CPB Netherlands Bureau for Economic Policy Analysis

Macro-volatility puts debt at risk | *Response to setbacks required*

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Early-warning indicators for debt sustainability

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Summary

This CPB Policy Brief develops a simple dynamic framework for assessing the sustainability of public finances over a medium-term horizon. This framework takes account of economic uncertainty underlying the evolution of public debt, and incorporates a comprehensive measure of the responsiveness of fiscal policies to economic setbacks. This allows us to assess the degree to which governments are in control of their finances. Using stochastic simulations, we derive 'early warning' indicators for financial stability, looking at both the expected evolution of public debt and the degree of uncertainty around this path. This approach is then used to assess the position of nine OECD countries in 2007 (thus, prior to the debt crisis); our results show that these indicators clearly distinguish countries that have sustainability concerns (Italy, Spain and Portugal) from those that do not (the US, the UK, the Netherlands and Belgium).

Nederlandse Samenvatting

In deze CPB Policy Brief presenteren we een eenvoudige dynamische benadering voor de beoordeling van de stabiliteit van overheidsfinanciën op de middellange termijn. Of en wanneer een schuldencrisis zich voordoet, is moeilijk te voorspellen. Wel kunnen de risicofactoren in beeld worden gebracht door modelsimulaties voor de overheidsfinanciën. Belangrijke determinanten zijn de mate van economische onzekerheid en de kwaliteit van het budgettaire beleid. Beide factoren bepalen in hoeverre de overheid 'in control' is over haar financiën. Met behulp van stochastische simulaties kunnen 'early warning' indicatoren voor de stabiliteit van de overheidsfinanciën worden afgeleid. Toepassing op de situatie in negen OESO-landen in 2007, dus vóór de crisis, geeft een duidelijk onderscheid tussen de landen met potentiële stabiliteitsproblemen: Italië, Spanje en Portugal, en landen met stabiele overheidsfinanciën: de VS, het VK, Nederland en België.

[1] This CPB Policy Brief is based on Lukkezen and Rojas-Romagosa (2012), and draws on Lukkezen and Rojas-Romagosa (2013). We thank participants at the Euroframe conference 2012 for their comments, and Nico van Leeuwen for excellent research assistance.
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1 Assessment of public finances

Assessment of public finances is no easy task. Recent experience in Europe underscores how hard it is to foresee sovereign debt crises, with regard to both occurrence and depth. Simple parameters, such as the size of the budgetary deficit or the level of public debt, are useful for monitoring the current state of government finances, but provide little insight into their future sustainability. Other factors are as least as important - in particular, the stability of the economic environment and the quality of fiscal policymaking. This policy brief presents a simple comprehensive framework to take account of these factors in the evaluation of the sustainability of public finances over a medium-term horizon.

Insight into the sustainability of public finances is essential to European policymakers and financial markets alike. It is key in decisions concerning the speed of fiscal consolidation, the need for reform and the determination of the appropriate risk premium on government debt. Furthermore, given the integrated nature of the European economies, unsustainable public finances in one member state may cause significant spillovers[5], which highlights the need for fiscal surveillance. There is considerable debate, however, on how to measure fiscal policy sustainability.

Often, static indicators such as the size of public debt or the budget balance are used to assess government finances in the short- and medium term.[6] While these indicators are straightforward and unambiguous, they provide little information on the uncertainties facing public finances in the years to come. Also, these indicators neglect the role of the policymaker in controlling public debt. For the long term, the European Commission employs long-range projections to assess the sustainability of public finances against the background of ageing populations. Essentially, these projections are static as well, since they take the economic policy arrangements and the economic environment as given. There is ample evidence, however, that the responsiveness of fiscal policy to economic setbacks and the quality of fiscal institutions are essential to debt sustainability.

We develop a dynamic, forward-looking framework to assess the stability of public finances in the medium term. Our approach entails a simple, practical stochastic simulation approach that incorporates the fiscal policy reactions of governments in each of the countries. The framework is stylized and focuses on the three key variables that determine debt dynamics: the interest rate, the growth rate of gross domestic product (GDP) and the stance of fiscal policy.

[5] For an overview of direct spillovers, see Lejour et al. (2011); for spillovers via contagion, see Arezki et al. (2011); and for spillovers via monetary policy, see Beetsma and Giuliodori (2010) and the references therein.

[6] European Commission (2012b) gives an overview and analysis of short-term indicators for debt sustainability, and has a website (http://ec.europa.eu/economy_finance/economic_governance/index_en) providing an overview of European regulations and directives based on such indicators. Long-term indicators stem from ageing studies (European Commission, 2012a). And proposals for early warning indicators that do take economic uncertainty into account are being developed; see Berti et al. (2012). Finally, Medeiros (2012) and Berti (2013) have developed an approach quite similar to ours using quarterly data and focusing on a shorter projection horizon.

Using stochastic simulations we assess how well the government is able to control the evolution of debt. This can be measured by the potential increase in debt in bad states of the world. If this potential increase in debt is large, the government cannot be regarded as in control of its public finances and default fears cannot be dismissed as irrational. After all, when the indicator is large, the debt level could rise significantly. Together with the prediction of average (median) debt levels - also following from the simulations - this offers a dynamic, forward-looking framework for the evaluation of public finances.

Countries with less volatility and larger responsiveness of fiscal policy to economic setbacks perform better, according to our indicator. We apply this approach to nine OECD countries, and show that in 2007 these indicators clearly distinguish countries that have sustainability concerns (Italy, Spain, Portugal and Iceland) from those that do not (the US, the UK, the Netherlands, Belgium and Germany).

