Draft: Comments Welcome

A Model of Debt Sustainability and Creditworthiness in the Euro Zone

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Abstract

Lacking their own central bank to lend to governments in their own currency, Euro Zone countries with weak fiscal positions and uncertain growth prospects have found their market creditworthiness to be fragile. This paper draws on the literatures on self-fulfilling currency and debt crises to develop a model of creditworthiness in the Euro Zone. The model incorporates institutional specific factors such as the available of conditional official funding and also a two-way feedback between growth and fiscal adjustment. Both the economic and political feasibility of the required fiscal adjustments are examined, as are the conditions for multiple self-fulfilling expectational equilibria. Using the Irish case as an illustration, the model is used to examine a range of policies to increase the robustness of creditworthiness.

1. Introduction

A central feature of the Euro Zone crisis has been the fragility of sovereign creditworthiness for countries with high debt/deficit levels and uncertain growth prospects. Lacking their own central banks to act as lenders of last resort to governments in their own currency, a number of Euro Zone countries have found their access to bond markets at interest rates consistent with debt sustainability can quickly evaporate (DeGrauwe, 2011).

This paper develops a model of debt sustainability and creditworthiness that incorporates specific institutional details of the Euro Zone and its crisis-resolution policies. These include the availability of official support programmes, where official ("troika") funding without forcing a restructuring of privately held sovereign debt is conditioned on the adoption of ambitious fiscal adjustment programmes, and also the possible intervention by the European Central Bank (ECB) in secondary bond markets. It also focuses on the two-way interaction between growth and fiscal adjustment that has been central to the "austerity versus adjustment" debate

The modelling approach is influenced by second-generation currency crisis models that were developed following the 1992-93 crisis of the Exchange Rate Mechanism (ERM) (in particular, Jeanne, 1997).[1] These models explicitly consider the decision of the

[1] See also Obstfeld (1996) and Krugman (1996).

government on whether to sustain a currency peg. Expectations that the government will abandon the peg will raise the costs of its defence. A central feature of these models is the possibility of multiple self-fulfilling expectational equilibria. In the present context, the government is assumed to weigh the costs of the fiscal adjustment required for access to official support against the costs of default. Greater expectations of default can make default more likely by pushing up interest rates and thus making it harder to achieve required improvements in the debt to GDP ratio. The fragility of creditworthiness is affected by domestic factors such as the political costs of fiscal adjustment and the costs of default, and also by official-sector policies on conditionality and secondary bond market interventions. Calvo (1988) developed a pioneering model of default that also shows the possibility of multiple equilibria,[2] and emphasises the potential role of interest rate management in avoiding a "bad equilibrium". The main innovation in the model developed here is the incorporation of an official lender willing to provide funding under conditions for the improvement in the debt to GDP ratio. This focuses attention on the willingness of the government to persevere with a difficult fiscal adjustment that is required as a condition for official support as the alternative to default.

The rest of the paper is structured as follows. Section 2 develops the basic intuition surrounding the default decision in the presence of an official lender, abstracting initially from uncertainty about growth and endogenous interest rates. Section 3 then introduces uncertainty over growth prospects and allows for probabilistic default. Section 4 allows for an endogenously determined interest rate based on expectations of default and shows how the economy could be subject to multiple self-fulfilling expectational equilibria depending on its underlying fundamentals. Finally, Section 5 discusses a range of possible policy implications of the model, using the Irish case as an illustration.

2. No Growth Uncertainty, Exogenous Interest Rate

2.1 Basic structure and timing

[2] See also Alesina et al. (1990) and Cole and Kehoe (2000).

The model of the government's creditworthiness has three main elements. First, there is a specification of the government's loss function that recognises both the costs to the government of fiscal adjustment and the costs to the government of default. Second, there is a specification of the conditions set down for official support, which results in a required adjustment in the primary balance. It is assumed that the government is not creditworthy without the backing of official support. And third, there is a specification of the two-way relationship between growth and the change in the primary balance: growth improves the primary balance through automatic stabiliser effects; but changes in the primary balance also harm growth.

Although time is continuing, we make a number of simplifying assumptions that allow us to focus on a two-period problem. In time *t*, the government inherits a debt to GDP ratio, d_t. A fraction of this debt matures in period *t*, but is assumed to be financed by official loans at a given interest rate. Thus the average interest rate on the debt is assumed to given. (In Section 4 we relax the assumption that the government is not borrowing from private debt markets.) Continued access to official funds is assumed to be available in *t*+1, but is conditioned on achieving a given reduction in the debt to GDP ratio. The key decision for the government comes in *t*+1, when they have to choose between doing the costly fiscal adjustment required to meet the conditions for official support (Plan A) and default (Plan B).

2.2 The government's loss function

As noted in the introduction, the key innovation in second-generation currency crisis models is to treat the government's decision on whether to abandon a currency peg as a political cost-benefit decision. Applying this logic here, the government's default decision is modelled as a trade-off between the cost of not defaulting – which requires a difficult fiscal adjustment as described below – and the benefit of not defaulting – which is the avoidance of the costs associated with default. The government is thus assumed to minimise a loss function of the form,

(1) $L_{t+1} = \gamma \Delta pb_{t+1}^{*}{}^2 - \pi\left(\Delta g_{t+1}^{fa}\right)^2 + \delta C_{t+1},$

where L_{t+1} is the loss to the government, γ is a parameter that reflects the direct political cost to the government of fiscal adjustment, Δpb^{*}_{t+1} is the change in the structural primary balance as a share of GDP (assumed to be equal to the discretionary adjustments undertaken by the government), Δg^{fa}_{t+1} is the growth impact of fiscal adjustment, π is a parameter that reflects the indirect political costs of fiscal adjustment on growth, C_{t+1} is the political cost to the government from defaulting, and δ is a dummy variable that takes on the value of one in the event of default.[3] It is assumed that in the event of default the required fiscal adjustment for access to official funding will not be undertaken; the identification of this required adjustment is examined in detail below. However, in addition to various reputation-related costs of defaulting, the cost of default could include the need to close the primary budget balance immediately, and so could change over time depending on the existing primary deficit. The quadratic form of the loss function means that the political costs of fiscal adjustment rise non-linearly with the size of the adjustment. The value of the γ will increase this cost for any level of fiscal adjustment. As developed in Appendix 1, the value of this parameter could rise if the margins of adjustment are limited (say because of the members of a coalition government have the power to limit particular adjustment margins), which could force the adjustment to take place on a narrow base, thus raising the overall political cost.

