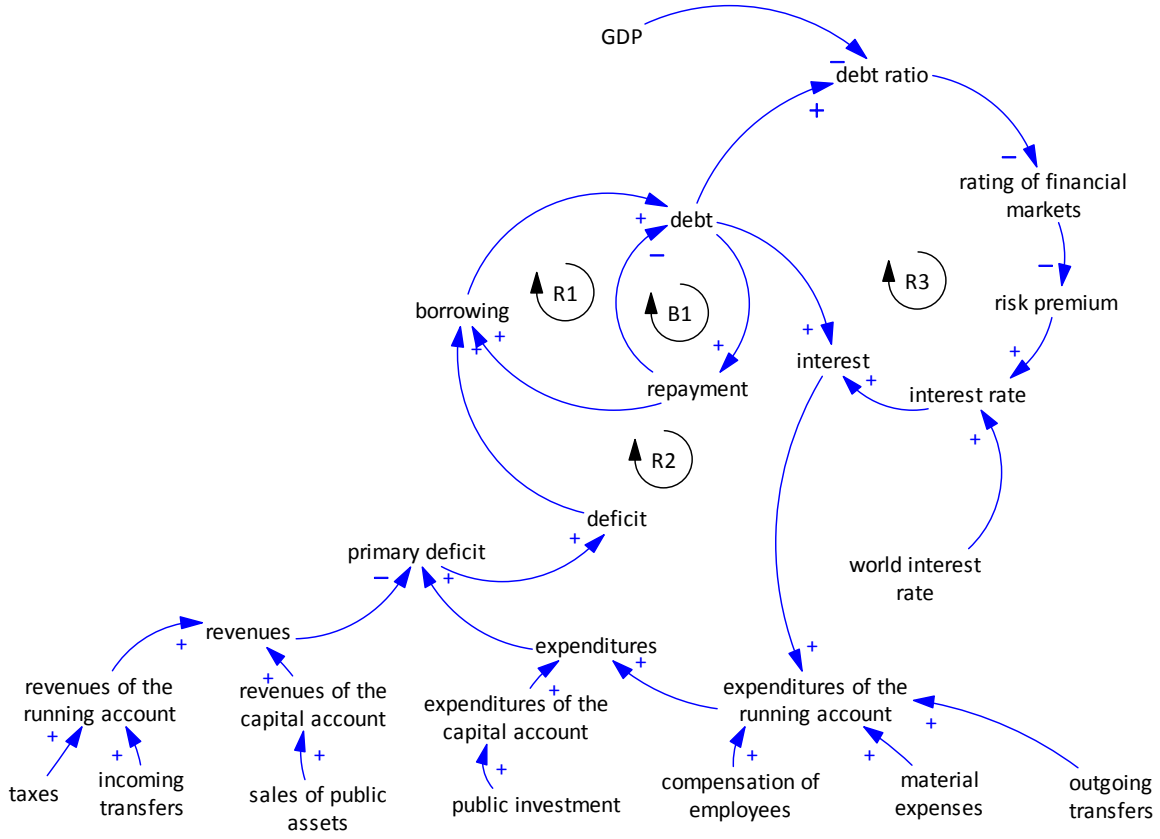


Figure 6: CLD with detailed components of the budget

It would be a questionable undertaking to incorporate such extraordinary events into a SD model because it does not make sense to try to identify feedbacks that lead to singular events like the German unification or the global crisis. But to set the stage for the following discussion of the German debt rule two details should be included in the CLD. First, it will prove helpful for the understanding of the next section to show the components of revenues and expenditures explicitly. Second, we have to note that there is no convincing economic reason for a government to repay its debt completely in the sense of bringing gross debt to zero. In the contrary, an ever growing debt may be judged as sustainable provided the debt to GDP ratio approaches a steady (and not "too high") value. Because, for every given height of national debt the debt ratio decreases as GDP increases, we should include GDP growth in our considerations. Both points are taken into account in Fig. 6

Fig. 6 encompasses the most important categories of revenues and expenditures of the budget. The shown details are important in the discussion of the mechanics and the effects of the debt rule because some forms of revenues and/or expenditures can (more or less) easily be adjusted, but others cannot. For expositional purposes the CLD of Fig. 6 just shows the variable "GDP" in order to display the "cause" of the debt-GDP ratio, but does not explain it.

A quite common way to model the long run development of GDP relies on the textbook version of the Solow-Swan growth model. The basic idea, framed in a SD perspective, is given in Fig. 7.