Our approach helps to assess whether a country is 'in control' of its public finances. It does not predict the actual occurrence of a debt crisis; the dynamics of a debt crisis are far too erratic and unstable for that. Several self-reinforcing mechanisms are at play: the very fear of a sovereign default may lead to a bad equilibrium via a spiral of rising interest rates, falling GDP and further deteriorating government finances. When markets anticipate that a government is no longer willing or able to take the actions necessary to restore sustainability, the country may be excluded from the international capital market - leading to a liquidity crisis, possibly followed by a default. Furthermore, our indicator should be regarded as a complement - not as an alternative - to other indicators, such as the debt level and the long-term sustainability of public finances. The merit of our indicator is that it assesses the uncertainties in the future evolution of public finances. In this respect it can be regarded as a first step towards a more full-fledged risk analysis of government finances.

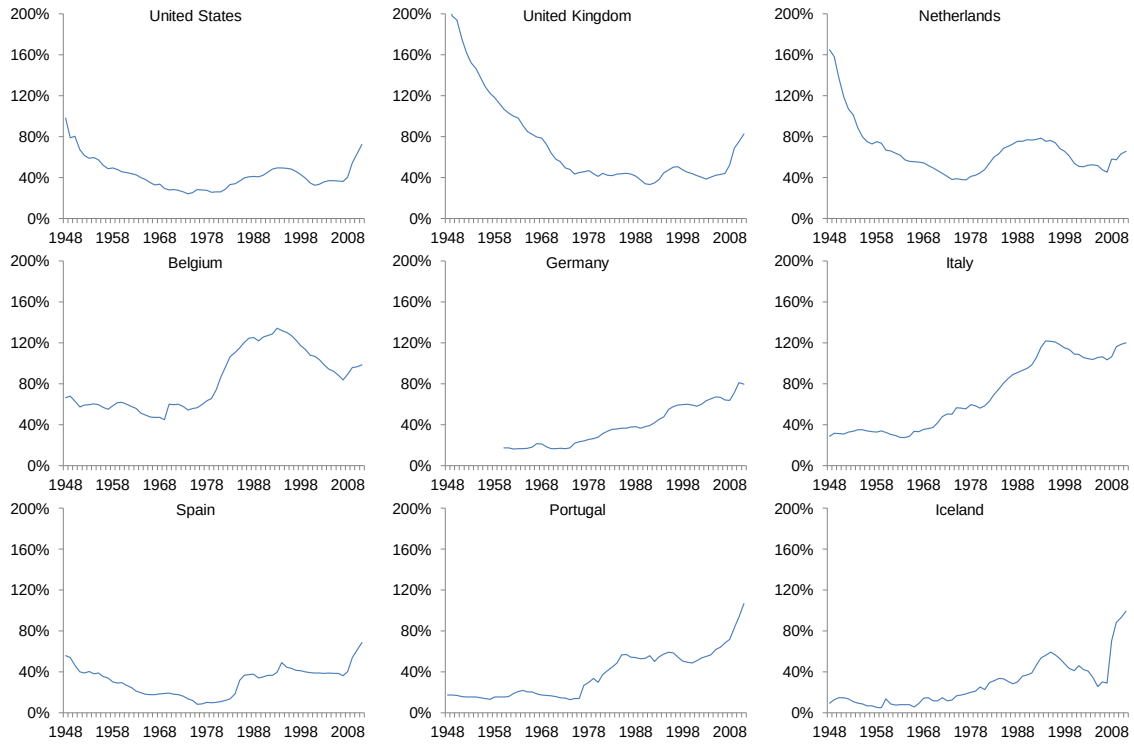
2 What determines debt sustainability?

When assessing the stability of public finances in a particular country it is insufficient to take into account only the size of the budgetary deficit and the height of public debt. Some countries manage well with substantial debts and deficits, while others plunge into a crisis with fairly mild deficits and debts. Moreover, not only economic circumstances are relevant; it is much easier, for example, to maintain a certain level of debt in an environment of thriving economic growth, as in many European countries in the decades after World War II. Also, it is important how well governments are able to cope with setbacks in their public finances. Countries differ widely in fiscal discipline and with regard to the quality of fiscal institutions. Finally, also the stability of the environment is important; in times of great economic uncertainty it is obviously harder to maintain control of public finances than in a more tranquil environment.

Figure 1 presents the evolution of public debt, for the post-war period, in nine OECD countries: the United States (USA), the United Kingdom (GBR), the Netherlands (NLD),

Belgium (BEL), Germany (DEU), Italy (ITA), Spain (ESP), Portugal (PRT) and Iceland (ISL).[7] [8] Five countries (the US, the UK, the Netherlands, Belgium and Spain) began with high debt levels after the war. These levels declined sharply afterwards, but increased again later, especially in the last decade. The other countries (Germany, Italy, Portugal and Iceland) began the period with relatively low debt levels, and experienced steady increases in debt.

Figure 1 Debt-to-GDP ratios in the post-war period



The evolution of these debt-to-GDP ratios is determined by the interest rate on public debt, the growth rate of GDP, budget surpluses and the past debt level. As explained in the box *The modified Aaron condition*, higher interest rates increase the growth of debt levels, whereas higher growth rates and a stronger responsiveness of the budgetary policy to debt tend to reduce debt growth.

The responsiveness of budgetary policy is measured by the reduction in the government deficit (or the increase in the surplus) for any euro increase in debt. We will henceforth call this the *fiscal response*. A positive fiscal response means that we may expect governments to take actions to reduce the deficit (or increase the surplus) when the debt ratio rises.

[7] Description of the data and data sources in Lukkezen and Rojas-Romagosa (2012). To ensure comparability with the literature we show gross federal debt levels for the United States in Figure 1, and base our analysis on federal debt in hands of the public. We assume government holdings of federal debt remain unchanged, and show gross federal debt levels. Note that the vertical scale can be different across countries.

[8] We focus on these countries as they have sufficiently long time series to estimate our model. Time series of at least 40 years are necessary, as they should span several business cycles and contain periods of increasing and decreasing debt levels in order to achieve reliable results. Coefficients are stable over time periods longer than 40 years; see Lukkezen and Rojas-Romagosa (2013). Thus, we interpret these coefficients as reflecting institutional variables.