2.3 Conditional official support

[3] A large literature exists on the economics of sovereign default (see Panizza (2009) for a recent review). A key question in this literature is why a sovereign debt market is possible at all given the absence of an external agency that can enforce repayment on sovereign governments. In other words, what are the costs of default that make lenders willing to lend? In a classic paper, Eaton and Gersovitz (1981) show that reputational costs that lead to the exclusion from the market can make the market possible where countries have no other means of insuring against output shocks. However, Bulow and Rogoff (1989) challenge the assumption that access to international loan markets are the only way to smooth consumption in the presence of output shocks, and raise the possibility that direct punishments, such as interference with trade, could be what really allows the market to exist. Cole and Kehoe (1998) focus on reputational spillovers to other domestic agents as an alternative cost of default to the exclusion of the sovereign from future borrowing. For example, reputational spillovers might be especially important for a country that depends on its capacity to maintain stable "rules of the game" in order to attract direct investments. Broner et al. (2010) emphasise the role of secondary markets where domestic agents cannot be prevented from purchasing domestic sovereign debt, thus raising the cost of default to domestic agents (and indirectly the cost to government), thus allowing the market to exist. The costs of default are treated as exogenously given in the model developed here.

We next assume that access to funding requires a required improvement in the debt to GDP ratio, z_{t+1}. We assume initially that the government is reliant on official funding, and that the debt ratio reduction is the condition set down for access to the funding.[4] (In Section 4, we relax this assumption and allow conditional official funding to be a back up for countries that retain market access.) Implicit in this setup is that the government (without the ability to print currency to pay off debts in extremis) is not creditworthy without the backing of official support. We assume that the ex ante conditionality imposed for access to official funding is credible in the sense that the official funders will impose it ex post.

The change in the debt to GDP ratio between *t* and *t*+1 can be written (approximately) as,[5]

$$(2)\ \Delta d_{t+1} = (i_{t+1} - g_{t+1})d_t + pb_{t+1},$$

where i_{t+1} is the nominal interest rate, g_{t+1} is the nominal growth rate (between *t* and *t*+1), d_t is the initial debt to GDP ratio and pb_{t+1} is the primary balance as a share of GDP in *t*+1. Setting this equal to z_{t+1} gives the required primary balance to achieve the necessary reduction in the debt to GDP ratio in *t*+1,

$$(3)\ pb^R_{t+1} = (i_{t+1} - g_{t+1})d_t + z_{t+1}.$$

The required *change* in the actual primary balance is then,

$$(4)\ \Delta pb^R_{t+1} = pb^R_{t+1} - pb_t = (i_{t+1} - g_{t+1})d_t + z_{t+1} - pb_t.$$

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[4] Similar results follow if we assume official lenders condition their support on achieving a target for the actual General Government balance rather than a target for the reduction in the debt to GDP ratio.

[5] This expression for the change in the debt to GDP ratio is strictly true under continuous time. Under discrete time, the first term on the right-hand side should be divided by $1 + g_{t+1}$. The approximation will be small where the growth rate is low.

2.4 Two-way interaction between fiscal adjustment and growth

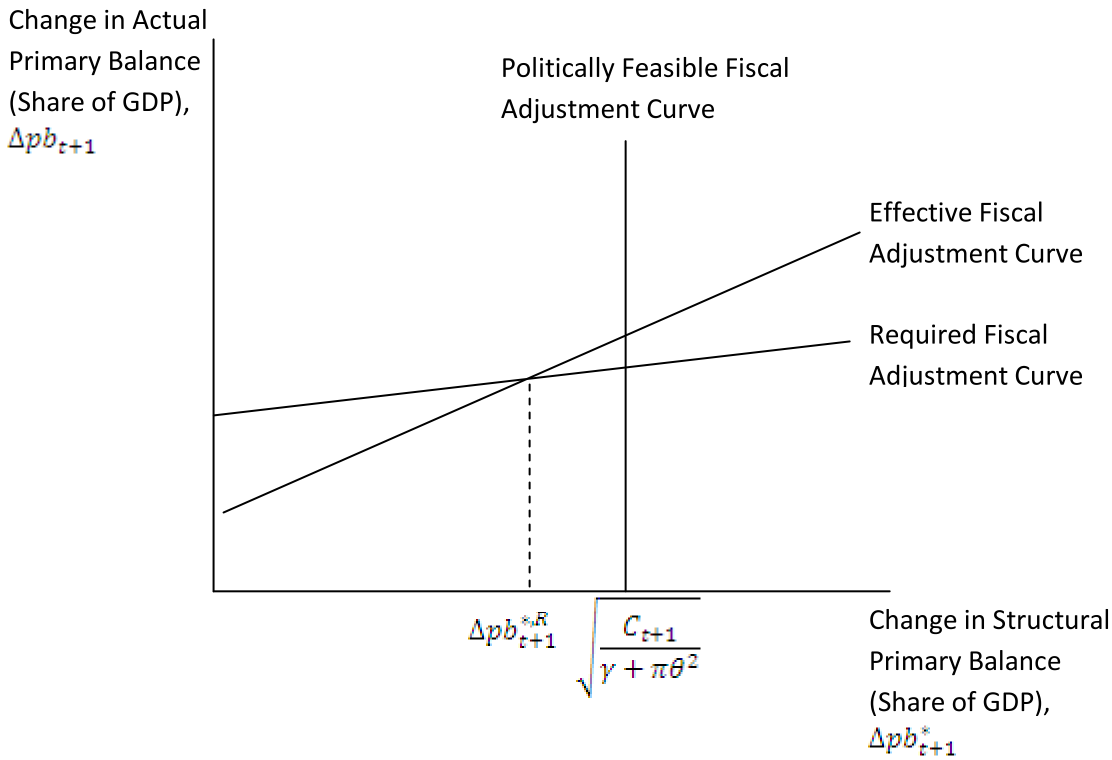
We next allow for a two-way interaction between the primary balance and growth: a change in the primary balance negatively affects growth through fiscal-multiplier effects; and growth positively affects the primary balance through automatic-stabiliser effects. Appendix 2 develops a simple model of this two-way interaction. The resulting reduced-form relationships between growth and the structural primary balance are given by,