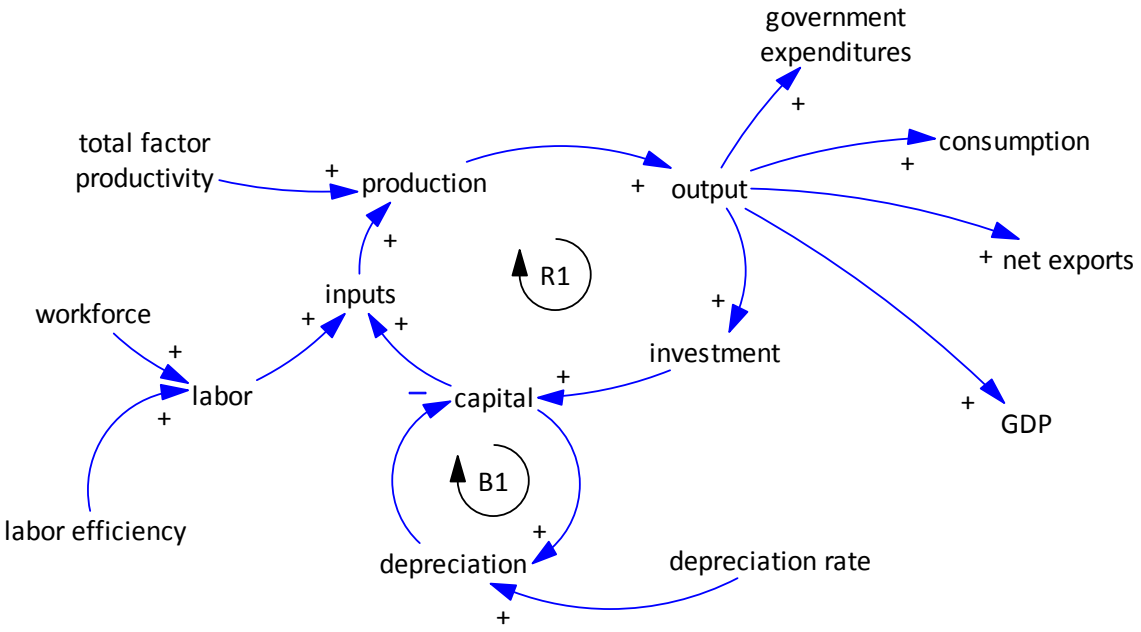


Figure 7: Explaining GDP

From a SD viewpoint the structure of Solow-Swan shown in Fig. 7 is to some extent a "quick and dirty" approach because of the many exogenous variables. The two feedbacks identified in the CLD are easily explained: The balancing loop B1 ensures that the model approaches a global steady state.[11] Sustained growth of GDP depends on the growth of labor which is assumed to be exogenous. Growth of the population and of the labor force can be observed in many developing countries. But in most industrialized countries, in fact, population does not grow. In the absence of growth of labor the GDP approaches in the Solow-Swan model a steady state with constant per capita income. In order to explain the fact of a growing per capita income in industrialized countries the simple neoclassical growth mode uses the "trick" of assuming technological progress With this approach the steady-state growth in per capita income is "explained". Alas, technological progress remains unexplained.[12]

[11] This result depends on the provision that the usual assumptions of the neoclassical growth model hold.

[12] The standard way to incorporate technological progress is to measure labor in efficiency units and to assume technological progress as being labor augmenting. Modern (endogenous) growth theory seeks to overcome this severe limitation of the traditional growth model. Classic contributions to this literature include Romer (1986), Lucas (1988), and Aghion and Howitt (1992). A good introduction to the topic is, e.g., Weil (2009).

3. The German Debt Brake

In 2009 the German parliament enacted an amendment to the German Constitution. Article 109(3) GG requires, in general, a budget balanced in the medium term as well on the federal level as on the state level. There are three exceptions to the general prohibition of financing expenditures by credits.

1. *Cyclical component*. The federal and the state governments are allowed to follow an anti-cyclical fiscal policy over the business cycle. That means, that tax decreases and expenditure increases caused by a downswing of the economy may be compensated by credits. But, as the budget must be balanced over the cycle, the borrowing during the downswing must be repaid in the following upswing.

2. *Emergency component*. In extraordinary emergency situations the federal government as well as the state governments may borrow at the financial markets provided there is a schedule which states how the credits will be repaid. To enact this exception from the general rule, a positive vote of the majority of the members of the *Bundestag* is required.

3. *Structural component*. With respect to the federal level, the requirement of a medium term balanced budget is substantiated in the way that the federal government is allowed to finance expenditures by borrowing up to a volume of 0.35 of nominal GDP per year. With respect to the state level, the state governments are not allowed to raise any "structural" credits.