The modified Aaron condition

A simple starting point for analysis of debt dynamics is the accounting equation that states that the change in debt depends on the primary balance *PB* and the interest payments on government debt corrected for the growth rate of GDP:

$$\Delta D = (r - g)D - PB$$

Here, *D* represents debt, *r* the interest rate, *g* the growth rate and PB the primary balance, which is the balance of government revenues and outlays excluding interest payments on public debt. Both debt D and the primary balance PB are measured as a ratio to GDP.[a] The growth rate *g* enters into this equation because a higher growth rate tends to reduce the debt ratio. This is because a higher growth of GDP raised the denominator of the debt - GDP ratio.

This equation allows us to decompose the increase of the debt ratio into three factors and their underlying processes. Both the interest rate and the growth rate vary over time, depending on economic circumstances. Also the government budget is subject to changing circumstances. Governments do not normally passively wait to see how their debt evolves over time. We can expect that governments put effort into curbing the growth of debt when it is rising (and reversely so, if debt is falling). This is reflected in the policy response function:

$$PB = a + bD$$

where *b* measures the response of the primary balance to debt, and *a* denotes the other determinants of the primary balance.

Finally, taking these two equations together yields

$$\Delta D = (r - g - b)D - a$$

This result summarizes the determinants of debt dynamics for the government. The crucial factor is the sign of the term (r - g - b) in front of the debt variable. If r - g - b > 0 (that is, if the interest rate exceeds the sum of the growth rate and the fiscal response coefficient), then debt is intrinsically unstable: a rise in *D* leads to a further acceleration of the growth of debt, which means that debt is on a potentially explosive path. If r - g - b < 0 (that is, the interest rate does not exceed the sum of the growth rate and the fiscal response coefficient), then the time path of debt is intrinsically stable; the growth of debt diminishes as debt is larger, eventually coming to a halt. The condition for stability r - g - b < 0 can be interpreted as a modified version of the Aaron condition, which is usually stated as the condition that the growth rate should exceed the interest rate, r - g < 0.[b]

Notes:
[a] The interest rate and the growth rate should both be measured in either real or nominal terms.
[b] The Aaron condition is stated as the real growth rate minus the real interest rate in Aaron (1966). Aaron shows that if this condition is satisfied a pay-as-you-go social security system improves welfare.

A zero or negative value indicates that governments fail to respond effectively, or even have a perverse reaction of increasing the deficit when debt increases (labeled *fiscal fatigue* by Ghosh et al. 2013). The fiscal response is thus important to the stability of government finances. For each individual country the fiscal response turns out to be quite stable over time, and can be viewed as a measure of the strength of fiscal institutions.[9]

If interest rates do not exceed the sum of growth rates and the fiscal response on average, then the modified Aaron condition is satisfied and the debt ratio is stable in the long run.[10]

[9] Countries with stronger fiscal institutions have higher cyclically adjusted budget balances (European Commission 2009) and lower volatility of government spending (Albuquerque 2011), implying that they respond more vigorously to deteriorating economic conditions.
[10] The stability of the debt-to-GDP ratio can be tested directly using unit root or cointegration tests. See Afonso (2005) for a survey of these types of studies. The test results, however, are both unreliable and not informative (Bohn 1998). They are

Then, after a shock, the debt level will return to a stable value again. Conversely, if interest rates on average exceed the sum of growth rates and the fiscal response, then a higher debt level will lead to further increases in debt, and will eventually end in a spiral of ever-increasing interest payments and higher debt levels. In this unstable case the beneficial effect of the growth rate and the policy response will be insufficient to offset the destabilizing impact of the interest rate.

3 Fiscal response crucial for debt stability

Figure 1 reveals quite different patterns for the public debt in individual countries. Following Bohn (1998, 2008), we can assess the underlying sustainability of public finances during this period using estimates for the fiscal response of each country over a longer period,[11] and relating these to average interest rates and growth rates during that period to see whether the modified Aaron condition was satisfied. The analysis is performed on a per-country basis using this common framework.[12]

Table 1 presents each country's estimated fiscal response, as well as its average interest rate and growth rates, both in real terms. We find that for most countries growth rates exceeded interest rates on average, which satisfies the original Aaron condition ($r - g < 0$). This means that debt levels were stable even without a significant stabilizing response of policy. Exceptions are Belgium and Germany, where the interest rate exceeded the growth rate. Next, looking at the policy response, we find statistically significant fiscal responses for the US, the UK, the Netherlands, Belgium, Germany and Italy. For Spain, Portugal and Iceland the response is found not to be significant, suggesting that these countries may lack solid stabilizing fiscal policies. We find that the modified Aaron condition (interest - growth – fiscal response < 0) is satisfied for all countries in the first group, indicating that debt is fundamentally stable. For the three countries without a significant policy response, the original Aaron condition is already satisfied.

unreliable because unit root tests have very low power in distinguishing unit root from near unit root alternatives, and they are not informative, as the test outcome does not inform via which channels stability is achieved. Finally, unit root tests provide a stationary picture and provide no information on the future evolution of the debt level. For this purpose a simulation exercise is needed.

[11] We estimate the response function $s_t = a + bd_t + \beta z_t$. Here s_t is the primary surplus to GDP ratio, d_t the debt-to-GDP ratio and z_t represents all other factors that may affect the primary surplus; a and b are constants.

[12] Panel data may offer an alternative, when the long time series required for a country-specific analysis are not available; see Mendoza and Ostry (2008) for an application. However, panel data provide no information about country-specific debt sustainability.