(5) $g_{t+1} = \varphi g^0_{t+1} - \theta \Delta pb^*_{t+1}$, and

(6) $\Delta pb_{t+1} = \omega \Delta pb^*_{t+1} + \mu g^0_{t+1}$,

where g^0_{t+1} is the underlying growth rate is the absence of fiscal adjustments, Δpb^*_{t+1} is the change in the structural primary balance between *t* and *t*+1, and all parameters are positive constants (see Appendix 1). Equation (7) shows the actual change in the primary balance as a function of the change in the structural primary balance, and is termed the effective fiscal adjustment equation. The implied *effective fiscal adjustment curve* is shown in Figure 1.

Figure 1. The Default Decision (No Uncertainty; Exogenous Interest Rate)



2.5 The default decision

We now have the necessary elements to examine the government's default decision. Substituting (5) into (4) we obtain,

(7) $\Delta pb^{R}_{t+1} = (i_{t+1} - \varphi g^{0}_{t+1} + \theta \Delta pb^{*}_{t+1})d_t + z_{t+1} - pb_t.$

We term this the required fiscal adjustment equation: it shows how the required change in the primary balance is a function of the change in the structural primary balance. The implied *required fiscal adjustment curve* is also shown in Figure 1. We next substitute (6) into (7) to identify the actual change in the primary structural balance that is required to meet the debt ratio reduction requirement taking into account the feedbacks between the primary balance and growth. This value is determined by the intersection of the effective and required fiscal adjustment curves in Figure 1, and is given by,

(8) $\Delta pb_{t+1}^{*,R} = \left(\frac{1}{\omega-\theta d_t}\right)[i_{t+1}d_t - (\mu+\varphi d_t)g_{t+1}^0 + z_{t+1} - pb_t]$.

From (6), the loss to the government from lower growth due to fiscal adjustment is,

(9) $\pi\left(\Delta g_{t+1}^{fa}\right)^2 = -\pi(\theta\Delta pb_{t+1}^{*})^2$.

From (1), a loss-minimising government will default (i.e. δ=1) if:

(10) $\left(\frac{1}{\omega-\theta d_t}\right)[i_{t+1}d_t - (\mu+\varphi d_t)g_{t+1}^0 + z_{t+1} - pb_t] > \sqrt{\frac{C_{t+1}}{\gamma+\pi\theta^2}}$.

The basic elements of the default decision can be seen using Figure 1. Assuming that the intercept on the effective fiscal adjustment curve lies below the intercept on the required fiscal adjustment curve (which means that a change in the structural primary balance is required to meet the required improvement in the debt ratio), the condition for the fiscal adjustment to be *economically feasible* is that the effective fiscal adjustment curve is steeper than the required fiscal adjustment curve (i.e. $\omega > \theta d_t$). Economic feasibility here means that there is an adjustment in the structural primary balance that will achieve the required adjustment in the actual primary balance. Note that the adjustment will not be economically feasible if the starting debt ratio is greater than $\frac{\omega}{\theta}$, which is equal to the inverse of the fiscal multiplier (see Appendix 2).[6]

[6] This suggests a demanding requirement for a fiscal adjustment to be economically feasible. For example, with a fiscal multiplier equal to 1, the maximum starting debt to GDP ratio consistent with fiscal adjustment leading to an improvement in the debt to GDP is 1. However, the stringency of this result is

However, even if the fiscal adjustment is economically feasible, it may not be *politically feasible*, in the sense that given the required adjustment that loss-minimising government will choose to default. As shown by (10), the maximum politically feasible fiscal adjustment is $\sqrt{\frac{c_{t+1}}{\gamma+\pi\theta^2}}$. The politically feasible adjustment curve is thus simply a vertical line at this maximum required adjustment before the government chooses default.[7] Figure 1 shows the case where the required fiscal adjustment is both economically and politically feasible and the government will choose not to default.

3. Growth Uncertainty; Exogenous Interest Rate

We next relax the assumption of certain underlying growth prospects by allowing growth (in the absence of fiscal adjustment) to be,

(11) $g^0_{t+1} = \bar{g}^0_{t+1} + \varepsilon_{t+1}$.

ε_{t+1} is a random variable with zero mean and a bell-shaped distribution (not necessarily symmetric).[8] The cumulative distribution of ε_{t+1} is denoted $F(\varepsilon_{t+1})$.

