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Avoiding debt traps: Fiscal consolidation, financial backstops and structural reforms

by

Pier Carlo Padoan, Urban Sila
and Paul van den Noord*

In this article we develop a simple and stylised analytical framework, which is both tractable and feasible to estimate, capturing several key dimensions of the sovereign debt crisis in Europe. We use it to examine if and how a combination of fiscal consolidation, structural reform and financial backstops can help countries, notably the southern euro-area countries, to escape from the debt trap. Our analysis confirms that the loss of fiscal policy space in countries trapped in bad dynamics inevitably requires that fiscal action be directed towards consolidation despite some output loss in the short run. In particular, reducing debt levels breeds stronger growth and results in lower sovereign risk premia. We identify also a very important role for structural reform to help countries escape from bad dynamics. Last but not least, we find that financial backstops are helpful, but only to “buy time”. This additional time must be used productively, for fiscal consolidation and structural reforms to bear fruit as well as to make progress with institutional reforms of the European monetary union.

JEL classification codes: E62, C33, C62

Key words: Fiscal policy, sovereign debt, multiple equilibria

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In the current macroeconomic environment economies may find themselves trapped in a “bad equilibrium”. One often hears the case made of periphery countries in the euro area being in such a “bad equilibrium”, characterised by the simultaneous occurrence of, and adverse feedbacks between, high and growing fiscal deficits and debt, high risk premia on sovereign debt, slumping economic activity and plummeting confidence. Remedies to break the downward spiral and escape debt traps generally include financial firewalls to prevent contagion and structural reforms to boost growth. The role of fiscal policy is less clear; whereas consolidation may help to put debt on a sustainable path, negative demand effects may, on the other hand, generate offsets and could exacerbate the downturn, adding to the risk premiums, and thus deepen the “bad equilibrium”.¹

These general mechanisms on their own are well understood, but how they interact in a consistent dynamic setting is less clear. In this article we provide a simple analytical framework to fill this gap. We develop a simple version of a model with two solutions – a stable and an unstable one – combining a negative relationship between debt and growth inspired by the seminal work of Reinhart and Rogoff (2010) and the government’s inter-temporal budget constraint. We extend this model to make it more realistic by adding the effects of fiscal policy and interest rates on growth and by introducing an interest rate equation. We estimate the core parameters of the model and use the estimates to identify, empirically, the two solutions and then simulate the policies that can help a country caught in bad debt and growth dynamics to recover. This model embeds three relevant sets of policy variables in a monetary union: structural reform, fiscal consolidation and the use of financial backstops to reduce sovereign bond yields.

We start with a brief account of stylised developments since the onset of the crisis. We then elaborate the theoretical model, report the estimation results of a panel regression analysis and finally examine the comparative static and dynamic responses to fiscal, structural and financial policies. The final section concludes.

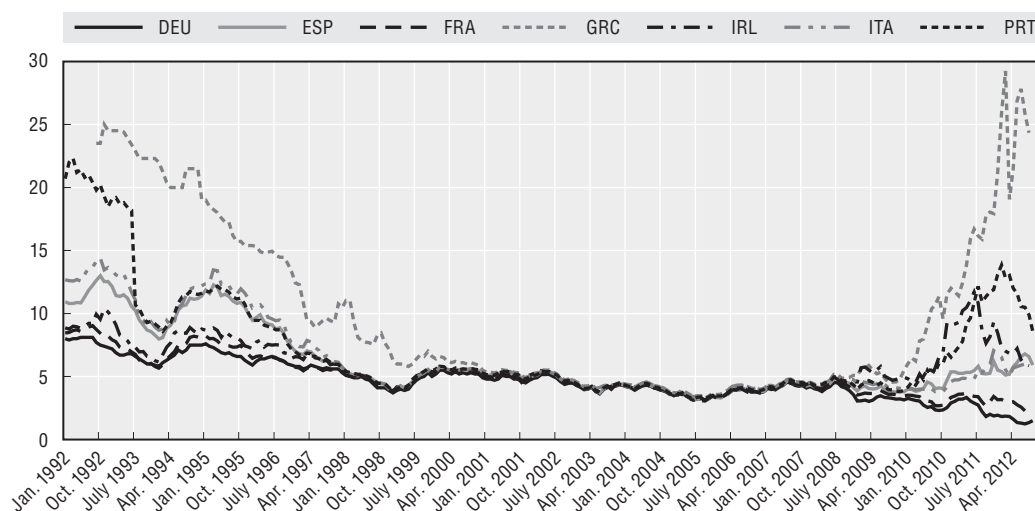
1. A brief review of the main issues

Over the past few years, even prior to the outbreak of the global financial crisis, new stylised facts have emerged in the macroeconomic environment. Public debt has grown significantly in almost all advanced economies. Partly this was a consequence of the drop in public revenues caused by the recession, and partly it was due to large public efforts, especially in some countries, to deal with banking crises. This has generated a negative feedback on growth with the possibility of a vicious circle of high debt, low growth and unsustainable public debt dynamics. Fragility has spilled over to banks which hold substantial amounts of sovereign debt in their balance sheets, especially in the euro area. This has, in turn, weighed negatively on confidence as the risk of a possible twin crisis affecting sovereign debt and credit markets simultaneously has become more significant. As has become painfully obvious, confidence can affect growth significantly. Simulations by the OECD (2011) point to a chain of causation which goes from confidence (in both

business and household) to financial markets, and next to the real economy. This relationship can affect growth positively or negatively and it can lead to significant differences in performance.

The increased role of confidence in driving macroeconomic performance suggests that we are operating in a world of multiple solutions, both stable and unstable. These may result in a strong overreaction of markets, especially in the euro area where national banking woes and sovereign stress are strongly intertwined. Take interest rates on sovereign bonds for example (Figure 1). After the crisis of the EMS in 1992, and in the run up to monetary union, these converged significantly and spreads practically disappeared for a number of years. After the outbreak of the crisis, markets overreacted in the opposite direction amplifying risk assessment and contributing to the emergence of vicious circles and a fragmentation of monetary and financial markets along national lines.

Figure 1. **Sovereign bond yields in the euro area (monthly averages, 10-year maturities)**



Source: OECD Analytical Database.

More generally, in OECD economies, for quite some time, markets have underpriced risk and favoured excessive risk taking including in private debt accumulation. During the so-called great moderation in the United States they have fuelled credit and housing booms and strengthened the perception that private debt was, after all, sustainable. An indication of this is the persistence of a negative interest rate-growth rate differential for OECD economies (Turner and Spinelli, 2011). In the euro area, this general pattern has taken the form of the expansion of current account (saving-investment) imbalances (OECD, 2012a) which was fed largely through the banking sector, unsustainable investment, and housing booms in deficit countries and the outflow of capital from surplus countries. Eventually – triggered by the financial crisis that erupted in the United States – booms turned to bust and the financial system in Europe ran into serious trouble, taking sovereigns down in its wake.

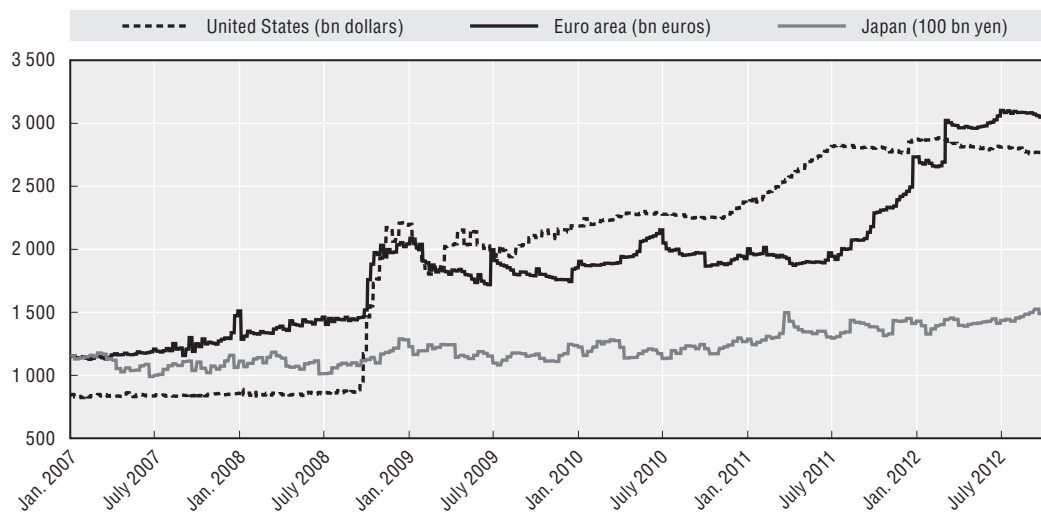
Dealing with such a situation is posing severe policy challenges. The loss of fiscal policy space inevitably requires that fiscal action is directed towards consolidation. Benefits of fiscal consolidation are long term, as reducing debt levels breeds stronger

growth, but also short term, to the extent that credible fiscal consolidation programmes may boost market confidence which translates into lower risk premia. However, in the short term the negative impact on demand may adversely affect market confidence to the extent that it depresses growth and hence debt sustainability. In practice, which of the two effects of fiscal consolidation prevails is an empirical issue largely dependent on the size of the fiscal multiplier.

Monetary policy in many advanced economies has reached the zero bound and, since the crisis, monetary authorities have introduced “unconventional” measures to deal with the recession. The balance sheets of major central banks have expanded accordingly (Figure 2). However, in a situation of financial fragility where disequilibria may spiral out of control, monetary authorities can fulfil an additional function with respect to supporting economic activity (in a framework of price stability and anchored inflation expectations), the “lender of last resort” function which can include both sovereign debt and credit markets. Such provision of a financial backstop is particularly relevant in situations in which, like the euro area crisis, contagion effects can be very significant and affect several channels at the same time.