Table 1 Modified Aaron condition for stability of public debt[13]

	USA	GBR	NLD	BEL	DEU	ITA	ESP	PRT	ISL
	1948-2009	1946-2011	1946-2011	1955-2011	1970-2011	1946-2011	1946-2011	1945-2011	1946-2011
Interest rate *r*	2.2	1.5	2.1	4.4	3.6	-1.2	-0.1	-3.6	-5.4
Growth rate *g*	3.2	2.2	3.7	2.8	2.5	4.4	4.2	3.8	5.3
Aaron cond. *r-g* (<0)	-0.9	-0.7	-1.6	1.6	1.0	-5.5	-4.3	-7.3	-10.7
Fiscal response b	7.8***	4.5***	7.7***	3.8***	2.6*	7.1***	*0.5*	*-0.5*	*-0.2*
Mod. Aaron cond. *r-g-b* (<0)	-8.7	-5.2	-9.3	-2.2	-1.6	-12.6	*-4.8*	*-6.8*	*-10.5*

Units are percentages; italic and grey = not significant, * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level.

In the post-war period most countries benefited from high growth rates relative to the interest rates on average.[14] All countries, however, experienced a steady decline in real growth rates and a steady rise in real interest rates, factors that may have led to the erosion of public finance sustainability. Table 2 shows the Aaron condition before and after 1987. In the first period, growth rates exceeded interest rates significantly in all countries, except for Belgium. However, this changed dramatically in the period after 1987, where the interest rates exceeded the growth rates for most countries. From 1995 onwards this goes without exception.

Table 2 Aaron condition (*r-g* < 0) no longer satisfied in many countries after 1987

	USA	GBR	NLD	BEL	DEU	ITA	ESP	PRT	ISL	Average
Aaron condition before 1987	-2.2	-2.0	-3.2	0.9	0.0	-7.3	-8.8	-9.7	-15.2	-5.3
Aaron condition after 1987	1.1	1.3	2.0	2.1	2.4	2.0	4.1	-2.6	-2.7	1.1

Units are percentages.

Accordingly, as the Aaron condition has not been satisfied over the last 25 years, solid fiscal responses have been essential for debt sustainability. For countries lacking a solid fiscal response, the reversal of the Aaron condition in the 1980s was one of the basic factors underlying the regime shift from falling debt ratios to rising debt ratios, as documented by Reinhart and Sbrancia (2011).[15]

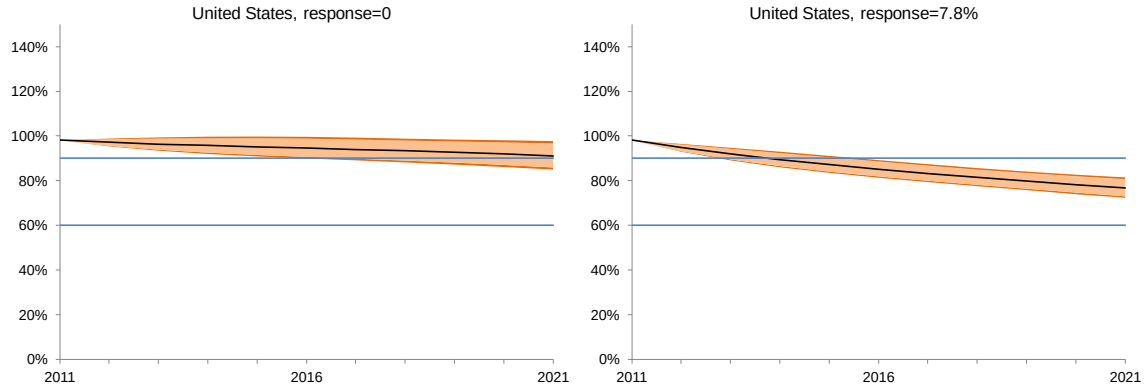
[13] The policy response of the United States decreases significantly when 2010 and 2011 are included. This may imply a structural break in the fiscal stance towards debt or it may indicate that the US government has a delayed response to debt increase which has yet to materialize.
[14] We use effective interest rates, which equal interest paid / debt outstanding. They are generally somewhat lower then the yields on 10 year government benchmark bonds.
[15] It may be noticed that, for this same reason, this period represented the 'golden episode' of funded pension systems, which clearly benefitted from the high interest rate relative to the growth rate.

4 Are governments in control of debt?

Debt developments are uncertain by nature and depend on many shocks that may hit the economy. Medium-term financial assessment therefore requires a stochastic simulation framework that provides insight into the evolution of debt in different - uncertain - states of the world, while incorporating country-specific elements. We follow the method proposed by Celasun et al. (2006) and Budina and van Wijnbergen (2008), which simulates interest rates and growth rates, taking account of the uncertain nature of these variables, based on estimates for each country separately.[16] The method combines these simulated interest rates and growth rates with the estimated fiscal response in order to determine the evolution in the debt ratio. Using multiple simulations yields a distribution of possible time paths for future public debt-to-GDP ratios. This distribution can be characterized by the median for the debt ratio and the confidence interval around this value.

Figure 2 plots these debt distributions over time for the next ten years, per country. Our starting point is the state of the economy at the end of 2011. The left-hand part of the figure shows the simulation without a fiscal response, whereas the right-hand part shows the simulation with the estimated fiscal response. No significant policy responses were found for Spain, Portugal and Iceland; for illustrative purposes we simulated the right-hand part of the figure for these countries with an assumed policy response of 7 percent, similar to such countries as the US, the Netherlands and Italy. The black line is the median and the colored areas indicate uncertainty in the projections; 90 percent of the stochastic debt paths remain within the light orange area, and 95 percent are within the light and dark orange areas together. The scale is the same in all graphs, so that countries can easily be compared.