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affected by the simplification of the two-period structure of the model. Allowing for multiple periods would introduce compounding effects on both the change in the debt and the change in GDP as a result of the initial fiscal adjustment. (It is assumed that there are permanent effects on output of a permanent fiscal adjustment.) If the interest rate is greater than the growth rate, the negative effect on the numerator of the debt to GDP ratio will rise in relation to the negative effect on the denominator over time. It follows that there is a date in the future that the effect of today's fiscal adjustment is a lower debt to GDP ratio, all else equal. In a multi-period model, a weaker requirement for economic feasibility could be that the debt to GDP ratio must be improving by some particular date. A concrete illustration is given in IFAC (2012a, Box C) in the context of Ireland's fiscal adjustment programme. The effect on the debt to GDP ratio of an additional improvement in the structural primary balance in 2012 is examined. For a multiplier of 1, the debt to GDP ratio would rise in 2012 given that the starting debt ratio is greater than 1 (1.15). However, simulations show that the multiplier would have to be greater than 3.8 for the debt to GDP ratio to be higher in 2015 (the final year of Ireland's adjustment programme), all else equal.

[7] Ostry et al. (2010) develop a model of "fiscal space" in which the politically feasible primary balance is a positive function of the debt to GDP ratio. Default is avoided if the primary balance required for debt sustainability does exceed the feasible primary balance, where both rise with the economy's debt to GDP ratio.

[8] Of course, the prospects for growth are not the only possible source of uncertainty. For example, where there is an explicit or implicit contingent liability on the sovereign for banking-system losses, this creates uncertainty about the size of the debt in the second period. Moreover, in addition to uncertainty about

Introducing growth uncertainty makes default a probabilistic event, where a sufficiently bad growth outcome will induce the government to choose default.[9]

To see this, we can now rewrite the default condition (9) under uncertain growth as,

$$(9') \quad \left(\frac{1}{\omega-\theta d_t}\right)\left[i_{t+1}d_t-(\mu+\varphi d_t)(\bar{g}^0_{t+1}+\varepsilon_{t+1})+z_{t+1}-pb_t\right] > \sqrt{\frac{C_{t+1}}{\gamma+\theta\pi^2}}.$$

This can be usefully rearranged as,

$$(11) \quad \varepsilon_{t+1} < -B_{t+1},$$

where $B_{t+1} = \dfrac{\sqrt{\frac{C_{t+1}}{\gamma+\pi\theta^2}}-\left(\frac{1}{\omega-\theta d_t}\right)\left[i_{t+1}d_t-(\mu+\varphi d_t)\bar{g}^0_{t+1}+z_{t+1}-pb_t\right]}{\mu+\varphi d_t}.$

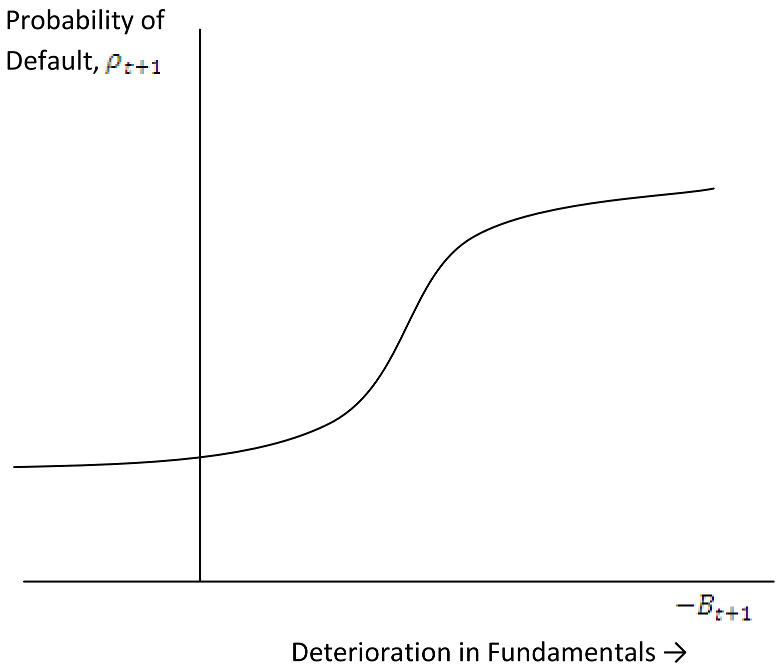
The expected fundamentals can be divided into: (i) interest-rate-related fundamentals; (ii) non-interest-rate-related fundamentals (the underlying growth rate, the nature of the feedbacks between growth and fiscal adjustment, the political costs of fiscal adjustment, the inherited debt, the nature of official-sector conditionality, and the starting primary balance); and (iii) the costs of default. The probability of default for

the economic fundamentals, there could be uncertainty about the parameters of the government's political loss function and the willingness of official lenders to impose the conditionality ex post.

[9] Growth uncertainty affects default prospects here by raising the possibility that the cost of the required fiscal adjustment will be pushed above the (fixed) cost of default. Grossman and Van Huyck (1988) develop a model where a distinction is made between an excusable and an inexcusable default. An excusable default could be associated with a bad economic outcome that the government cannot control. Excusable defaults might not be punished in the same way in terms of future exclusion from sovereign debt markets. This raises the possibility that an (excusable) adverse growth shock could also lower the cost of default, further increasing the probability of default when such a shock occurs.

any given value of $-B_{t+1}$ is then $F(-B_{t+1})$.[10] Note that an increase in $-B_{t+1}$ reflects a deterioration in the expected fundamentals. From (9') and (11) we can see that a higher starting debt ratio amplifies the effects on the probability of default of changes in other elements of the expected fundamentals and also the effects of growth shocks. The probability of default is graphed as a function of the expected fundamentals in Figure 2.