The available policy toolkit also includes structural reforms. Structural reforms, which consist of a large number of different measures, can have a significant impact on growth (OECD, 2012a), but the benefits of growth require time to materialise in full.

Figure 2. **Central bank liabilities (in local currency)**



Source: Federal Reserve; Bank of Japan; European Central Bank.

Since the beginning of the crisis many countries have enacted structural reforms, often in tandem with fiscal consolidation measures (OECD, 2012b). This bodes well for the future, but time may be too short for the benefits of structural reforms to materialise and for markets to appreciate such improvements and translate them into lower risk premia. If markets are patient, debt sustainability would be easier and favourable dynamics could be set in motion where lower risk premia and higher growth reinforce each other. But if markets are impatient, such good dynamics may never be feasible. Rather, bad dynamics, characterised by higher risk premia and lower growth, may prevail, leading countries towards explosive debt.

This calls for co-ordinated action where available policy tools, fiscal, financial, and structural policies must operate in co-ordination to allow economies to move towards a high-growth and low-debt equilibrium. What such a co-ordinated solution might look like is the subject of the rest of this article.

2. A simple model of growth and debt

In this section we provide a simple yet consistent analytical framework to analyse the interactions described in the previous section. It is inspired by a model developed by Duesenberry (1958) to analyse the Great Depression which had many characteristics similar to the current situation. We start off with the exposition of the model, which we subsequently use to analyse the stabilisation properties of three policy levers: structural reforms, financial backstops and fiscal consolidation.

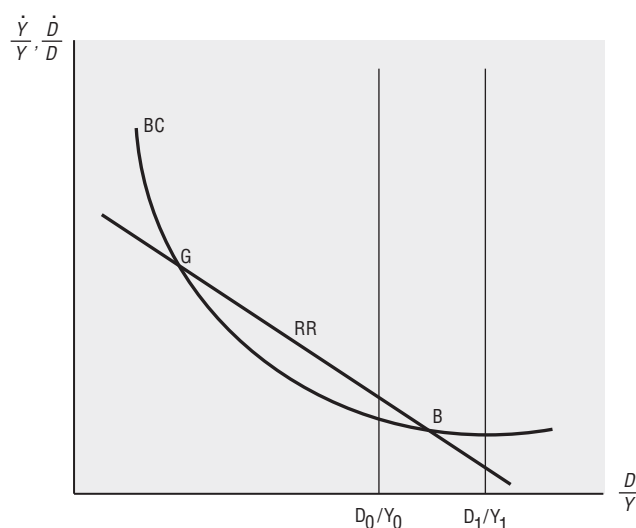
2.1. Assumptions and specification

The model has three equations. The first equation describes a negative relationship between public debt and economic growth (Y = output, D = real government debt and an over-dot indicates the change in the variable):

$$\frac{\dot{Y}}{Y} = a - b \frac{D}{Y} \quad (1a)$$

This equation is depicted in Figure 3 as the downward-sloping straight line RR. RR stands for Reinhart and Rogoff (2010) who have recently tested this relationship empirically. This negative relationship can be explained, *inter alia*, by adverse expectations with regard to future taxation associated with high public debt. It may also capture the effect of sovereign stress spilling over to banks which hold substantial amounts of sovereign debt on their balance sheets, in turn weighing negatively on the cost of financing for the private sector and on confidence and growth. Growth is positively affected by the

Figure 3. “Good” and “bad” growth and debt dynamics



Note: The horizontal axis measures the public debt to GDP ratio and the vertical axis the growth rates of public debt and output. RR is the relationship between growth and debt and BC the government's budget constraint. If the debt ratio is located right from the intersection B, it derails while output growth falls at an accelerating pace. Left of B the debt ratio converges towards G.

exogenous impact of structural reforms captured by parameter a . To keep the model simple we abstract from inflation, hence real and nominal variables are identical, and we also ignore potential output.

Growth equation (1a) can be augmented with the impact on growth of financial conditions (to the extent this is not already captured by the debt ratio) proxied by the (real) interest rate r , and the fiscal policy stance proxied by the primary deficit as a share of GDP p :²

$$\frac{\dot{Y}}{Y} = a - b \frac{D}{Y} - fr + gp \quad (1b)$$

According to this relationship, a higher interest rate depresses growth and a larger fiscal deficit supports (and by extension fiscal consolidation weakens) growth, with the associated semi-elasticities represented by the parameters f and g , respectively. These are just the first-order effects of interest rates and fiscal policy on growth. There are second-order effects that run through the government's budget constraint, which is the second equation of the model and in fact an identity. It relates the primary deficit as a per cent of GDP p to the interest rate r and public debt D :

$$\dot{D} = rD + pY \quad (2a)$$

Dividing the two sides of the equation by D yields:

$$\frac{\dot{D}}{D} = r + \frac{p}{D/Y} \quad (2b)$$

This is the hyperbolic relationship between real growth of debt and the debt ratio depicted as BC (as in budget constraint) in Figure 3.³ As the debt ratio increases, the real growth of debt approaches asymptotically the real interest rate. If the debt ratio is located in the interval between points G and B (for example at a level indicated by D_0/Y_0), output growth will exceed the growth of debt, and hence the debt ratio is falling until point G (for "good" dynamics) is attained: this is a stable steady state. However, if the debt ratio is located to the right of point B (e.g. if the debt ratio equals D_1/Y_1), the growth of debt exceeds output growth. Beyond the point B (indicating "bad" dynamics) debt keeps growing while output growth keeps falling, hence the debt ratio is on an explosive path.

What is not shown in Figure 3 (for the sake of simplicity) is that if the debt ratio is on an explosive path the real interest rate is bound to increase, thus adding momentum to the debt explosion. To capture this effect we need to introduce an interest rate equation, which is the third equation of our stylised model. Specifically, we assume that the interest rate responds to the growth in the debt ratio and an (exogenous) factor h . Therefore:

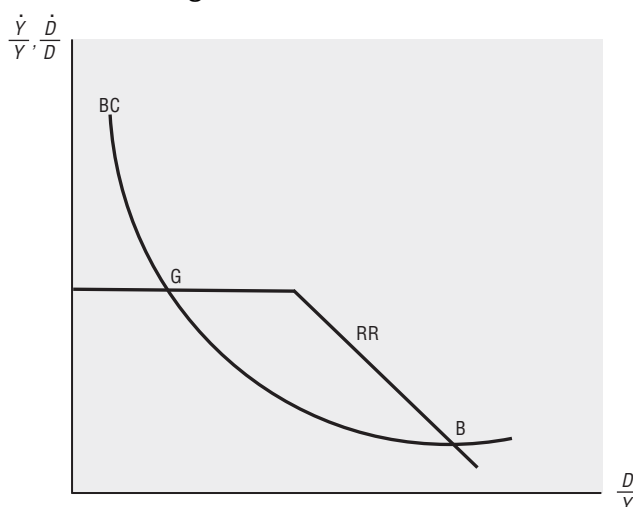
$$r = h + c \left(\frac{\dot{D}}{D} - \frac{\dot{Y}}{Y} \right) \quad (3)$$

The rationale for including the growth rate of the debt ratio as an explanatory variable is that we see this as a good measure of the sustainability of public finances. Specifically, we expect an accelerating debt ratio to raise the probability of default (for real or as perceived by the markets), i.e. the faster the increase in the debt ratio, the higher the risk premium. The parameter h under normal circumstances represents long-term neutral interest rates, but in stress situations also captures the impact of swings in market sentiment and contagion effects (in as much as these are unrelated to local debt dynamics) as well as financial backstops to offset such sentiment and contagion effects. These components will be disentangled in the estimated version below. As we shall see these factors seem to play an important role in the recent euro area sovereign debt dynamics.

In sum, our model points to three potentially explosive feedback mechanisms: i) between the debt ratio and growth; ii) between the debt ratio and the interest rate; and iii) between growth and the interest rate. Specifically, a high debt ratio depresses growth, which in turn boosts the debt ratio, etc., a high interest rate pushes up debt which gives a higher interest rate, etc., and a higher interest rate depresses growth which pushes up the debt ratio and hence the interest rate, etc. These feedbacks will be explosive if the initial debt ratio is “right of B” or converge (to the “good” solution G) if it is located “left of B”.

It is possible to derive formal expressions for the debt positions that correspond to the solutions G and B, but before we do so we need to address an important technical consideration. The negative correlation between debt and growth has been explained in different ways (Cecchetti *et al.*, 2012, Elmeskov and Sutherland, 2012, Reinhart and Rogoff, 2010 and others), but there is evidence that debt ratios negatively affect growth only beyond a certain threshold. Therefore, the RR schedule may be “kinked”, as depicted in Figure 4. The empirical literature following Reinhart and Rogoff’s seminal paper generally finds the debt threshold to be close to 90% of GDP.⁴ Indeed this is what we find also in our own empirical work (see below). This does not change the basic features of the model, other than that the value of the parameter b in equation (1b) is conditional on the level of the debt ratio.