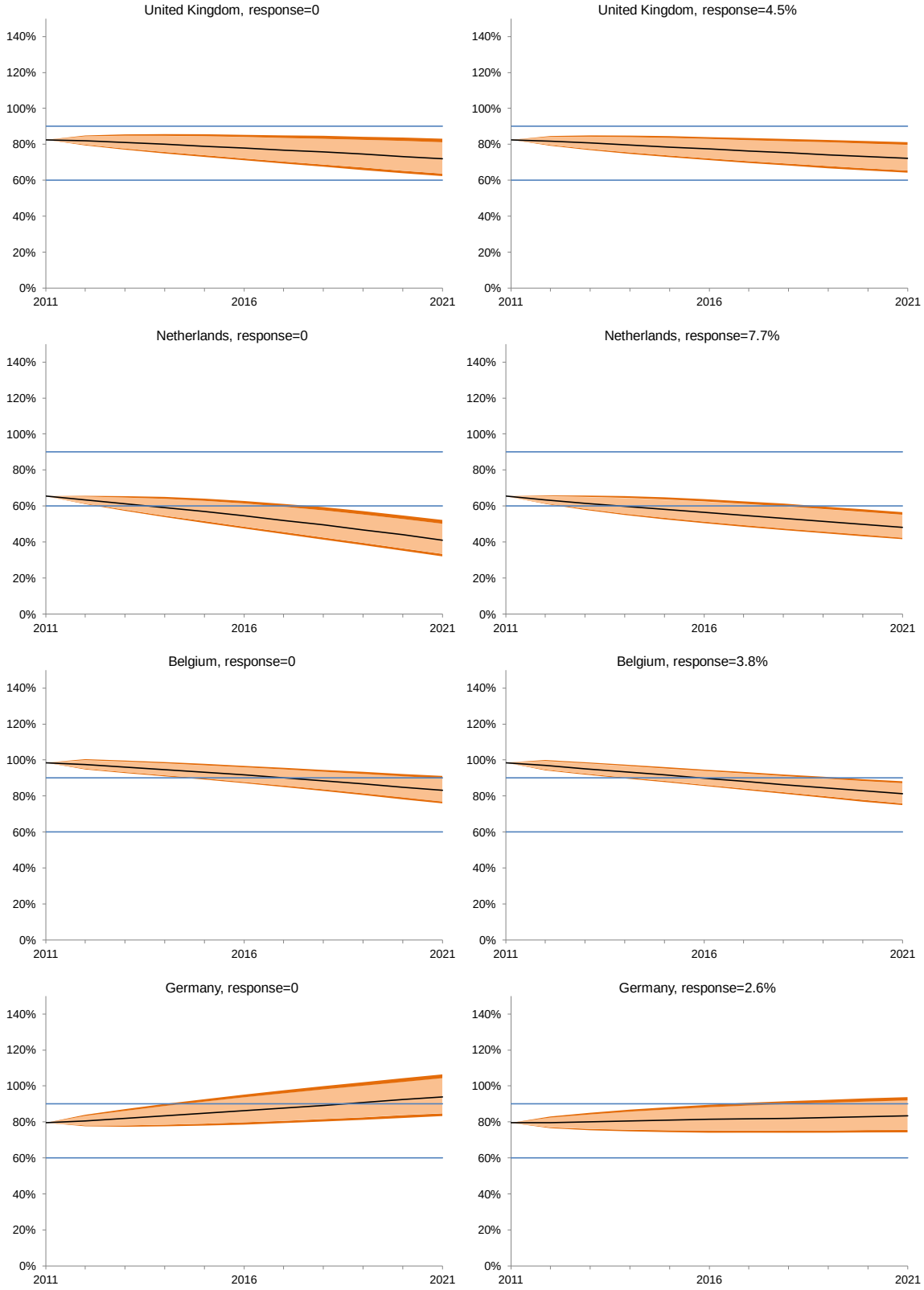
Figure 2 Simulated debt paths, without (left) and with (right) fiscal response



Notes: Debt levels in percent of GDP. The black line is the median debt path, the light orange area contains 90 percent of the debt paths, the light and the dark orange area contain 95 percent of the debt paths and the blue reference lines are at 60 and 90 percent respectively.

[16] This method simulates interest and growth rates using a vector autoregressive model; see equation (8) in Lukkezen and Rojas-Romagosa (2012).

Figure 2 (continuation): Simulated debt paths, without (left) and with (right) fiscal response



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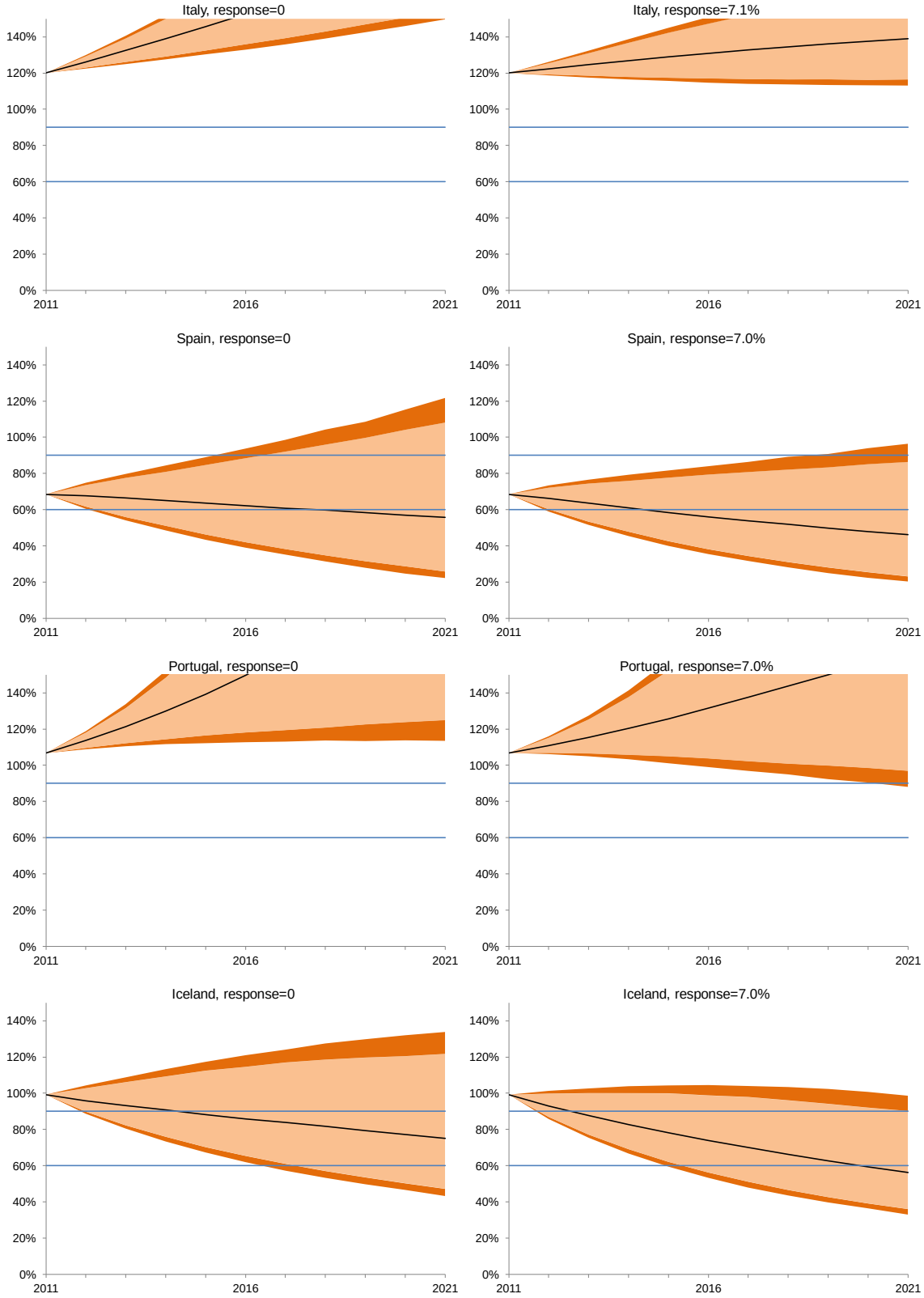