Figure 2. The Relationship between Expected Fundamentals and the Probability of Default (Uncertain Growth; Exogenous Interest Rate)



4. Growth Uncertainty; Endogenous Interest Rate

We finally allow for an endogenously determined interest rate. We retain the assumption that official funding is available conditional on achieving a required reduction in the debt to GDP ratio, but it now serves a back-up role given the assumed continued reliance on private debt markets. The country is assumed to borrow in the private debt market in period *t* at a market determined interest rate, where the interest rate reflects the probability of default. However, only a fraction, *s*, of the inherited debt in period *t*, must be financed at the market interest rate, i^m_{t+1}, so the average interest

[10] See Jeanne (1997) for a similar application in the context of a currency crisis under a fixed currency peg system.

rate is $i_{t+1} = si^m_{t+1} + (1-s)i^0_{t+1}$, where i^0_{t+1} is the pre-contracted for interest rate on the non-maturing debt. The probability of default will again reflect the government's willingness to achieve the required reduction in the debt ratio set down as a condition for access to official funds by the official creditors. However, the market interest rate will be one component of the expected fundamentals affecting the default decision. The expected fundamentals is now given by,

$$(12)\ B_{t+1} = \frac{\sqrt{\frac{c_{t+1}}{\gamma+\pi\theta^2}}-\left(\frac{1}{\omega-\theta d_t}\right)\left[\left(si^m_{t+1}+(1-s)i^0_{t+1}\right)d_t-(\mu+\varphi d_t)\bar{g}^0_{t+1}+z_{t+1}-pb_t\right]}{\mu+\varphi d_t}.$$

For simplicity, we assume the risk-free interest rate is zero, private investors are risk neutral and that there is full default if default occurs at all (i.e. a zero recovery rate). Thus the market interest rate is equal to the ex ante default probability, ρ_{t+1}. Taking advantage of the fact that the interest rate is one determinant of the expected fundamentals, we can graph the default probability as a function of the interest rate (holding the other determinants of the expected fundamentals in B_{t+1} constant). This relationship is shown in Figure 3.[11] Imposing the rational expectations condition ($\rho_{t+1} = i_{t+1}$), we can identify the equilibrium interest rate.

[11] Note that allowing for partial default would cause the interest rate line to swivel upwards and so lie above the 45 degree line for a strictly positive probability of default.

Figure 3. Relationship between the Interest Rate and Probability of Default (Uncertain Growth; Unique Equilibrium Interest Rate)

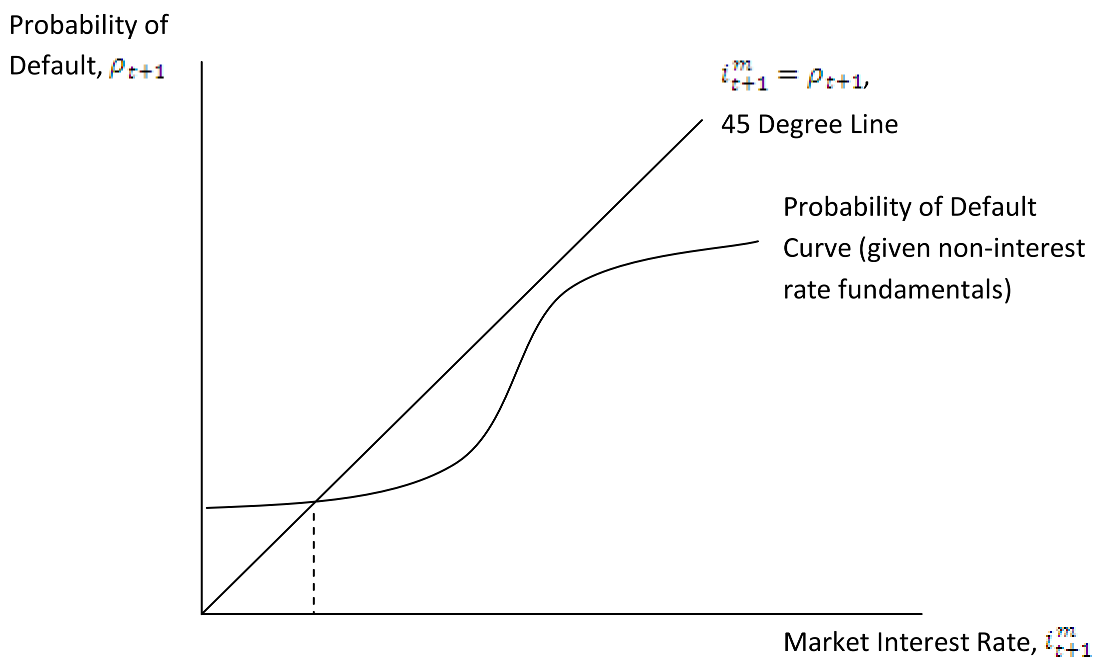
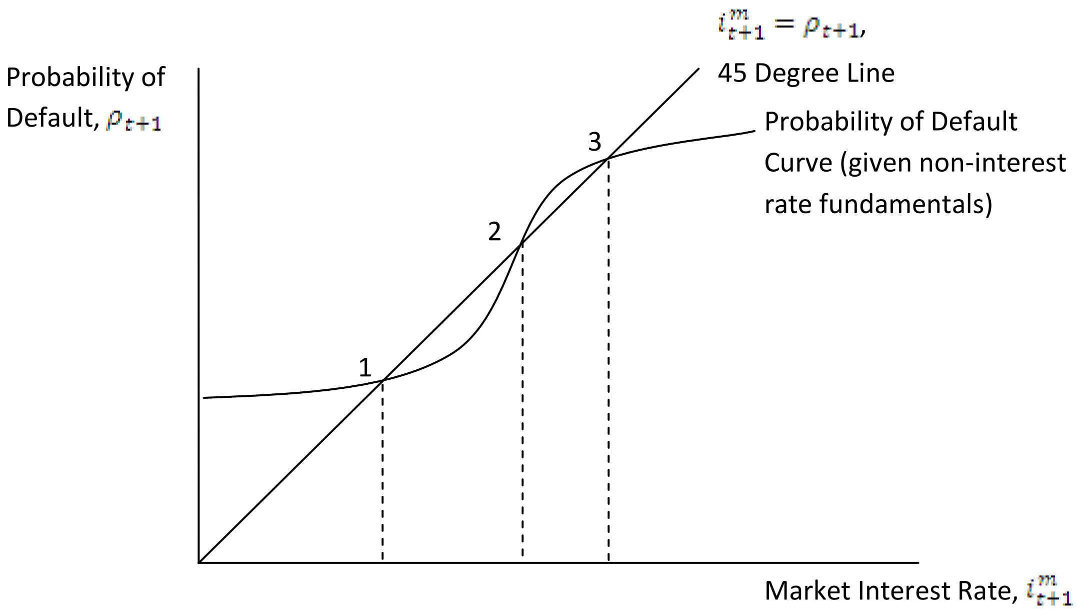