Figure 4. Debt threshold



Ignoring this consideration for now, the steady-state debt ratio (when debt and output grow at the same rate) can be derived by equating the BC and RR equations (1b) and (2b) and equating the growth rates of debt and output in the interest equation (3), which yields:

$$-b\left(\frac{D}{Y}\right)^2 + [a + gp - (1 + f)h]\frac{D}{Y} - p = 0 \quad (4)$$

This has two solutions:

$$\left(\frac{D}{Y}\right)^G = \frac{[a + gp - (1 + f)h] - \sqrt{[a + gp - (1 + f)h]^2 - 4bp}}{2b} \quad (5a)$$

$$\left(\frac{D}{Y}\right)^B = \frac{[a + gp - (1 + f)h] + \sqrt{[a + gp - (1 + f)h]^2 - 4bp}}{2b} \quad (5b)$$

Equations (5a) and (5b) are the solutions G and B, respectively. It is interesting to note that the parameter c , the semi-elasticity of the real bond yield with respect to the growth in the debt ratio, drops out of the equations, which is simply a consequence of the economy assumed to be in a steady state and hence the debt ratio being constant. This implies that the adverse feedback loop from debt via the bond yield on growth does not operate via a change in the “bad” solution B itself but rather by influencing the pace of decline or improvement as the economy is moving away from that solution. That said, *exogenous* increases in the bond yield (an increase in h) will lower the debt ratio corresponding to the “bad” solution B (see below).

For the solutions (5a) and (5b) to be feasible it is necessary that the term under the root sign is positive. At the limit it could be zero in which case only one solution exists, which has a “bad” right side (debt ratio and growth derail right of the solution) and a “good” left side (debt ratio and growth stabilise left of the solution). Whether or not these solutions are feasible is an empirical question, which we will address below. But before we address that issue we will first examine how policy can help a country trapped in bad debt and growth dynamics to recover.

2.2. Policies to escape from “bad” debt and growth dynamics

Within the logic of this model there are three policy levers available for countries to escape from bad debt and growth dynamics: structural reform (affecting a), financial backstops to reduce the bond yield (affecting h), and fiscal policy (p). These policies should not be seen as alternatives, but rather as complements as they can be mutually reinforcing, as will be demonstrated below. The term financial backstops is used here as a shorthand for a multitude of possible policies to contain bond yields, including, in the context of European monetary union, bond purchases by the European Central Bank, official lending (“Troika”) programmes and the recapitalisation of banks to break the adverse feedback loop between banks’ balance sheets and sovereigns.

As depicted in Figure 5, structural reform shifts the RR schedule outward. As a result, a country whose debt ratio D_1/Y_1 was on an explosive path initially, will find itself to the left of the (now shifted) bad solution B' . The country will see its debt ratio fall and growth resume towards the good solution G' . Obviously, however, it takes time for structural reform to exert this virtuous effect on growth and debt, but time is severely lacking when a country is trapped in bad dynamics. Moreover, for structural reform to produce this virtuous effect, confidence must be restored. Think for example of product market liberalisation that opens up new investment opportunities. Without confidence and the availability of affordable funding these opportunities for investment may not be taken up and so higher growth would not materialise. With a financial backstop in place the interest rate could fall, giving some boost to confidence too, and the RR schedule would shift outwards even before structural reforms start to bear fruit.

Financial backstops can help countries to escape from bad debt and growth dynamics also through another channel: via the government budget constraint. This is depicted in Figure 6, illustrating how a fall in the interest rate shifts the BC schedule downward and thus again pushes the bad solution B further to the right, triggering a convergence towards the (now also shifted) good solution G' . Hence, financial backstops boost growth directly (via the private lending and investment channel) as well as indirectly by containing the sovereign debt-interest snowball. Obviously this presupposes that the backstops are not “misused” by the government as a way to sidestep structural reform or fiscal consolidation

(to which we turn next). Furthermore, it is also important that the financial backstop is set up in a way that moral hazard is contained; otherwise the confidence bridge provided by the financial backstop breaks down.

These findings can be formalised by computing the relevant policy multipliers from equation (5b):

$$\partial \left(\frac{D}{Y} \right)^B / \partial a = \left(\frac{D}{Y} \right)^B \frac{1}{\sqrt{[a + gp - (1+f)h]^2 - 4bp}} > 0 \quad (6)$$

$$\partial \left(\frac{D}{Y} \right)^B / \partial h = - \left(\frac{D}{Y} \right)^B \frac{1+f}{\sqrt{[a + gp - (1+f)h]^2 - 4bp}} < 0 \quad (7)$$

These equations confirm the graphical analysis: structural reform and financial backstops help a country to escape from bad debt and growth dynamics (as they “shift the bad solution to the right”). Importantly, these multipliers also confirm that these policies are mutually reinforcing: a rightward shift in the “bad” solution triggered by structural reform raises the multiplier of financial backstops and *vice versa*.

In our stylised model fiscal consolidation works via two channels – output and the government budget constraint. This is similar to financial backstops, which work through the same channels, except that the effects of fiscal consolidation are in opposite directions, with the net effect ambiguous. Fiscal consolidation is represented by a sustained cut in the primary deficit p , which shifts the BC schedule down as depicted in Figure 7. However, as shown in Figure 8 it also implies a negative demand shock, shifting the RR schedule down. The former is potentially stabilising (the bad solution shifts to the right) whereas the latter is potentially destabilising (the bad solution shifts to the left).

It is again possible to derive the relevant multiplier to measure the impact of changes in the primary deficit p on the bad solution, which reads:

$$\partial \left(\frac{D}{Y} \right)^B / \partial p = \left[g \left(\frac{D}{Y} \right)^B - 1 \right] \frac{1}{\sqrt{[a + gp - (1+f)h]^2 - 4bp}} \begin{matrix} > \\ \leq \end{matrix} 0 \quad (8)$$

Whether an increase in the primary deficit gives a lower bad debt ratio (beyond which the economy becomes unstable) or the reverse is indeed ambiguous and depends on the initial level of the bad solution and on the “Keynesian” fiscal demand multiplier g . When

both are large, such that $g \left(\frac{D}{Y} \right)^B > 1$, fiscal expansion (an increase of p) will have a favourable impact on the bad solution i.e. it will shift it to the right. This is a situation where the country has fiscal space available to effectively boost the economy out of bad debt and growth dynamics through fiscal expansion. But if either of the two is small (the Keynesian fiscal impact on growth is small and the initial bad solution for the debt ratio is small, for instance, because the country suffers from a bad reputation in financial markets as gauged by a high value of the parameter h), such that $g \left(\frac{D}{Y} \right)^B < 1$, fiscal expansion will exacerbate the bad dynamics trap. Fiscal consolidation is then the appropriate policy, possibly in combination with structural reform and financial backstops (since these increase the multiplier (8) and hence the effectiveness of fiscal consolidation).

Figure 5. **The impact of structural reform and financial backstops through the output channel**

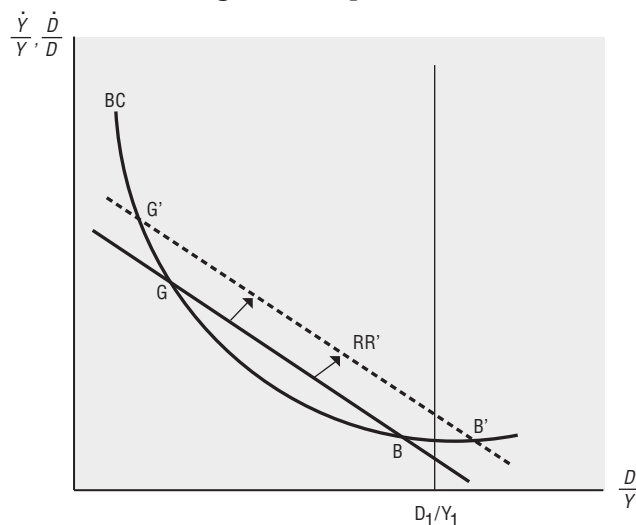
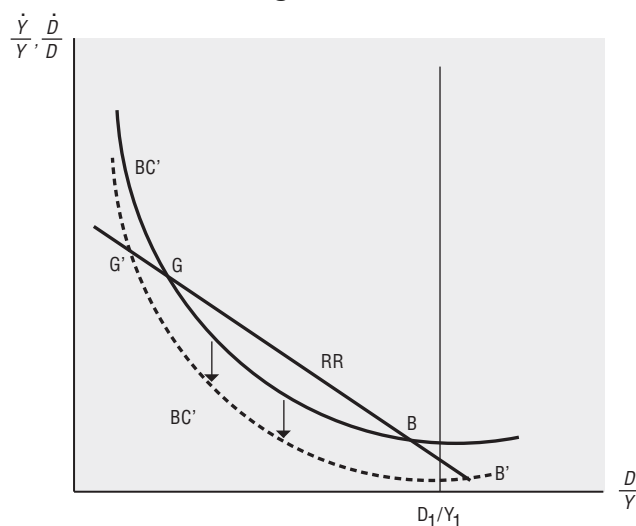


Figure 6. **The impact of financial backstops through the government budget channel**



Where exactly the bad solution ends up after fiscal consolidation is thus an empirical question: our theory cannot predict this. There is a vast though inconclusive literature on the subject, prompted by Giavazzi and Pagano (1990) who argued that fiscal consolidations can be expansionary, based on a number of case studies. According to Perotti (1999) the odds of an expansionary effect of fiscal consolidation increase with the extent of the initial fiscal predicament, in line with our finding that the initial position of the “bad debt ratio” matters for the stabilisation properties of fiscal policy. SVAR modelling work by Tenhofen, Heppke-Falk and Wolff (2011) yields evidence of a strong positive growth impact of public investment, but other fiscal shocks are found to have very little net impact on growth. However, more recently there have been additional views and evidence that the fiscal demand multiplier may be positive and large (of the order of one or more), and fiscal consolidation destabilising, at least in depressed economies (see, for example, De Long and Summers, 2012 and IMF, 2012).