Almost all economists agree on the welfare increasing effects of cyclical deficits (and hence, in principle, on the need of a cyclical component in the German debt rule). The main argument is quite simple: As all taxes have distortionary effects (i. e. they alter the allocation of goods and factors of production) an increase and decrease of tax rates that tried to follow the up and down of expenditures would be costly in terms of welfare losses. Hence, the prevailing view is to let the automatic stabilizers do their job and to accept deficits in busts that are repaid in booms.

The emergency component has a similar economic background. If there is an unforeseeable emergency situation (a natural catastrophe, e.g.) that requires a big amount of additional public means then it is less distorting (and welfare decreasing) to finance the needs by raising credits instead of increasing tax rates or instead of introducing new taxes. As the possibility to raise credits under exceptional circumstances creates incentives to exploit the debt rule, the barrier (requirement of a positive vote of the majority of the members of the Bundestag) is quite high – at least given the German political system which makes it hard to get such a majority.

The German debt rule does not replace the rules of the Stability and Growth Pact. These are still as valid for Germany as for any other country of the Euro zone. All components are compatible with the SGP. This is also true for the structural component. The SGP requires a maximum deficit of 3 percent of GDP and a debt of 60 percent at maximum (or, if above, a clear tendency to approach this number) but, what is sometimes overlooked, the SGP aims at a *balanced budget* according to the rule "close to balance or in surplus" (CTBOIS) which is seen as fulfilled if the deficit is not higher than 0.5 percent of GDP.

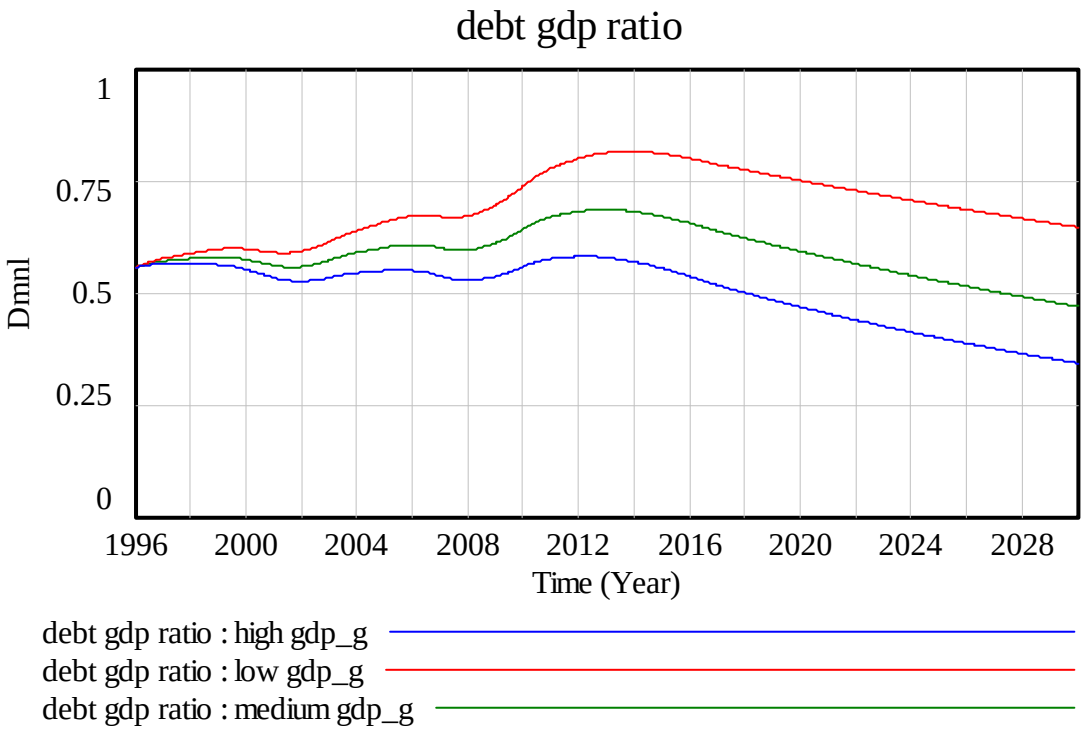


Figure 8: The debt to GDP ratio under different growth scenarios

The effects of the debt brake were simulated. The simulation uses for the period 1996 – 2010 historical data. The Data source is OECD (2010). According to this source, the public deficit of Germany was 161 Billion EUR. The estimates for 2011 and 2012 are 104 Billion EUR and 88 Billion EUR, respectively.[13] The debt brake requires a deficit down to 0.0035 percent of the GDP in 2017. To calculate the level of debt allowed in 2017 we estimated the GDP of 2017 assuming a nominal average growth rate of 3 percent per year. According to this estimate (a GDP of about 3000 Billion EUR) the structural deficit allowed under the debt brake is 10 Billion EUR, approximately. We assume further that the government uses the room the structural component gives. Moreover, in the base scenario

[13] For consistency reasons, all numbers have been calculated as differences of government debt from one year to the year before. It has to be mentioned that the Maastricht deficit is not equal to the difference of the debt, in general.