Figure 3 shows the case where the non-interest rate fundamentals are such that there is a unique equilibrium interest rate. However, recognising that deterioration in the non-interest fundamentals will cause the probability of default curve to shift upwards, a situation can arise where there are multiple potential equilibria – or "sunspots". Such a case is shown in Figure 4. The possibility of multiple equilibria arises because the interest rate affects the expected probability of default; but the expected probability of default also affects the interest rate. An equilibrium interest rate is one in which the resulting expected probability of default would validate that interest rate. Equilibrium 1 and equilibrium 3 in Figure 4 are stable; whereas equilibrium 2 is unstable. (Starting from equilibrium 2, any shock to the interest rate or other elements of the expected fundamentals would cause the economy to move further away from that equilibrium.) This reflects a phenomenon much discussed during the Euro Zone crisis, and identified in Calvo (1988), whereby an economy is at risk of falling into a self-fulfilling bad expectations trap – pessimistic expectations on the chances of avoiding default leads to a high interest rate, which validates the initial pessimistic expectations through a deterioration in the expected fundamentals.

A higher cost of default has mixed effects in the model. A higher cost makes it less likely a government will default for a given value of the fundamentals, thereby lowering the interest rate at which it can borrow in the bond market, and so improving those fundamentals. However, in the event default does occur, a higher cost will mean greater costs to economy (in addition to political costs to the government).[12]

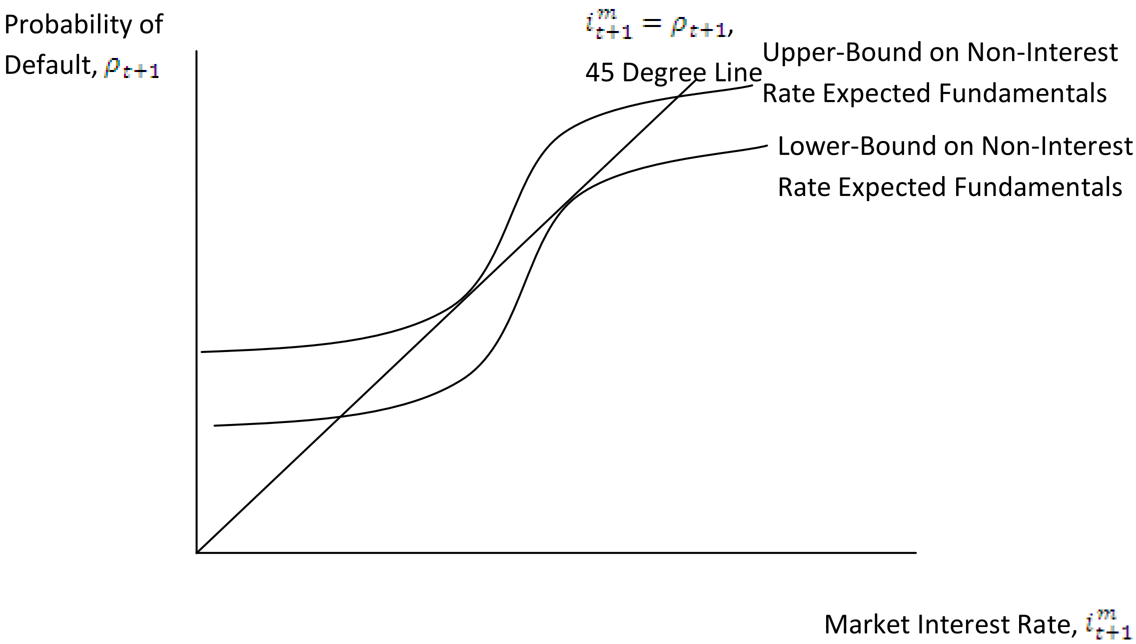
[12] The double-edged sword nature of higher default costs is also a feature of Calvo (1988): "[*A*]*lthough increasing the costs of repudiation enhances the "credibility" of the government in capital markets, the latter may be bought at the cost of lower consumption if the economy ends up at the bad equilibrium*" (Calvo, 1988, p. 653, emphasis in original). In the context of the debate over reforms that would lower the costs of international default (see, e.g., Eichengreen, 2003), Dooley (2000) and Shleifer (2003) emphasise the ex ante costs of a less costly default ex post. However, Bolton and Jeanne (2009) note that market outcomes may result in a sovereign debt structure that is inefficiently difficult to restructure, and an appropriately designed international bankruptcy regime would alleviate this inefficiency.

Figure 4. Relationship between the Interest Rate and Probability of Default (Uncertain Growth; Multiple Equilibrium Interest Rates)



Whether an economy faces the possibility of multiple self-fulfilling equilibria depends on the non-interest rate expected fundamentals pushing the economy into a zone of vulnerability. Figure 5 shows the range of values for the non-market-interest expected fundamentals consistent with a unique equilibrium. Any position of the default probability curve in between these limits is associated with multiple equilibria.