Figure 7. **The impact of fiscal consolidation through the government budget channel**

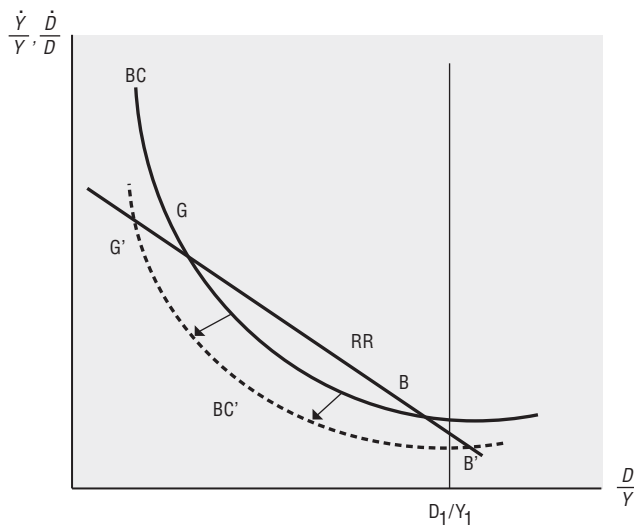
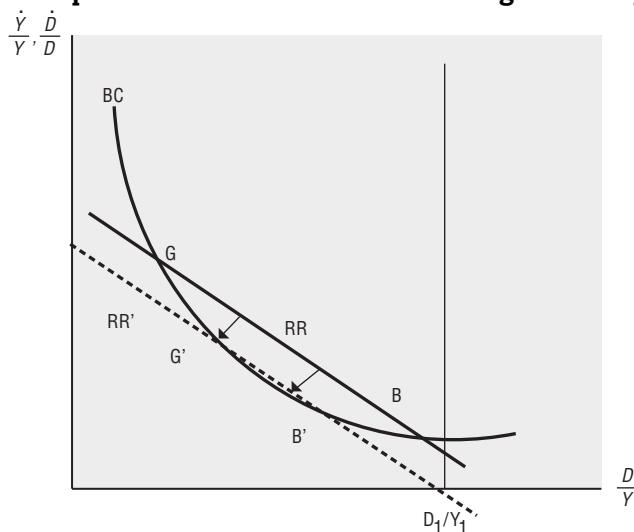


Figure 8. **The impact of fiscal consolidation through the output channel**



To sum up, the effect of fiscal policy on the growth path of the economy is ambiguous and strongly depends on the initial conditions. It is therefore of crucial importance to empirically calibrate the model so as to be able to assess the need for, and effectiveness of, fiscal consolidation alongside other policy tools when countries are trapped by bad debt and growth dynamics. We turn to this in the sections below.

3. Panel estimates

In this section we report estimation results for the growth and interest rate equations (1b) and (3) which we will use as the basis for simulations of both shocks and policy responses in the next section. The data for GDP growth, public debt, primary deficit, interest rates and control variables are obtained from the *OECD Economic Outlook 90 Database*. More details on the variables used can be found in the Data Annex. The estimations are based on a sample of 28 OECD countries and data spans for up to 52 years, from 1960 to 2011.⁵ We use annual data.

We purposefully use as broad a sample as possible, in order not to make results dependent on an arbitrarily chosen period or group of countries. However, in this way the sample is unbalanced: for some countries the data go back to the 1960s, whereas for others, it only goes back to the 2000s. The exact composition of the panel also depends on the estimation method due to a different use of lags. If characteristics of countries with a shorter series differ in a systematic way, having an unbalanced panel may result in a sample bias, but we nevertheless think that having a larger and longer sample brings about important benefits. In any case, in our empirical approach we at all times control for country fixed effects, taking much of this problem away. Moreover, when we test the robustness of our results to shortening the time period, the conclusions remain largely unaltered.

3.1. The growth equation

We estimate the following equation:

$$\bar{g}_{i,t+n} = \alpha + \beta_1 \frac{D_{i,t}}{Y_{i,t}} + \beta_2 M_{i,t;debt>T} * \left(\frac{D_{i,t}}{Y_{i,t}} - T \right) + \gamma \frac{P_{i,t}}{Y_{i,t-1}} + \theta r_{i,t} + \delta' X_{i,t} + \mu_i + \vartheta_t + \varepsilon_{i,t} \quad (9)$$

where $\bar{g}_{i,t+n} = \frac{1}{n} \sum_{k=1}^n \frac{\dot{Y}_{i,t+k}}{Y_{i,t+k-1}}$, i denotes a country and t denotes time. All the main variables of

interest are expressed in per cent or percentage points. The dependent variable $\bar{g}_{i,t+n}$ is n -year forward-overlapping moving average of annual real GDP growth rates, between year $t+1$ and $t+n$. Varying the future time span allows us to distinguish between potentially differing short-term and medium/long-term effects of the explanatory variables on growth. We set n to 1, 3 and 5. This approach also partly addresses the problem of endogeneity due to reverse causality and simultaneity between GDP growth, public debt and primary deficit. Whereas we claim that debt and primary deficit affect growth, it may also be the case that low growth leads to increases in public debt and primary deficit via automatic stabilisers and induced policy reactions. Therefore, by keeping the two policy variables at time t and moving the growth rate forward in time, endogeneity is weakened. Similar measures of growth have been used in Checherita and Rother (2010) and Cecchetti et al. (2011). In addition, our preferred specification rests on instrumental variable estimation so as to address any remaining endogeneity.

The term $\frac{D_{i,t}}{Y_{i,t}}$ in equation (9) represents public debt as a share of GDP, which in the third term on the right-hand side is interacted with a dummy variable M , indicating whether the public debt is above the threshold T . This recognises the fact that the effect of debt on growth may be non-linear. In order to avoid a discrete jump in the estimated regression line at the point where public debt equals the threshold, T is subtracted. This ensures that the growth equation is kinked like the one depicted in Figure 4. The $\frac{P_{i,t}}{Y_{i,t-1}}$ and $r_{i,t}$ measure the primary deficit as a share of (lagged)⁶ GDP and the real long-term interest rate on government bonds, respectively. μ_i stands for country-fixed effects and ϑ_t for time-fixed effects.

Finally, $X_{i,t}$ stands for a vector of controls. Here we follow the growth regressions literature and include a standard set of controls as, for example, reported in Barro and Sala-i-Martin (2004) to capture conditional convergence. It is important to note, however, that our approach

differs from standard growth regressions in that we use GDP growth as opposed to per capita GDP growth as the dependent variable. This is done in order to be consistent with the model presented in Section 2. Nevertheless, we include population growth and GDP per capita as controls, which essentially boils down to an analogous specification.

The controls in our case include: *inflation rate* to control for macroeconomic stability; the logarithm of the *initial GDP per capita*, to control for the catching up effect; *investment (gross capital formation) as a share of GDP* to measure capital formation and to serve as a proxy for the saving rate; *mean years of schooling* to measure human capital; *trade openness* measured as the sum of total exports and imports as a share of GDP; *population growth* and the *dependency ratio* to control for the evolution of labour supply; and a *banking crisis indicator*, to control for potential negative effects on growth in years of banking crises as predicted by Reinhart and Rogoff (2009).

The banking crisis variable is based on the data on systemic banking crises constructed by Laeven and Valencia (2008 and 2010).⁷ In constructing the banking crisis indicator we follow Cecchetti *et al.* (2011); it takes a value of zero if in the subsequent n years there is no banking crisis, and the value of $1/n$, $2/n$, and so forth, if a banking crisis occurs in one, two, *etc.*, of the subsequent n years. The banking crisis indicator is, therefore, the only regressor which is not predetermined with respect to the future average growth rate.

Table 1 reports the estimation results for three different averages of future GDP growth rates: five-year forward average, three-year forward average and a one-year forward growth rate. In columns (2), (4) and (6) we report fixed effects results. Due to the overlapping nature of our dependent variable, the error term follows a moving-average process, therefore we use a robust procedure to compute the standard errors of our coefficient estimates; the standard errors are also clustered by country. Despite the future growth rate on the left-hand side, there may still be endogeneity bias remaining if the growth rate and sovereign debt are jointly determined by a third, omitted variable. Therefore, in columns (1), (3) and (5) we report the results from the instrumental variable GMM estimation, implemented in stata by the *xtivreg2* of Schaffer (2010). To instrument for the sovereign debt ratio and primary deficit ratio, we use their 1-3 period lags. Reported standard errors are robust to heteroskedasticity and autocorrelation of the order 5, 3 or 2, in columns (1), (3) or (5), respectively. GMM IV is our preferred specification, and is also used later in the simulations of the model for policy analysis. The reported fixed-effects estimation results primarily serve as a robustness check.

At the bottom of the Table 1 we list the estimated threshold effect. This is the level of debt where the kink in the growth equation appears. The estimation procedure of the threshold follows Hansen (1999); for each specification we search over a grid of different thresholds to find the one that minimises the residual sum of squares. We then take the estimated threshold effect as given, and use it to estimate the model. The estimated threshold effects in all cases are close to 90%, consistent with findings by other researchers. Reinhart and Rogoff (2010) find that for the level of debt ratio above 90%, the average growth rate falls, whereas below that threshold, the relationship between government debt and GDP growth is weak. A point estimate for the threshold close to 90% for the effect of public debt on growth is also reported in Cecchetti *et al.* (2011) and Checherita and Rother (2010). Kumar and Woo (2010), on the other hand, consider two externally-imposed thresholds at 30% and 90% debt levels, and they find that beyond the 90% level, debt becomes harmful to growth.