(medium gdp_g – medium GDP growth), we assume that the growth of nominal GDP continues as before.

Due to these assumptions the value of nominal public debt increases steadily. But Fig. 8 reveals that the debt-to-gdp ratio declines after 2013. A lower growth rate of nominal GDP weakens this process; a higher nominal growth rate of GDP strengthens it. But the general tendency remains the same.

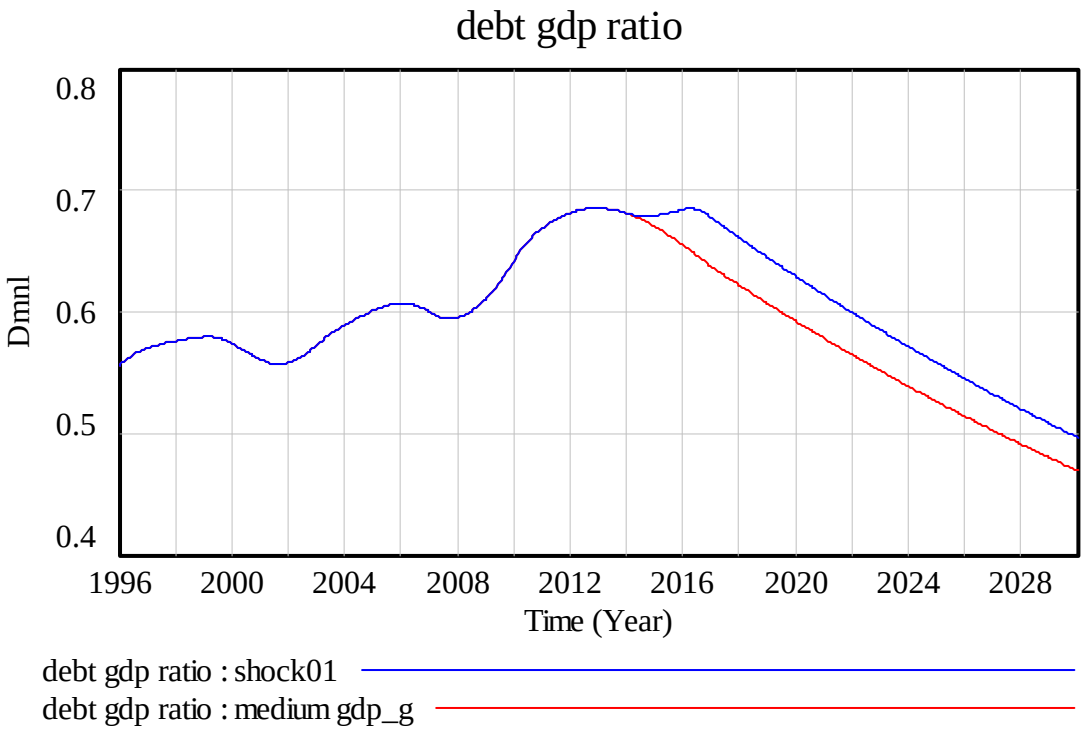


Figure 9: Consequences of a negative shock to the economy

Fig. 9 shows the result of a scenario which assumes a shock to the economy. The shock is modeled as driving up the deficit in two consecutive years (2015, 2016) to values of 80 Billion EUR in each period. Thereafter a return to the debt brake path is assumed. As one can see the shock postpones the adjustment path somewhat but does not alter the general result.

A comparison between the development with and without debt brake is shown in Fig. 10. All runs assume a nominal GDP growth rate of 3 percent per year. The run labeled medium gdp_g is the reference scenario which assumes that the debt rule is completely fulfilled. There are two "business as usual" scenarios: bau01 and bau02; bau01 assumes that the debt brake is not obeyed and that the future nominal deficits are similar to the deficits of the past before the global crisis. (In fact, the data of the years before 2007 were just replicated.) Scenario bau02 is basically the same but the nominal deficit is scaled up by 40 percent to take account of a slight inflation in future time periods. The simulations show that the debt ratio is declining, albeit slowly, if the deficits of the future are the "ordinary"

deficits of the past. Even when we assume that we get the deficits of the past *including* the deficits of the global crisis another time, the debt-gdp ratio remains stable as "crisis" scenario demonstrates.