Figure 5. Range of Non-Interest Rate Expected Fundamentals Associated with Possibility of Multiple Equilibria



Note: Deterioration in non-interest rate fundamentals will shift the probability of default curve upwards.

4. Discussion of Potential Policy Implications: An Application to Ireland

The model provides a useful framework for examining a range of domestic- and Euro Zone-level policies that would improve a country's creditworthiness. Using the Irish case as an illustration, this section concludes by examining a number of possible policy actions. Of course, no simple model can capture the richness of factors affecting a particular country's creditworthiness. However, the model does help highlight a number of inter-related factors within a consistent framework.

Ireland lost access to international bond markets at affordable yields in the second half of 2010, and entered into an official "troika" support programme at the end of that year. The programme came with conditions attached to speed of required fiscal adjustment (in addition to conditions on banking-sector and structural reforms). After peaking in mid-2011, bond yields have steadily declined as the government has met programme targets and Euro Zone crisis-resolution policies have evolved. However, uncertainty surrounding growth prospects, a daunting remaining fiscal adjustment and sometimes halting crisis-resolution policy developments at the Euro Zone level, have left debt sustainability and market/official creditworthiness fragile (IFACb, 2012). The model suggests a range of national and international official-sector policies that could reduce this fragility.

(1) *Policies to reduce the political costs of a given fiscal adjustment.* The model highlights the importance of the political costs of fiscal adjustment. These costs associated with fiscal adjustment are captured by the parameter γ. From the special budget of July 2008 and the planned adjustments under the programme out to 2015, the total actual and planned adjustments amount to approximately €32 billion (or roughly 20 percent of 2011 GDP). The adjustments have taken place across a wide range or expenditure and revenue areas. However, recent adjustment efforts have narrowed the range of potential adjustment margins, and, in particular, have ruled-out near-term adjustments in public-sector pay rates, tax rates and social welfare rates. This appears to reflect an agreement by the centre-right/centre-left coalition that came to power in early 2011 to avoid adjustments in areas that are especially sensitive to each of the core voter constituencies. However, a concern is that by narrowing the range of potential adjustment margins, the adjustment falls heavily on certain areas, including government services (notably health and education) and the capital budget. While narrowing the margins of adjustment could avoid politically contentious areas and thus lower the political costs of a given adjustment, an overly narrow adjustment could also undermine the perception of fairness – with non-protected areas getting hit particularly hard – and also fall heavily on areas that are particularly damaging and come with high political costs (see Appendix 1). An adjustment programme that leaves all adjustment margins "on the table" could improve the perceived feasibility of the programme overall (IMF, 2012).

(2) *Policies that increase the perceived cost of default.* The model underlines that a default decision involves a trade-off between the political costs of fiscal adjustment and the political costs of default, C_{t+1}. While the ultimate choice is the result of a cost-benefit decision, one advantage of being able to convincingly show a strong reluctance to default is that it can lower market interest rates, and thus improve the

underlying economic fundamentals. This suggests the ex ante value of strongly attaching the government's political reputation to the avoidance of default.[13] One advantage of raising the political costs as opposed to economic costs of default is that in the event that default does occur – say because of a highly negative growth shock – the costs fall are political costs to the government rather than on the economy. Another possible approach is to take actions that would actually increase the economic costs (and thereby the political costs) of default ex post.[14] Broner et al. (2010) explain the fact that domestic residents often come to hold a large share of the debt issued by their government through secondary market trading in terms of the effect on the perceived probability of default and thus interest rates. While Irish bonds have been traditionally overwhelmingly been held by international investors, the recent move to introduce "amortising bonds" (to back "sovereign annuities" issued by life insurance companies and held by domestic pension funds) is a move towards greater domestic holdings. The potential costs and benefits of such bonds/annuities goes well beyond the implications for sovereign creditworthiness, but they would, if widely held domestically, work to increase the domestic costs of default, the thereby make any commitment to avoid default more credible. Of course, purposively raising the economic costs of default is a risky action: while it may lower the ex ante probability of default and thus improves creditworthiness; it will make the default more damaging if it actually occurs ex post.

(3) *Policies relating to official-sector conditionality.* An important contributor to market creditworthiness for crisis-affected economies is the perception of back-up access to official funding – especially if this access would come without a forced

[13] Borensztein and Panizza (2009) examine the empirical evidence for a range of costs that could result from sovereign default. They find that "economic costs" such as bond-market and international trade exclusion are "significant but short-lived". However, they find that the "political consequences of a debt crisis . . . seem to particularly dire for incumbent governments and finance ministers" (p. 683).

[14] Zettlemeyer et al. (2012) provide an insightful review of Greece's 2012 debt restructuring, which they assess as generally positive in terms of its effects on Greece and in terms of the broader effort to resolve the Euro Zone crisis. In the context of the current model, it is interesting to consider the possible implications of a "successful" restructuring of Greece's sovereign debt on the creditworthiness of other crisis-affected countries. On the one hand, the ability to affect an orderly restructuring with lower costs to Greece than feared is likely to lower the expected C_{t+1} and thus to lower creditworthiness. But on the other hand, to the extent that the orderly restructuring lowered the costs imposed on bond holders, this would have a positive impact on creditworthiness. This latter effect is absent in the model due to the assumption of full default once default occurs. Of course, looking beyond the creditworthiness effect, a lower value of C_{t+1} is positive for the defaulting country in the event that default occurs.