Table 1. **Estimated growth equations**

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
	GMM IV	FE	GMM IV	FE	GMM IV	FE
	Five year forward of GDP growth rate (%)		Three year forward of GDP growth rate (%)		One year forward of GDP growth rate (%)	
Government debt/GDP (%)	-0.000271 (0.00493)	-0.000546 (0.00775)	0.00204 (0.00563)	-0.000555 (0.00762)	0.0135* (0.00710)	0.00213 (0.00741)
Government debt and threshold dummy	-0.0274*** (0.00818)	-0.0276** (0.0122)	-0.0269*** (0.00874)	-0.0285*** (0.0103)	-0.0258*** (0.00963)	-0.0293*** (0.00898)
– interaction	0.0116 (0.0201)	0.0177 (0.0213)	0.0389 (0.0263)	0.0239 (0.0265)	0.0596 (0.0405)	0.0105 (0.0335)
Primary deficit/lagged GDP (%)	-0.0611*** (0.0235)	-0.0288 (0.0264)	-0.122*** (0.0335)	-0.0954** (0.0406)	-0.216*** (0.0447)	-0.155** (0.0577)
Real long-term interest rate	-0.0571** (0.0241)	-0.0483 (0.0325)	-0.119*** (0.0275)	-0.110*** (0.0376)	-0.236*** (0.0431)	-0.206*** (0.0524)
Inflation rate (%)	-9.333*** (0.863)	-8.876*** (1.090)	-9.241*** (0.944)	-8.758*** (1.081)	-6.825*** (1.270)	-6.388*** (1.046)
Log of GDP per capita	-0.0605*** (0.0224)	-0.0609* (0.0297)	-0.0492* (0.0295)	-0.0674* (0.0339)	0.0236 (0.0398)	-0.0146 (0.0385)
Gross fixed capital formation/GDP (%)	-0.0688 (0.186)	-0.0974 (0.252)	-0.247 (0.197)	-0.231 (0.233)	-0.587*** (0.216)	-0.483** (0.232)
Mean years of schooling	0.0143** (0.00686)	0.0159* (0.00881)	0.0180** (0.00717)	0.0182* (0.00923)	0.0313*** (0.00927)	0.0214** (0.0102)
Trade openness	-0.303 (0.228)	-0.244 (0.259)	-0.402 (0.255)	-0.436 (0.294)	-0.0652 (0.256)	0.0100 (0.257)
Population growth (%)	-0.0359* (0.0216)	-0.0338 (0.0244)	-0.0477* (0.0248)	-0.0389 (0.0259)	-0.0320 (0.0312)	0.0102 (0.0258)
Total dependency ratio	-1.659*** (0.325)	-1.765*** (0.399)	-1.771*** (0.330)	-1.778*** (0.395)	-1.645*** (0.399)	-1.644*** (0.460)
Banking crisis indicator	Year dummies	Yes	Yes	Yes	Yes	Yes
Constant		162.5*** (18.49)		162.9*** (18.59)		119.9*** (18.02)
Effect of government debt/GDP (%)	-0.0277*** (0.000)	-0.0281*** (0.005)	-0.0249*** (0.000)	-0.0291*** (0.001)	-0.0123* (0.061)	-0.0271*** (0.000)
– above threshold (p-value)						
Observations	640	699	696	755	749	808
Number of countries	28	28	28	28	28	28
Debt threshold	91	91	86	86	82	87

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All regressions use country-fixed effects. Instrumental variables in GMM IV regressions [columns (1), (3) and (5)] are 1-3 period lags of government debt ratio and primary deficit ratio. In GMM IV regressions the reported standard errors are robust to heteroskedasticity and autocorrelation of the order 5, 3 or 2, in columns (1), (3) or (5), respectively. In fixed-effects panel regressions [columns (2), (4) and (6)] the reported standard errors are robust to heteroskedasticity and adjusted for clusters by countries.

According to the results reported in Table 1 the effect of government debt below the threshold is not statistically significant, except perhaps in the short term as indicated in column (5). Above the threshold, on the other hand, the effect is consistently negative and statistically significant, shown in italics towards the bottom of Table 1. First, comparing the coefficients across different specifications one can note that the negative effect of debt on growth becomes stronger over time, that is, the coefficient in column (5) is smaller in absolute value than that in column (1). Therefore, increasing public debt by 1 percentage point this year will on average reduce GDP growth next year by 0.012 percentage points, whereas it will reduce the average annual growth over the next five years by 0.028 percentage points. The effect of debt on growth in the latter case is therefore about twice as large.

The direction of the effects of the primary deficit and the interest rate on growth is also as expected and the longer-run effects are generally weaker than the short-run effects. However, in all cases the effects are statistically not significant, suggesting that these effects are, if anything, weakly positive. Increasing the primary deficit as a share of lagged GDP by 1 percentage point this year increases the growth rate by 0.060 percentage points in the next year, as reported in column (5). This drops down to 0.039 for the average growth rate in the next three years, column (3), and to 0.012 over the next five years, column (1)⁸. In the same way, the real long-term sovereign interest rate has a stronger negative effect on growth in the short term as compared with the medium/long term.

Table 1 also reports the results for other controls. The coefficient of the log of GDP per capita has a negative sign, implying the so called “catch-up” effect. The inflation rate has a negative effect on GDP growth and trade openness has a positive effect, both as expected. A strong and negative effect on growth comes from the banking crisis indicator. For example, a banking crisis one year ahead is expected to reduce the growth rate in that same year by about 1.6 percentage points, as reported in column (5). The rest of the coefficients on controls are statistically not significant. The population (total dependency ratio and population growth) and education variables are slow-moving hence, perhaps in the fixed effects setting, they do not have enough variation. Recall also, that in our case we use GDP growth on the left-hand side instead of per capita GDP growth, therefore, when we compare the coefficient on population growth with other growth regression estimations we should subtract 1 from our result. Doing so, we get somewhat closer to the results reported in Checherita and Rother (2010). The coefficient on investment (gross fixed capital formation) is also not statistically significant, but insignificant coefficients for this variable are reported in similar regressions also by Cecchetti *et al.* (2010) and Checherita and Rother (2010).

3.2. Interest rate equation

We estimate the following interest rate equation:

$$\bar{r}_{i,t+1} = \sigma + \varphi \left(\frac{\dot{D}_{it}}{D_{i,t-1}} - \frac{\dot{Y}_{i,t}}{Y_{i,t-1}} \right) + \omega' W_{i,t} + \mu_i + \vartheta_t + \epsilon_{i,t} \quad (10)$$

where, the dependent variable $\bar{r}_{i,t+1}$ measures the one year forward real long-term interest rate on government bonds, i denotes a country and t denotes time. μ_i and ϑ_t stand for country-fixed effects and year dummies, respectively, and $\epsilon_{i,t}$ is the error term. Again, all the main variables are expressed in per cent or percentage points.

The second term on the right-hand side in equation (10) represents the growth rate of the debt to GDP ratio. As suggested in the theoretical section above, we would expect the long-term sovereign interest rate to increase when debt dynamics worsen. We use the current debt dynamics to estimate the effect on future interest rates. Moving the interest rate one year forward partly solves the problem of simultaneity, given that the current interest rate can have quite a strong impact on current debt dynamics. However, as stressed also by Laubach (2009), it is the expectations of future debt dynamics that are important for determining the interest rate, and can also be used to circumvent the problem of endogeneity. He for example uses projections of fiscal variables several years into the future to estimate the interest rate equation. However, to stick to the model as presented in Section 2, we use the current level of debt growth. Expectations about debt

dynamics are thus incorporated into the country-fixed effect and the error term. Of course, in this way the error term remains correlated with the debt growth term, therefore we again estimate the model using instrumental variable GMM estimation.

The $W_{i,t}$ in equation (10) stands for the controls. In choosing the controls we follow Laubach (2009) and Checherita *et al.* (2010) that estimate similar equations. The *real short-term interest rate* controls for the effect of monetary policy and monetary conditions more generally on long-term interest rates; the *inflation rate* controls for macroeconomic stability and rises in prices, and the measure of *trade openness* allows for the open economy and controls for potential effects of openness on capital flows and interest rates.

On top of this we also include two additional sets of controls. First is the *banking crisis indicator* variable and the *interaction of the banking crisis indicator with the “southern eurozone” dummy*. The “southern eurozone” indicator variable is equal to one for the following countries: Greece, Ireland, Italy, Portugal, Slovakia, Slovenia and Spain; and zero otherwise, from the year they adopted the euro. The second set of controls includes, in addition to the debt growth variable, the *interaction of the debt growth with the “southern eurozone” dummy*.

The rationale for including these variables comes from the discussion in De Grauwe and Ji (2012). They observe that the increase in the debt-to-GDP ratios since 2007 is significantly faster in the United States and the United Kingdom than in the eurozone, yet it is the eurozone that has experienced a severe sovereign debt crisis. They argue that this is because the eurozone countries do not have control over their own money. Thereby, member countries are susceptible to movements of distrust. When such movements of distrust occur, the sovereign spreads are likely to increase significantly without much movement in the underlying “fundamentals” that influence the solvency of the country. In their paper they find that while before the crisis the debt-to-GDP ratios in the eurozone do not seem to have affected the spreads, after 2008, this relationship becomes quite significant, *i.e.* it appears that financial markets are less tolerant towards high debt-to-GDP ratios in the eurozone as compared with the stand-alone countries, and especially so in the eurozone periphery. Evidence discussed in Section 1 is consistent with this view.

To capture this phenomenon we therefore include the banking crisis dummy and interact it with the southern eurozone dummy to see whether in the time of crisis, the sovereign yields in the “southern eurozone” increase more than predicted by fundamentals. On the other hand, the interaction of the debt growth variable with the “southern eurozone” indicator measures whether *changes* in debt growth have stronger consequences for the “southern eurozone” compared with the rest of the OECD countries.

In Table 2 we report the results from the fixed-effects panel estimation, column (2), and the instrumental variables GMM estimation, column (1), our preferred specification.⁹ Instrumental variables used in column (1) are the 1-3 period lags of government debt ratio growth and interactions. The reported standard errors are robust to heteroskedasticity and autocorrelation.