Notes: Debt levels in percent of GDP. The black line is the median debt path, the light orange area contains 90 percent of the debt paths, the light and the dark orange area contain 95 percent of the debt paths and the blue reference lines are at 60 and 90 percent respectively.

Comparison of the results in the left-hand and right-hand panels reveals that a positive policy response tends to stabilize public debt, in both an upward and a downward direction. Also, uncertainty diminishes as the orange interval narrows. Whether debt converges to a steady state depends on the modified Aaron rule. For all countries with significant policy responses, debt accumulation becomes stable in the long run. The level to which debt converges depends on the stance of fiscal policy together with the interest rate and the growth rate.

Three countries feature high uncertainty. Spain, Portugal and Iceland are particularly at risk, as they did not have a history of robust policy responses (i.e. significant fiscal response coefficients). This means that the right-hand side graphs for these countries are not to be expected from past experience; the right-hand side graphs merely illustrate the significant difference that robust policy responses could make. For Spain, the underlying economic dynamics are unfavorable as well, with low growth relative to the interest rates, leading to a strong tendency for debt to grow. In the other group of countries (those with significant policy responses), Italy seems to be most at risk, featuring the widest bands - mainly due to the high initial level of public debt, and not determined so much by its growth and interest rate volatility, or its fiscal response.

These simulations are based on observed behavior of interest rates and growth rates until 2011. The current debt crisis is represented by only a few observations in these data. In that respect, the simulations feature the dynamics of debt in more or less normal times. We deliberately do not take account of the impact of the size of debt on interest rates caused by speculations on default, and the risk of a vicious debt–interest rate spiral (De Grauwe 2012, Corsetti et al. 2013). The aim of our analysis is not to describe debt dynamics during a crisis, but rather to develop an early warning system for fiscal policy in normal times - precisely to avoid such a debt crisis. Our simulation results (and thus the indicators) are robust when the observations after 2007 are omitted from our dataset.

5 Indicators for debt sustainability

Using these simulations we derive a comprehensive indicator for assessment of fiscal policy. The ‘at risk’ indicator measures the degree to which governments are in control of their public finances by estimating the risk of a significant debt increase in the near future. Our indicator is constructed as follows:

1. The expected debt level in ten years is the median debt path in the simulation.
2. An expected probable upper bound for the debt level in ten years is the path that is higher than 97.5% of the debt paths in the simulation.
3. Our 'at risk' indicator, which measures the deviation of the upward dispersion in the simulation, is the expected probable upper bound minus the expected debt level in ten years.

Thus, the 'at risk' indicator measures the possible increase in debt that might happen with a probability of 2.5%. In 97.5% of the cases debt remains below this bound. Admittedly, the choice of the exact parameters is arbitrary. We have experimented with several time intervals and thresholds, but this does not change our results qualitatively.

Alternatively, we could calculate the probability that the future debt level exceeds some particular threshold - above which the debt level is expected to have a negative impact on the economy.[17] We choose not to do so. Several studies have recently focused on determining such a threshold.[18] Such a threshold needs to be country specific, however, for it to be economically meaningful. At the present state, it does not seem possible to determine such a country-specific threshold from the data.

Table 3 Debt sustainability indicators, 2011–2021

	2011	2021			
		No fiscal response		Fiscal response	
	Initial debt	Median debt	'At risk'	Median debt	'At risk'
USA	102	*95*	*6*	89	6
GBR	82	*73*	*10*	73	9
NLD	65	*44*	*11*	50	8
BEL	99	*85*	*7*	83	6
DEU	80	*92*	*12*	83	11
ITA	120	*182*	*48*	137	33
ESP	68	56	59	*42*	*39*
PRT	107	199	167	*132*	*110*
ISL	99	78	54	*50*	*33*

Note: Debt levels and indicators in percent of GDP. Italic and grey = counterfactual.