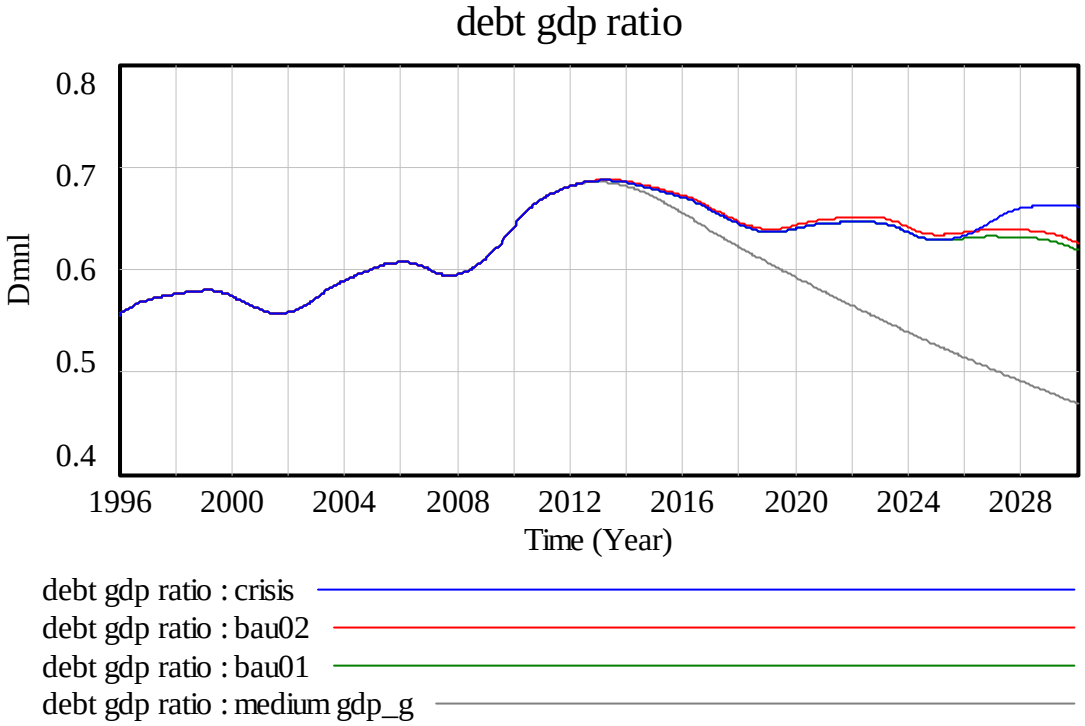


Figure 10: The debt ratio with and without debt brake

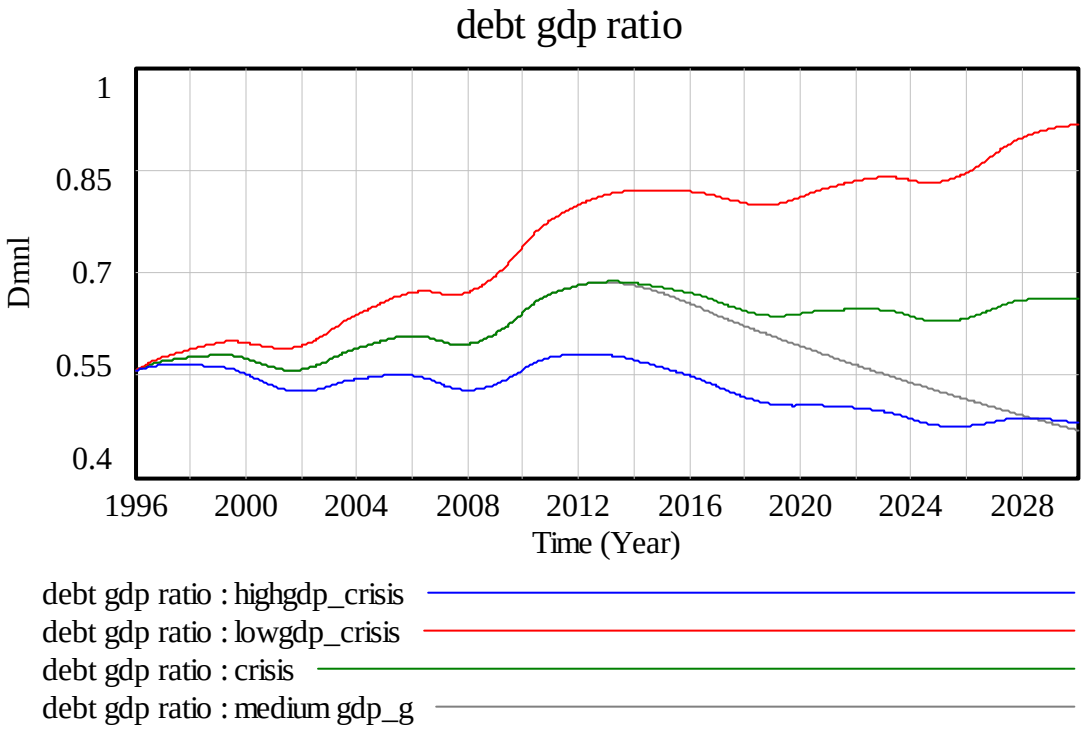


Figure 11: Economic growth and debt rule

Much more important than the adherence to the debt rule is economic growth. Fig. 11 supports this point. The scenarios shown here are: (one more time) the reference scenario medium gdp_g (assuming an economic growth rate of 3 percent per year and adherence to the debt rule); crisis, highgdp_crisis, and lowgdp_crisis. The latter scenarios assume a replication of the heights of public debt seen in the global crisis and growth rates of nominal GDP of 3 percent, 4 percent, and 2 percent, respectively. The simulations show that a low nominal growth of 2 percent per year is not sufficient to keep the debt-gdp ratio stable. This observation reminds us that it is probably more important to keep the growth rate of income sufficiently high instead of concentrating on bringing deficit and debt down. Some observers fear that one of the side effects of fiscal rules like the debt brake is that they hamper economic growth. Besides this, there a number of further criticisms that shed doubt on the effectiveness and the usefulness of the rule. We will now turn to these crticisms.

First, one can argue that there is no need for the debt brake. As we have seen in section 2 the empirical picture is quite mixed. There are countries with a permanently high and/or increasing national debt like Italy or Japan. On the other hand, in countries like the United States or the United Kingdom there have been prolonged time periods in which the debt-to-GDP ratio was declining. A typical pattern is that the deficit increases in extraordinary situations and it declines if the economic growth is robust. The cyclical component and the emergency component of the debt brake do not exclude this pattern.