The reported effect of the growth of government debt to GDP ratio on long-term real interest rates in column (1) is of a positive sign, as expected. A rise in debt growth by 1 percentage point increases the next year real long-term interest rate by 6.3 basis points for countries that do not belong to the “EMU south” group. The interaction of the debt growth with the south eurozone dummy shows that for these countries movements in debt have a much larger effect on interest rates compared with the rest of the OECD.

Table 2. **The effect of growth in sovereign debt on long-term interest rates**

	(1)	(2)
	GMM IV	FE
Dependent variable: One year forward real long-term interest rate		
Growth in government debt ratio (%)	0.0628** (0.0263)	0.0159** (0.00669)
Interaction – debt growth and EMU “south” indicator	0.103*** (0.0329)	0.0148 (0.0216)
Banking crisis indicator	-0.126 (0.393)	0.388 (0.310)
Interaction – banking crisis and EMU “south”	1.855* (0.976)	2.844*** (0.926)
EMU “south” indicator	0.431 (0.379)	0.0459 (0.646)
Real short-term interest rate	0.161*** (0.0482)	0.274*** (0.0909)
Inflation rate (%)	-0.261*** (0.0422)	-0.281*** (0.0769)
Trade openness	0.0129 (0.00957)	0.00256 (0.0121)
Year dummies	Yes	Yes
Constant		1.872** (0.736)
Observations	772	821
Number of countries	29	29

Note: GMM IV regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are in parentheses. All regressions use country-fixed effects and we include year dummies. In GMM IV regression the instrumental variables are 1-3 period lags of government debt ratio growth and its interaction terms. The reported standard errors are robust to heteroskedasticity and autocorrelation of order 2, respectively. In the fixed effects panel regression the reported standard errors are robust to heteroskedasticity and adjusted for clusters by countries.

Interestingly, the banking crisis by itself does not have a statistically-significant impact on the long-term sovereign interest rate, although in the sense of economic significance, the coefficient is quite large. More importantly, however, there is evidence that for the southern euro countries, the banking crisis causes significant stress and, on average, adds about 180 basis points more to the interest rate compared with other countries in times of banking crisis. The results are therefore telling a story that the southern euro area countries in times of banking crisis are, for reasons not related to “fundamentals”, put under higher market pressure and at the same time they need to pay the higher price for any increases in their debt growth. This is evidence for the behaviour of markets as described by De Grauwe and Ji (2012).

4. Policy experiments

The econometric estimates reported in the previous section allow us to identify the empirical values of the parameters in the theoretical model. Once we have empirically estimated the parameters we are able to compute the debt levels that correspond to the “good” and “bad” solutions as well as the multipliers developed in Section 2 (comparative statics). In addition, we are able to set up a dynamic version of the model in discrete time, and use it to run shock and policy simulations (comparative dynamics).

4.1. Comparative statics

Most parameter values in our stylised model can be directly inferred from the estimation results, with the exception of the terms a and h appearing in, respectively, the growth and interest rate equations. These comprise country-specific constant terms as well as the impact of a range of control variables on growth and the interest rate, and hence vary across countries and over time. In addition we need to modify the theoretical model to capture the threshold effect of public debt on growth. Specifically, the relevant growth equation reads:

$$\frac{\dot{Y}}{Y} = a - b_1 \frac{D}{Y} - b_2 M \left(\frac{D}{Y} - T \right) - fr + gp \quad (1c)$$

where M is a dummy variable taking the value 1 if the debt ratio is above the threshold and zero otherwise and b_2 represents the difference in the growth impact of the debt ratio above the threshold, T . This equation can be re-written as:

$$\frac{\dot{Y}}{Y} = a' - (b_1 + b_2 M) \frac{D}{Y} - fr + gp \quad (1d)$$

in which $a' = a + b_2 M \times T$. This gives us a properly adjusted estimate of the constant term in the equation. The debt threshold, i.e. the level of debt where the kink in the growth equation appears, is fixed at 82% of GDP, consistent with our regression results for the GMM IV results for the one-year forward growth equation (our preferred specification).

The numerical parameters inferred from the estimation results, are reported in Table 3. The baseline parameters refer to the parameters excluding the impact of financial crisis and/or the country being part of the “euro area south” in the interest rate equation. The second column in the table presents the parameters that apply to countries in the euro area south whose bond yields and growth rates are affected by the banking and sovereign debt crisis. In line with the regression results, the parameter a is reduced by 0.016 to capture the estimated impact of the banking crisis on growth. Similarly, the parameters c and h are increased by 0.103 and 0.019 to capture the stronger impact of, respectively, growth in the debt-to-GDP ratio and the banking crisis.

These parameter estimates allow us to identify the “good” and “bad” debt ratios and the multipliers developed in Section 3. It should be stressed, however, that these estimates apply to the average of the sample as a whole and not necessarily to individual countries or sub-periods, and obviously are surrounded by uncertainty margins. The results are reported in Table 4. For a primary deficit (p) equalling 0.3% of GDP (which is the sample

Table 3. **Model parameters**

	Whole sample pre-crisis	“Euro area south” crisis
a	0.028	0.012
b_1	-0.013	-0.013
b_2	0.026	0.026
c	0.063	0.166
f	0.216	0.216
g	0.060	0.060
h	0.027	0.046

Note: In the calibrated model fractions are not expressed as percentages, meaning that intercepts of the estimated growth and interest-rate equations are divided by 100.

Table 4. “Good” and “bad” debt and multipliers under different assumptions

In per cent

	“Good” debt ratio	“Bad” debt ratio	Multipliers with respect to:		
			a	p	h
Whole sample pre-crisis	69	107	10	-8	-12
$b_2 + 1$ SE	69	81	5	-5	-6
$b_2 - 1$ SE	69	241	40	-14	-49
$f + 1$ SE	75	95	10	-10	-13
$f - 1$ SE	63	118	9	-7	-11
$g + 1$ SE	69	108	3	-8	-12
$g - 1$ SE	70	105	10	-9	-12

Note: SE indicates standard error on panel estimates of the parameters; multipliers measure the impact on the “bad” debt ratio of 10 basis points (0.1 percentage point) changes in a , p or h .

average), the corresponding sample average “bad” debt ratio equals 107% of GDP. This implies that, on average, a country recording a debt ratio above 107% would see its debt ratio spiral out of control and its economy slump in the absence of offsetting policy action. Conversely, the “good” solution to which the debt ratio converges if it is below the 107% threshold turns out to be 69% of GDP. This means that if the debt ratio is in the 69%-107% interval it would, on average, be falling towards 69% (and conversely increasing towards 69% if it is below that level). Again, these are rough orders of magnitude based on estimates that apply exclusively to the sample average, and for illustrative purposes only.

The multiplier analysis in Table 4 shows that, again for the sample as a whole, structural reform yielding a sustained increase in economic growth of 0.1 percentage points per annum raises the bad debt ratio (i.e. moves out the point B) by 10 percentage points. This suggests that the contribution structural reforms brings to debt sustainability can be significant. Similarly, a sustained cut in the risk premium on the interest rate by 10 basis points increases the bad debt ratio by 12 percentage points. A sustained increase in the primary deficit as a share of GDP by 0.1 percentage point reduces the bad debt ratio (beyond which bad dynamics set in) by 8 percentage points. This means that, based on our sample and time period, fiscal expansion, on average, renders the economy less stable. The consequence is that a country caught in bad dynamics should pursue a restrictive fiscal policy.

Table 4 also reports a sensitivity analysis for different assumptions with regard to the estimated model parameters. We have computed the impact of increases or decreases amounting to one standard error for several parameters. The most striking finding is the large sensitivity of the results to variations in the parameter value for b_2 , the semi-elasticity (interaction term) of growth with respect to the debt ratio beyond the “Reinhart-Rogoff threshold” of 82%. This suggests that relatively small changes in the sensitivity of growth to debt can have a substantial impact on macroeconomic stability. This adds a dimension to the original Reinhart-Rogoff findings which focus on the impact of debt on trend growth whereas from our analysis also its impact on macroeconomic stability can be inferred.