The numbers in Table 3 correspond to the simulations in Figure 2. The second column reports the debt level at the end of 2011, the third and fourth columns are from the left panel in Figure 2 and lack a fiscal response, and the fifth and sixth columns are from the right panel in Figure 2 and include a fiscal response. The third and fifth columns present the median debt ratio in 2021, the end of the ten-year period which starts in 2011, and the fourth and sixth columns report the 'at risk' indicator measuring the size of a potential debt increase.

The median debt decreases for 6 countries (US, UK, Netherlands, Belgium, Spain and Iceland) and increases for 3 countries (a small increase for Germany, a sizeable one for Italy and a large one for Portugal). More importantly, however, our 'at risk' indicator distinguishes countries with few to no debt sustainability concerns (US, UK, Netherlands, Belgium and Germany) from countries with serious debt sustainability issues (Spain, Italy, Portugal, Iceland). Important to note is that Spain and Iceland are somewhat unusual, featuring declining debt ratios on average but high risks of an increase in debt. By comparing the cases with and without fiscal response it is clear that robust fiscal policies are very important for countries to be in control of their public finances - particularly for countries that are already at risk.

[17] Or the probability with which it exceeds some institutional threshold on which there exists political consensus.
[18] See Table 8 in IMF (2013) for an overview of studies that estimate the effect of government debt on output growth, and Lukkezen and Suyker (2013) for tentative calculations on a prudent debt level from a precautionary savings motive.

6 Can we use these indicators?

Indicators based on stochastic analysis have several advantages over the current available indicators. The original sustainability norms envisaged at the creation of the European Monetary Union (EMU) were to follow the Maastricht Treaty criteria: ceilings of 3 percent and 60 percent on government deficits and debt-to-GDP ratios, respectively. These indicators, however, are static and are not able to capture volatility in the economy and the government's ability to control public finances. It is now clear that several countries have violated these criteria without consequences (Germany), while others that met these criteria (Spain) have nonetheless experienced debt sustainability concerns.

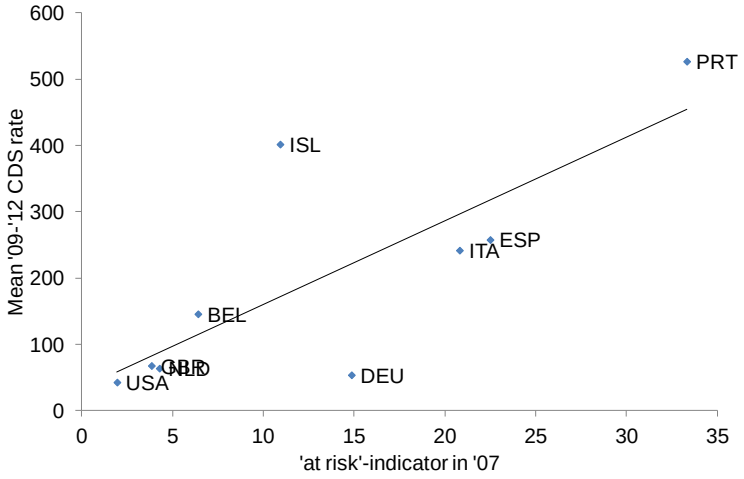
Alternative indicators currently in use, such as structural balances or cyclically adjusted budget balances (CABB), are often plagued by measurement issues. They depend on projections of future growth, which are known to have an upward bias (Larch and Salto, 2005), and their estimates are vulnerable to endogeneity problems: from the debate on the size of the fiscal multiplier it becomes clear that it is nontrivial to disentangle the effects of expected growth on the CABB from the effects that the CABB has on growth. Our indicators do not suffer from these shortcomings. They incorporate volatility as well as the government's expected policy response while working with ex-post realizations only.

Our indicators have predictive value. Figure 3 reports the market perceptions of default risk per country during the period 2009–2012 (average) relative to our 'at risk' indicator prior to the crisis (2007). The market perception of default risk is given by the 5-year mid-market Credit Default Swap (CDS) rate. Ex ante (so, before the crisis), our 'at risk' indicator makes a distinction between countries with and without debt sustainability concerns, which is qualitatively similar to the distinction that the financial market made on average during the crisis. The US, the UK, the Netherlands and Belgium pose negligible risk, Germany and Iceland pose small risk, whereas Italy and Spain face debt sustainability concerns and Portugal faces the highest risk in our sample.[19] In 2007, however, the market perceptions did not distinguish between these countries.

Our indicator is fairly robust: when comparing our 2007 indicator with the 2011 indicator, there are two qualitative differences. The main difference is in the Icelandic indicator, which has significantly deteriorated since 2007. When we add the crisis year, Iceland's debt-to-GDP ratio increased by 70%-points - from 29% to 99% of GDP. With these high debt levels, Iceland experiences a higher risk of a fiscal crisis now than it did in 2007. Another, albeit minor, difference between 2007 and 2011 is that the German indicator improved somewhat (from 15 to 11), probably because Germany's crisis experience was comparatively mild.

[19] The correlation of the 'at risk' indicator in 2007 with the mean 2009–2012 CDS spread is 0.78. The correlation of the 'at risk' indicators in 2011 with the mean 2009–2012 CDS spread is 0.92.

Figure 3 Default risk in 2009–2011 vs the 'at risk' indicator 2007



Note: Rates in basis points for 5 year CDS, observation window Jan-09 until Nov-12; indicators in percent.

Some caveats apply. First, our estimated fiscal response is an institutional variable that measures how - over medium- and long time periods - the government of a particular country deals with medium-sized changes in debt levels. It is not suitable to analyze debt sustainability for very short periods. For instance, it cannot provide information on whether Spain will be able to roll over its debt in the coming months.[20] Second, the shocks in our simulations depend on the historic volatility of interest and growth rates. Our indicator thus does not contain unexpected exogenous events (e.g. war, natural disasters); neither does it consider potential structural breaks such as institutional reforms or structural changes in the economy. Third, our indicator is not informative on the specific policy measures that aim to improve debt sustainability. Our framework essentially treats policy responses as being endogenous. In this sense it complements other approaches focusing on measures that have to be taken in order to restore sustainability. For example, ageing studies (European Commission, 2012) analyze the impact that ageing has on public finances, given constant policy arrangements - and as such are suited to explore alternative policy options to improve sustainability.