The need for a debt rule was, inter alia, based on the argument of gaining better ratings in the financial markets. The better ratings should lead to lower interest rates, and a, hence, to less interest expenditures. This argument has only little substance: the interest rate the German government has to pay is very low compared to most other nations. And there are no signs that the introduction of the debt brake has lowered the interest rate any further.

Second, there are fears that the debt rule if obeyed strictly will lead to lower economic growth and to more unemployment. The argument behind this view is as follows: The debt rule does not differentiate between public investment and public consumption. In trying to bring the deficit down to the level required by the debt brake mainly investment expenditures reduced leading to a comparatively smaller public capital stock. But a smaller public capital stock (a less effective infrastructure, e.g.) hampers the productive work of the private sector.

It is this second viewpoint that is especially relevant for the effects of the German debt brake for the Bundesländer (states). These effects have been attracted only very limited attention in the evaluation of the debt rule. In the following section we will use a qualitative SD approach to foster the discussion.

4. Effects of the debt rule on the state level: The case of Saarland

As already stated at the beginning of the last section, the German debt brake is a rule binding not only the federal government but also the governments of the federal states, the *Bundesländer*. The cyclical component and the emergency component are effective to the Bundesländer as well. In contrast, the structural component is not valid on the state level. Thus the Bundesländer have to balance their budget exactly. The amendment to the constitution requires the balanced budget starting with the year 2020. Until this point of time, there is a transition period which should foster a smooth path from a current deficit position to the balanced budget. As with the regulations to the central government the debt brake does not aims at reduction of the nominal debt but at a decrease in the debt-to-GDP ratio. A balanced budget implies approaching a zero debt-to-GDP ratio in the long run.