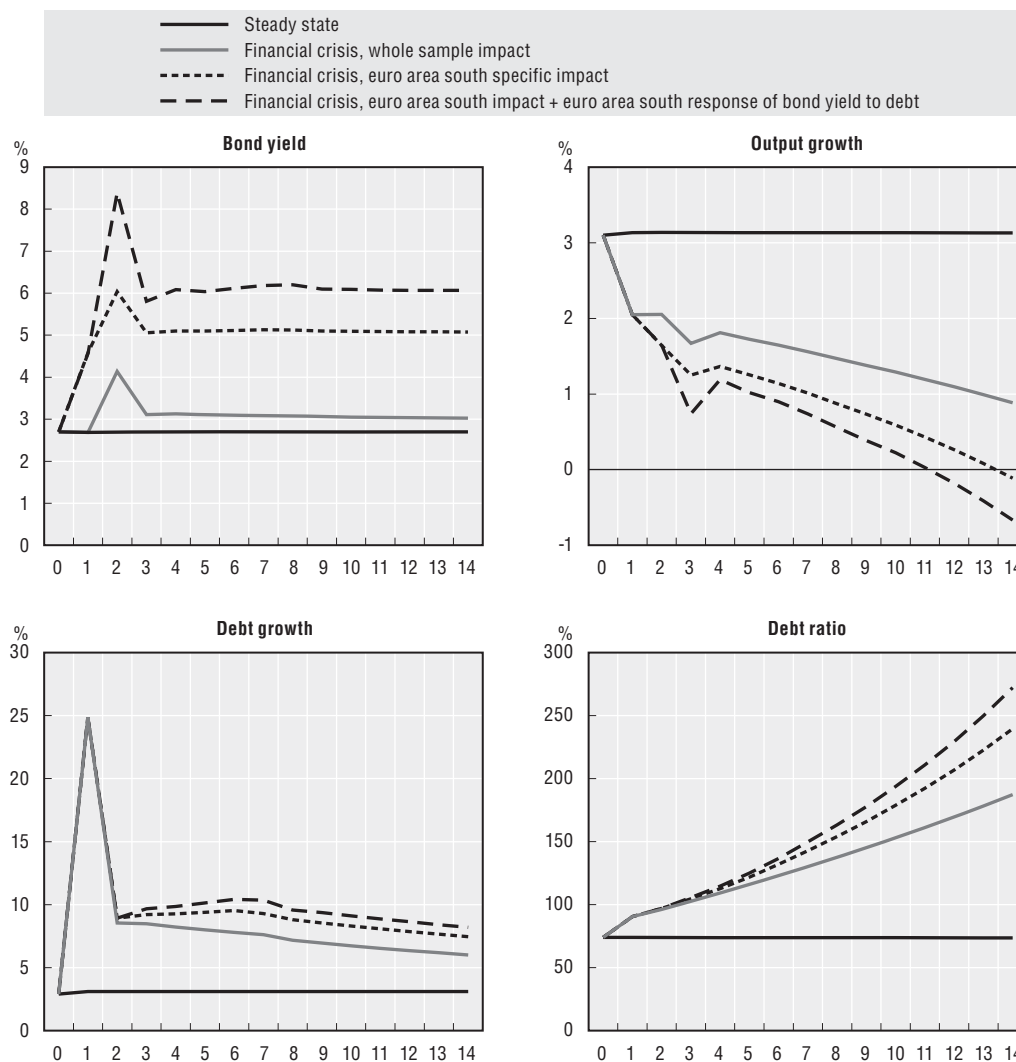
Importantly, adopting the parameter values that apply to “euro area south” countries in crisis (reported in the second column of Table 3) does not yield a feasible solution for the “good” and “bad” debt ratios. In terms of the graphical representation of the theoretical model this means that the BC schedule has shifted so much upward and/or the RR schedule so much downward that they no longer intersect. In other words, without strong and decisive policy actions, these countries can never return to a stable path of debt and growth dynamics, as will be illustrated by our comparative dynamic simulations in the next section.

4.2. Comparative dynamics

The model can be used to carry out dynamic simulations of policy impulses. We focus our attention on the “euro area south” as this is the most interesting case to look at in the current situation. To do so, we first need to set up a baseline trajectory of these economies after the crisis without subsequent policy responses to resolve it, which is done in four steps. All simulations are carried out for a period of 15 years, including the initial year “0”. In a *first* step a simulation is run in which all parameters are fixed at their values for the whole sample as shown in the first column of Table 3.¹⁰ For the initial value of the (exogenous) primary deficit p we again take the whole-sample average (0.3%) and for the initial debt ratio we take the “good” solution of 69%, (slightly above the sample average of close to 60% of GDP) to ensure that these economies start off from a stable equilibrium steady state (see the “steady-state” dark solid lines in Figure 9).¹¹

In the *second* step, the impact of the financial crisis is simulated by decreasing the intercept a in the growth equation in line with the estimation results (equivalent of a once-and-for-all decline in economic growth of 1.6%). In addition, we shock the primary

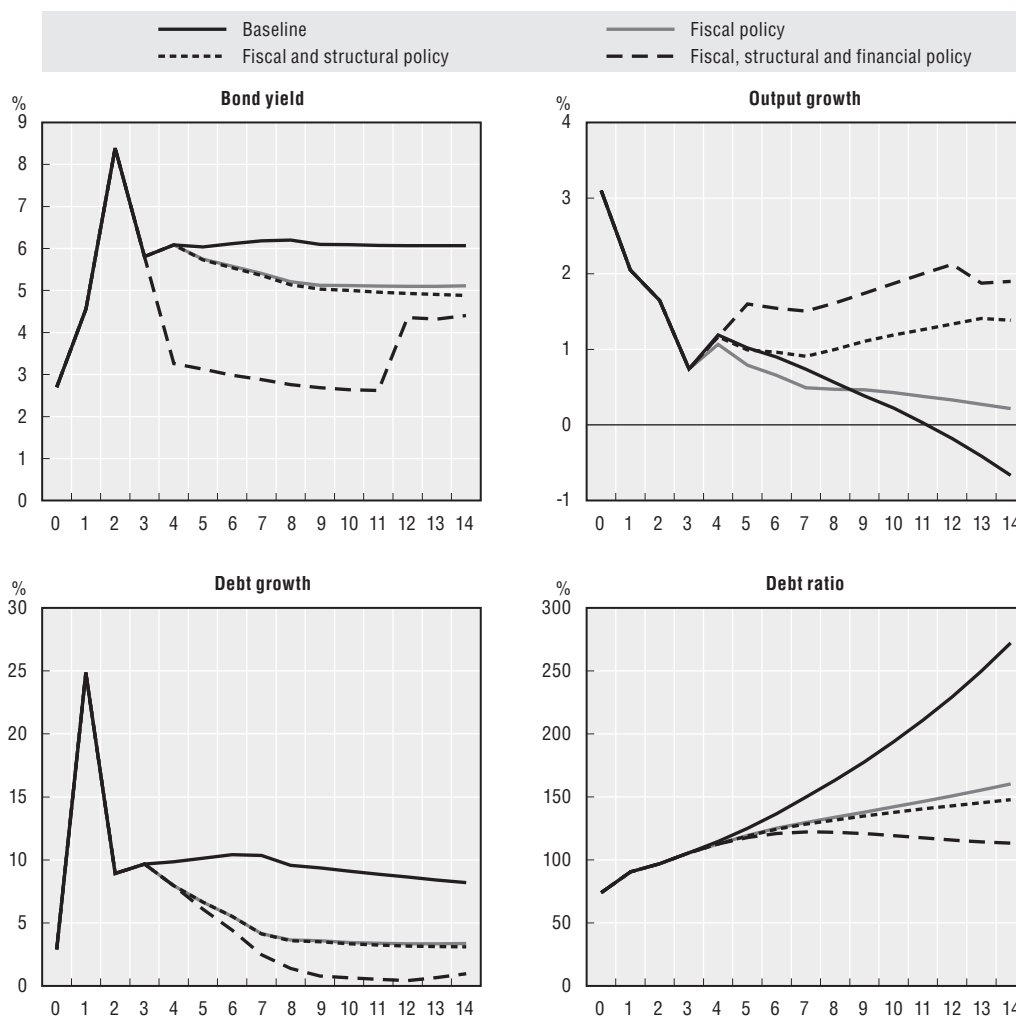
Figure 9. Baseline simulation for the “euro area south”



deficit p by 5% once and for all to reflect the fiscal expansion that countries pursued (both discretionary and by letting automatic stabilisers operate) as activity slumped, and shock the debt ratio by 15% of GDP in period 1 to reflect the fiscal cost of bank rescues. The size of these shocks is roughly calibrated on actual developments in OECD countries in the wake of the acute phase of the financial crisis in 2008/09. As shown in Figure 9, this set of shocks raises the sovereign risk premium initially, to fall back later, though not all the way to its initial (steady-state) level. Growth is declining and the debt ratio explodes: the economy is clearly pushed beyond the “bad” debt solution.

In a *third* step, we shock the sovereign yield (h) to bring it in line with the estimation results for euro area “southern” countries, and in a *fourth* step we increase the parameter that gauges the sensitivity of the sovereign yield to public debt and growth developments (c), again to bring it in line with the estimation results for the group of euro-area “southern” countries. As Figure 10 shows, the resulting baseline for the (average) “euro area south” country sees the sovereign bond yield peak at over 8%, growth slide towards negative territory and the debt ratio heading towards 200% of GDP in ten years time from the initial 69%.

Figure 10. Policy simulation for the “euro area south”



Obviously these results should be interpreted with caution; they indicate expected directions and rough orders of magnitude and should not be interpreted as “forecasts”. The main purpose of this simulation, as noted, is to construct a baseline that broadly gauges the macroeconomic performance of euro area southern countries in the wake of the financial crisis, against which the impact of policy responses can be assessed.

Onto this complete euro area south baseline three policy shocks are superimposed. First, fiscal consolidation is assumed to be implemented roughly in line with the required fiscal consolidation effort to bring public finances back on a sustainable path, on average, in the southern euro area countries for an exogenously given growth rate and bond yield (see OECD, 2012). Accordingly, the primary deficit is cut by 8 percentage points of GDP, in four steps of 2% in each of the years 4, 5, 6 and 7 of the simulation period (fiscal consolidation is thus assumed to start in earnest four years into the crisis again roughly in line with the observed pattern). As shown in Figure 10, due to the negative demand impact of fiscal consolidation, output growth is initially lower than in the baseline, but will eventually recover towards a higher growth path. The bond yield would be permanently lower (by about 100 basis points) and the rise in the debt ratio clearly less steep.¹² The upshot is that fiscal consolidation is crucial for macroeconomic stability over the medium to long run, but also carries short-run costs. Even so, and unlike in OECD (2012), the economy is still on a “bad” path.

Second, structural reform is then assumed to be implemented and beginning to bear fruit in year 4, raising the growth rate eventually by 1%, though in steps of only one-tenth of a per cent every year i.e. the parameter a is increased by cumulative steps of 0.1% per year. This assumes both a strong effort and a large multiplier of structural reform, indeed close to the maximum attainable for a weighted average of distressed euro area countries, based on recent estimates by Bouis and Duval (2011). There are no (net) negative growth effects of structural reform assumed for the initial period, roughly in line with findings in Cacciatore *et al.* (2012) suggesting that (some forms of) structural reform can be expected to bear fruit from the outset. In this simulation growth-debt dynamics further improve, but the debt ratio is still increasing, suggesting the economy is still “to the right of the bad solution”.