Our indicator is therefore not meant to replace current indicators, but rather to complement indicators monitoring the actual state of public finances (deficit and debt) and the indicators that focus on long-term sustainability from aging studies. Our indicators could, for instance, provide guidance on whether it is reasonable for a country to join a monetary union. In such a union, it may be harder to control public debt by monetary and exchange rate instruments, which puts more of a burden on the sustainability of fiscal policy. It is precisely this medium-term institutional relationship between fiscal policy and debt sustainability that is captured by our indicators.

[20] To do so would require a structural model, such as that in Corsetti et al. (2013), which describes the effects of fiscal and monetary policy on private decision making under sovereign risk.

References

Aaron, H., 1966, "The Social Insurance Paradox", *Canadian Journal of Economics and Political Science*, 32(3): 371–374. [Link]

Albuquerque, B., 2011, "Fiscal Institutions and Public Spending Volatility in Europe", *Economic Modelling*, 28: 2544–2559. [Link]

Afonso, A., 2005, "Fiscal Sustainability: The Unpleasant European Case", *FinanzArchiv* 61(1): 19–44. [Link]

Arezki, R., Candelon, B., and Sy, A., 2011, "Sovereign Rating News and Financial Markets Spillovers: Evidence from the European Debt Crisis", IMF Working Paper, 11/69. [Link]

Beetsma, R. and Giuliodori, M., 2010, "The Macroeconomic Costs and Benefits of the EMU and Other Monetary Unions: An Overview of Recent Research", *Journal of Economic Literature*, 48: 603–641. [Link]

Berti, K., 2013, "Stochastic Public Debt Projections Using the Historical Variance-covariance Matrix Approach for EU Countries", DG ECfin, Economics Papers 480. [Link]

Berti, K., Salto, M. and Lequien, M., 2012, "An Early-detection Index of Fiscal Stress for EU Countries", European Economy, Economic Papers, 475. [Link]

Bohn, H., 1998, "The Behavior of U.S. Public Debt and Deficits", *Quarterly Journal of Economics*, 113(3): 949–963. [Link]

Bohn, H., 2008, "The Sustainability of Fiscal Policy in the United States", in R. Neck and J. Sturm (eds.), "*Sustainability of Public Debt*", MIT Press, 15–49. [Link]

Budina, N. and S. van Wijnbergen, S., 2008, "Quantitative Approaches to Fiscal Sustainability Analysis: A Case Study of Turkey since the Crisis of 2001", *World Bank Economic Review*, 23(1): 119–140. [Link]

Celasun, O., X. Debrun and J. Ostry, 2006, "Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A 'Fan-Chart' Approach", IMF Working Papers 06/67. [Link]

Corsetti, G., Küster, K., Meier, A. and Müller, G., 2013, "Sovereign Risk, Fiscal Policy, and Macroeconomic Stability", *The Economic Journal*, 123(566): F99–F132. [Link]

De Grauwe, P., 2012, "Governance of a Fragile Eurozone", *Australian Economic Review*, 45(3): 255–268. [Link]

European Commission, Directorate-General for Economic and Financial Affairs, 2009, "Fiscal Rules, Independent Institutions and Medium-term Budgetary Frameworks", in *Public Finances in EMU – 2009*, Part II.2.4. [Link]

European Commission, Directorate-General for Economic and Financial Affairs, 2012, "Fiscal Sustainability Report 2012", *European Economy*, 8. [Link]

European Commission, Directorate-General for Economic and Financial Affairs, 2012, "Report on Public Finances in the EMU", *European Economy*, 4. [Link]

Ghosh, A., Kim, J., Mendoza, E., Ostry, J. and Qureshi, M., 2013, "Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies*", The Economic Journal*, 123(566): F4–F30. [Link]

Hall, R., 2013, "Fiscal Stability of High-Debt Nations under Volatile Economic Conditions", NBER Working Paper, 18797. [Link]

IMF, 2013, Fiscal Monitor, April, [Link]

Larch, M. and Salto, M., 2005, "Fiscal rules, inertia and discretionary fiscal policy, "*Applied Economics*, 37(10): 1135-1146. [Link]

Lejour, A., Lukkezen, J. and Veenendaal, P., 2011, "Sustainability of Government Debt in the EMU", in: Meeuwen, W. (eds.), *The Economic Crisis and European Integration*, Edward Elgar (Cheltenham, UK, 2011), 35–54. [Link]

Lukkezen, J. and Rojas-Romagosa, H., 2012, "When Is Debt Sustainable?", CPB Discussion Paper, 212. [Link]

Lukkezen, J. and Rojas-Romagosa, H., 2013, "Stochastic Debt Sustainability Indicators", *Revue de l'OFCE*, 127: 99–122. [Link]

Lukkezen, J. and Suyker, W., 2013, "Prudent Debt Level: A Tentative Calculation", CPB Background Document, June 5th. [Link]

Medeiros, J., 2012, "Stochastic Debt Simulation Using VAR Models and a Panel Fiscal Reaction Function: Results for a Selected Number of Countries", DG ECfin, *Economics Papers* 459. [Link]

Mendoza, E. and Ostry, J., 2008, "International Evidence on Fiscal Solvency: Is Fiscal Policy "Responsible"?", *Journal of Monetary Economics*, 55(6): 1081–1093. [Link]

Padoan, P., Sila U. and van den Noord, P., 2013, "Avoiding Debt Traps: Financial Backstops and Structural Reforms", *Revue de l'OFCE*, 127: 369-388. [Link]

Reinhart, C. and Sbrancia, M., 2011, “The Liquidation of Government Debt”, NBER Working Paper, 16893. [Link]

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