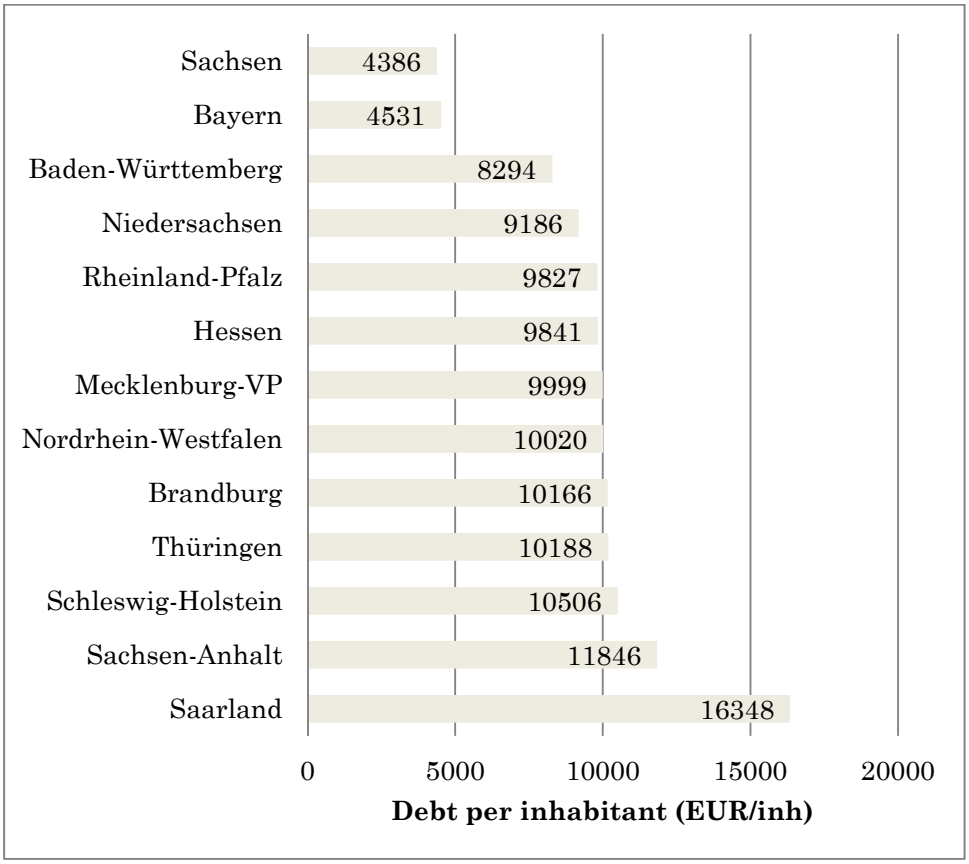


Figure 12: Public debt of the German states (Euro per inhabitant) (Source: Statistisches Landesamt Baden-Württemberg 2010)

An important aspect of the evaluation of the debt rule effects on the state level is the fact that the debt burden differs widely between the Bundesländer. Fig. 12 shows public debt of the Bundesländer per inhabitant for 2009. As the Saarland

has to bear the highest debt burden, we will use it as an example for our further considerations.

The German debt rule encompasses financial support for the economically weakest Bundesländer on their path of transition. The support totals to an amount of 7.2 Billion EUR over the period from 2011 to 2019. This is equivalent to a sum of 800 Million EUR per year. Of these 800 Million EUR 260 Million EUR are allotted to the Saarland. The financial aid is given under the provision of credible consolidation activities that lead to a balanced budget in 2020. In 2009 the deficit of the Saarland was about 700 million EUR. The debt amounted to nearly 11.000 million EUR. The revenues of the Saarland were 2.899 million EUR, of which 2044 million EUR were taxes and 793 million EUR were transfers. The point is that the state government has nearly no leeway to decide autonomously on taxes or transfers. The most important positions on the expenditure side were compensation of employees (2.038 million EUR), operating expenditures (1.048 million EUR), and interest (529 million EUR). Investment expenditures were 44 million EUR.