We examine in a *third* simulation how financial support – in addition to other policies – can bring the economy back onto a path towards the “good” debt ratio by lowering the bond yield. There are two dimensions to consider: the size of the impact on bond yields and the duration. As to the size, we assume financial policy to generate a sustained negative shock to h and c bringing the values of these parameters back to the OECD averages reported in Table 3 (i.e. we assume the elimination of the area-specific systemic effect plaguing southern euro members). To determine the required duration of financial support of this size we experimented with different durations (all starting in year 4). The purpose of this simulation is precisely to examine how long it would need to be sustained so as to ensure that the economy tends back to the “good” debt ratio. It turns out that in our model and setting the minimum period to obtain convergence towards that ratio is eight years. This is a very long period of time if the fall in interest rates is to be the result of a temporary intervention. However it may be much more realistic if it is the result of institutional reforms that strengthen monetary union to the point of eliminating risks of break up and “contagion effects” in the weakest members.

As shown in Figure 10, the bond yield substantially falls during this period, to rise again when the support is clawed back. Even so, this operation brings the yield onto a lower path permanently. The growth of the debt ratio is stemmed to eventually stabilise and next follow a slightly downward-sloping path. Output growth is on a gradual recovery path, despite a minor setback when the financial support ends. The upshot is that a sovereign confidence “bridge” with a duration of the order of eight years would engineer a return to the “good” debt ratio, conditional on fiscal and structural policy action as laid out above. However eight years is quite a protracted period which would bear a substantial cost and runs against the intuition that financial backstops are temporary in nature. This suggests that a stronger contribution to debt sustainability should come from structural reforms and fiscal consolidation and that a more permanent fall in interest rates can come as the result of institutional reforms aimed at strengthening the architecture of monetary union.

5. Concluding remarks

In this article we attempt to gauge the processes that trap countries in “bad” dynamics of high and growing fiscal deficits and debt, high risk premia and deep recession. For this we develop a simple and stylised analytical framework, both tractable and easy to estimate, capturing several key dimensions of the current crisis. We use it to examine if and how a combination of fiscal consolidation, structural reform and financial backstops can help countries, notably the southern euro-area countries, to escape from the debt trap. From the analysis we infer the following three main conclusions.

First, financial backstops are helpful to deal with a crisis situation and offsetting the risk of falling into a debt trap. In principle it does not matter whether these backstops are directed toward sovereigns or banks, since their fates are tightly intertwined (sovereigns guarantee banks while banks hold government bonds). However, either way their impact is limited and fades away relatively soon if not followed by permanent and credible solutions to break the feedback loop between banks and sovereigns, *i.e.* deeper monetary union, including banking, fiscal and political union. In other words financial backstops only “buy time”. Time must be used productively for fiscal consolidation and structural reforms to bear fruit, as well as to launch deep reforms of monetary union.

Second, our analysis confirms that the loss of fiscal policy space of countries trapped in bad dynamics inevitably requires that fiscal action be directed towards consolidation, as reducing debt levels breeds stronger growth and results in lower sovereign risk premia. It also shows that fiscal consolidation initially may depress growth, but not to an extent where this would push a country into bad dynamics or prevent it from escaping from it. So, in a medium-term timeframe the trade-off between “austerity” and growth would not exist. However, in the short run it may well indeed, and this makes the political economy of fiscal consolidation tricky. This is why it is particularly useful for countries trapped in bad dynamics to be able to benefit from a “confidence bridge” through financial backstops.

Third, there is a very important role for structural reform to help countries escape from bad dynamics. Since the beginning of the crisis many countries have enacted structural reform in tandem with fiscal consolidation measures, which bodes well for the future. We find that a boost to growth through structural reforms is key to facilitate the exit from bad dynamics. As in the case of fiscal consolidation, however, the positive impact on growth builds up over time, thus potentially giving rise to a political economy dilemma.

Once again, financial backstops to engineer positive interest-rate-debt-growth dynamics already in the short run may help economies to overcome the high-debt trap. Even more importantly, institutional reforms that strengthen monetary union could bring about a permanent fall in interest rates that greatly facilitates debt sustainability. Therefore, avoiding debt traps in monetary union is likely to require a well-designed and implemented combination of structural reforms, fiscal consolidation and financial measures alongside a deepening of monetary union.

Notes

1. The terminology “good” and “bad” equilibrium, while widely practiced, is in fact inaccurate: the bad equilibrium refers to an unstable solution which hence cannot be qualified as in “equilibrium”. We therefore will hitherto use instead the terms “good” and “bad” solution.
2. We include the level rather than the change of the primary public deficit in this growth equation. This is consistent with the “Robertsonian saving” hypothesis embedded in Duesenberry’s (1958) model. This hypothesis postulates that the next period’s output is determined by the preceding period’s income less net saving (S_n), so $Y_{t+1} = k(Y - S_n)$, where k is a constant. This implies that $\dot{Y} / Y = -kS_n / Y - (1 - k)$, so it is the level of net saving as a share of output that determines the next period’s output growth rate. Net saving can be broken down into public net saving as a share of output, i.e. the fiscal position, and private net saving as a share of output, which in turn may be assumed to be a function of the public debt ratio, the real interest rate and wealth effects stemming from structural reforms, as is implicitly assumed in equation (1b).
3. For the sake of simplicity we omit in this specification the impact of other factors on changes in the stock of debt, such as revaluations, the purchase or sale of financial assets by the government, or default.
4. See Cecchetti *et al.* (2011) and Checherita and Rother (2010). Some authors find two thresholds, with debt below the lower threshold favourable to growth and debt beyond the higher threshold harmful to growth; see Kumar and Woo (2010) and Elmeskov and Sutherland (2012) who report thresholds of 30% and 90% and 45% and 66%, respectively.
5. The countries included are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States.
6. To see why current primary deficit is taken as a share of lagged GDP, one should observe that the debt growth equation is derived from the expression $\dot{D}_t = r_t D_{t-1} + P_t$, dropping country index i for the moment. Now, dividing this by D_{t-1} and rearranging, we obtain the expression that corresponds to equation (3): $\frac{\dot{D}_t}{D_{t-1}} = r_t + \frac{P_t / Y_{t-1}}{D_{t-1} / Y_{t-1}}$.
7. They “consider a banking crisis to be systemic if two conditions are met: i) Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations); and ii) Significant banking policy intervention measures in response to significant losses in the banking system”. This variable is originally available up to the year 2009, thus we “update” it by extending the last value in 2009 for another two subsequent years, assuming that the countries in the financial crisis in 2009 remained in the crisis for another two years, and *vice versa*. We think that the error thus committed is not too big.
8. It should be noted that the size of the so-called fiscal multiplier is an ongoing debate, and furthermore, fiscal multipliers may be very different in a booming economy as compared with an economy in crisis, when monetary policy faces a zero lower bound, there is ample economic slack and households face liquidity constraints. To empirically explore this issue further is beyond the scope of this paper, but for readers who want to read more, a good starting point is IMF (2012).
9. Note that due to data availability, compared with the estimation of the growth equation there is one extra country included: Luxembourg. Excluding this country from the interest-rate estimation would not make much difference to the results.

10. The effective interest rate on government debt is assumed to be equal to the five-period moving average of the market yield.
11. We assume that southern euro countries start from the same 69% level of “good” debt. Hence we assume that their specific h and c values are triggered only after the crisis has hit. The lower value for a is not area specific, but applies to the whole sample after the financial crisis has hit.
12. According to OECD (2012) this order of magnitude of fiscal consolidation would be sufficient to stabilise the debt ratio only if economic growth recovers, which is clearly not the case in this simulation.

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Data annex

Source: OECD Economic Outlook 90 Database.

Variables:

GDP growth – annual growth rate of gross domestic product, volumes.

Public debt ratio – general government gross financial liabilities, values, as a share in gross domestic product, values. For some countries (Greece, Ireland, Luxemburg, Portugal and Slovenia), gross public debt, Maastricht criterion, values, extends further back in time, therefore for these countries we back-dated the public debt series. The Maastricht series was multiplied by a factor such that the two series have the same value in the first year that the public debt series appears.

Primary deficit – government primary balance, values. In regressions it is used as a share in lagged gross domestic product, values.

Real long-term interest rate – real long-term interest rate based on lagged GDP deflator, based on the long-term, 10-year government bonds yields.

Real short-term interest rate – real short-term interest rate based on the private consumption deflator, based on short-term, 3-month interbank interest rate.

Inflation – based on the consumer price index.

Gross fixed capital formation ratio – gross fixed capital formation, total, volumes, as a share in gross domestic product, volumes.

Mean years of schooling – measures mean years of schooling for the population of 24-65 years of age. Education data is obtained from Bouis *et al.* (2011). In the data the information on education is available for every five years only. For the missing values we interpolate the series.

Trade openness – measured as the sum of exports and imports as share in gross domestic product, volumes. Exports and imports are exports of goods and services, volumes, and imports of goods and services, volumes, respectively.

Population – total population obtained from OECD Statistics.

Total dependency ratio – total dependency ratio computed as the sum of the number of those under 15 years of age and the number of those over 64 over the number of 15-64 year olds. Population data are obtained from OECD Statistics.

Banking crisis indicator – based on data on the systemic banking crisis constructed by Laeven and Valencia (2008 and 2010). They “consider a banking crisis to be systemic if two conditions are met: i) Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations); and ii) Significant banking policy intervention measures in response to significant losses in the banking system”. In constructing the banking crisis indicator we follow Cecchetti *et al.* (2011), meaning that it takes a value of zero if in the subsequent n years there is no banking crisis, and the value of $1/n$, $2/n$, and so forth, if a banking crisis occurs in one, two, etc., of the subsequent n years.