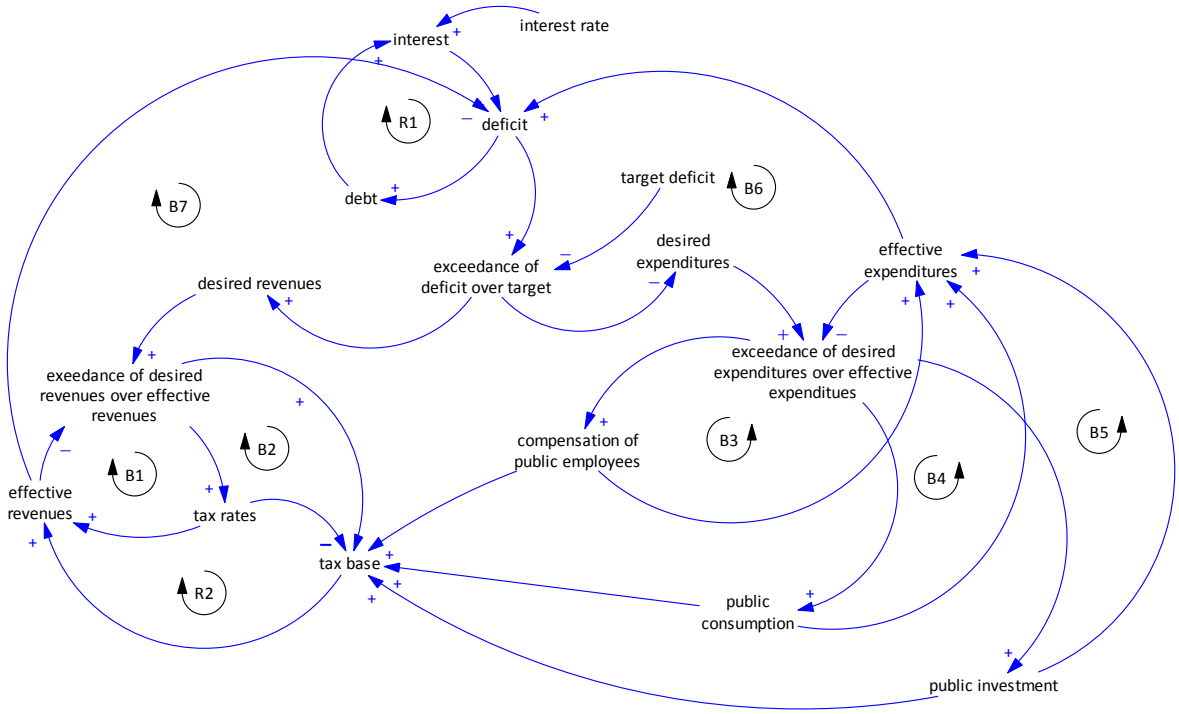


Figure 13: Budget feedbacks and the debt rule

Fig. 13 identifies the important loops which help to evaluate the effects of the debt brake on a structural weak federal state like the Saarland. There are two reinforcing loops and seven balancing loops. Loop R1 reflects the debt spiral already discussed above. Loop R2 may be called the tax erosion loop as it emphasizes the fact that an increase in tax rates (in order bring effective

revenues closer to the desired level) erodes the tax base because the tax increase is an incentive to avoid the economic activity which is taxed.

The loop B1 describes the balancing effect of an increase in the tax rate, given the tax base. This loop helps to decrease the discrepancy between desired and effective revenues. On the expenditure side there are three balancing loops, all working in a similar way. Therefore, the interpretation is limited to loop B3. If desired expenditures exceed effective expenditures one way to decrease the discrepancy is to increase the compensation of public employees (either by increasing the salaries or by employing more people). This will increase effective expenditures and narrow the gap. Analogously, the gap can be narrowed by increasing public consumption or public investment.

The discrepancy between desired and effective levels of revenues and taxes is caused by the exceedance of the deficit over its target value. An increase in revenues or a decrease in expenditures helps to lower the discrepancy. The target deficit is given by the requirement of the debt rule. As the Saarland runs a substantial deficit in the actual situation the exceedance of desired revenues over effective revenues is positive but the exceedance of desired over effective expenditures is negative. Hence, to narrow the gap the compensation of employees, public consumption, and public investment have to be decreased.

Given a deficit of 700 million EUR, interest expenditures of about 530 million EUR the primary deficit is approximately 170 million EUR. The transfers of 260 million EUR are only of limited assistance. To get to the path required by the debt rule the Saarland would have to increase tax revenues and to decrease expenditures by a large amount. Will this be possible? And what are the consequences of striving to reach the goal of a balanced budget? As said before, the German states have nearly no way to influence the revenue side of the budget. But their possibilities to influence the expenditure side are also limited. Most of the compensation of employees is fixed by long running contracts. The same is true for operational expenses. The only category that encompasses somewhat more flexible expenditures is investment. Hence it is likely that in order to decrease public spending the government will cut back investment. This in turn will decrease future prosperity (and future tax revenues).

4. **Conclusion**

As a consequence of the global economic crisis in most nations the public debt has increased substantially. This increase has raised concerns of policymakers, media, and the public. In Europe, the credit crisis of Greece, Ireland, Portugal, and Spain has drawn special attention to ways to handle the debt problem.

Following the Swiss example, Germany has introduced the so-called debt brake as an amendment to its constitution in 2009.

In order to evaluate some of the effects of this policy measure we employed a system dynamics approach. In section three of this paper we used a Vensim model to simulate the effects of the debt rule under ideal conditions. A subsequent verbal discussion pointed to shortcomings of an analysis limited to the debt brake "mechanics".

Section four focused on an aspect of the debt break, widely neglected in the discussion so far. The debt brake is not only relevant for the central government but also for the state governments. A qualitative system dynamics approach revealed important weaknesses of the German debt brake with respect to the underlying structural problems that cause the deficits of some of the German states. Further research should elaborate on these structural problems in extending the qualitative analysis and in developing appropriate simulation models.

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