restructuring/default on privately held debt. Such official-sector support will typically be conditional on domestic fiscal adjustment efforts. However, overly stringent conditionality will increase doubts that the conditions can be met. The form of the conditionality also matters. For example, conditions specified in terms of improvement in the actual General Government deficit or reductions in the debt to GDP ratio will be harder to meet if there is a negative growth shock relative to the growth outlook in the programme. One potentially useful policy change from the view point of restoring robust market creditworthiness would be to specify the fiscal conditionality in growth-contingent terms. In the context of the model, it is assumed that conditionality requires a given improvement in the debt to GDP ratio, z_{t+1}. Such an improvement is closely linked to improvements in the actual primary balance.[15] Without reducing the expected level of effort, this conditionality could be more supportive of regaining market access if it is specified in terms of improvements in the structural primary balance (see, for example, Abbas, et al. 2011), which could be operationalised through (audited) implementation of discretionary expenditure and revenue measures. Under such an approach, the required adjustments would not increase in the event of an adverse growth shock, with resulting benefits in terms of perceived creditworthiness.[16]

(4) *Policies that reduce the burden of official debt.* Not surprisingly, the probability of default rises in the model with the starting level of the debt to GDP ratio, d_t. There is also an interaction between the starting debt ratio and growth shocks. Of particular relevance to Ireland, the June 29th, 2012 Leaders' Summit made a commitment to "examine the situation of the Irish financial sector with the view of further improving the sustainability of a well-performing adjustment programme". From an official sector viewpoint, relief on the portion of sovereign debt related to recapitalisation of the banking sector could potentially be justified by the positive

[15] Note that the change in the debt to GDP ratio is equal to the General Government (or total) deficit and the product of the growth rate and the starting level of debt. Official ("troika") support programmes have typically been specified in terms of targets for the General Government deficit, and thus the implied debt-ratio reduction target does allow for a degree of accommodation to adverse growth shocks.

[16] The model has assumed that official-sector funding will be available if the conditions are met. However, actual crisis resolution has been affected by doubts about the availability of funding – especially funding that would not be further conditioned on a restructuring of privately held debt. While they come in various forms, Eurobonds – again conditioned on various fiscal and structural actions – could add to the credibility of available funding and further underpin creditworthiness.

impact on the country's creditworthiness, reducing the chances of a longer-term dependence on official assistance. One country's successful exit from official assistance could also send a broader signal to investors, showing that a conditional temporary support strategy can lead to a return to sovereign bond markets without forcing a restructuring of privately held debt.

(5) *Policies that reduce the probability of bad expectational equilibrium through intervention in secondary bond markets.* As noted in the introduction, a feature of second-generation currency crisis models is susceptibility to self-fulfilling bad-expectations equilibria. In the sovereign default context, Euro Zone countries with large debts/deficits and weak/uncertain growth prospects appear to be susceptible to bad expectational equilibrium involving high default probabilities and high interest rates. Even where official support is potentially available, it effectiveness in avoiding a bad equilibrium is reduced if there is likelihood that it will require a restructuring of privately held sovereign debt. European Central Bank (ECB) intervention to cap yields in secondary bond markets could remove the risk of such bad equilibria arising. Central to the success of such intervention is the credibility of the ECB's commitment to keep yields low enough to avoid the economy tipping into the bad equilibrium. The ECB's initial effort in the form of the Securities Market Programme (SMP) had limited success, possibly because of a perceived reluctance to do what was necessary to keep yields sufficiently low. The ECB's Outright Market Transactions (OMT) programme appears to have been designed to make a more credible commitment. One element is linking such bond-buying to European Stability Mechanism (ESM) conditionality. However, conditionality could be a double-edged sword. On one side, as seen in the model, making support conditional on achieving fiscal adjustment targets creates the risk that conditions will not be met (especially when growth disappoints). On the other side, without conditionality, investors might doubt the ECB's willingness to persevere, especially where there is mixed support for such interventions from Euro Zone governments. Overall, reasonably strict conditionality may be required to make the programme credible. However, as with the broader official support discussed above, the model suggests this conditionality is likely to be more effective in restoring

creditworthiness if it comes with ex ante flexibility based on realised growth outcomes.

Appendix 1. Political Costs of Fiscal Adjustment

This appendix develops a simple example of the political costs of fiscal adjustment in the context of a "coalition government", where member parties of the coalition have the power to limit certain "margins of adjustment", such as tax rates or public sector pay rates. Alternatively, certain organised interest groups could have the power to limit particular margins of adjustment. This is an example of the phenomenon of the common-pool problem, whereby individual groups with power over particular dimensions do not fully internalise the aggregate welfare effects of their actions (see, e.g. von Hagen and Hardin (1995). Calmfors and Wren-Lewis (2011) discuss the common-pool problem as one potential factor leading to a tendency to "deficit bias" in fiscal policy over time.

We examine an example where there are three margins of adjustment for the structural primary balance, $m^*_{1,t+1}$, $m^*_{2,t+1}$, and $m^*_{3,t+1}$. The total adjustment is then,

(A.1.1) $$\Delta pb^*_{t+1} = m^*_{1,t+1} + m^*_{2,t+1} + m^*_{3,t+1}.$$

We assume that the marginal cost of additional adjustments is rising along each adjustment margin. This is captured by a total adjustment cost function,

(A.1.2) $$K_{t+1} = \frac{1}{2}\left(m^*_{1,t+1}\right)^2 + \frac{1}{2}\left(m^*_{2,t+1}\right)^2 + \frac{1}{2}\left(m^*_{t+1}\right)^2.$$

Minimising K_{t+1} given the constraint imposed by (A.1.1) gives the optimum adjustments across the three margins as a function of the total adjustment as, (A.1.3) $m^*_{1,t+1} = m^*_{2,t+1} = m^*_{3,t+1} = \frac{1}{3}\Delta pb^*_{t+1}$.

Now substituting the optimum adjustments along each margin into the objective function (A.1.2) gives the total political cost of the adjustment as a function of the total adjustment as,

(A.1.4) $K_{t+1} = \frac{1}{6}\Delta pb^{*}_{t+1}{}^{2}$.

Thus, with no individual constraints across the adjustment margins in this example, γ is equal to $\frac{1}{6}$.

We now allow for individual parties in the coalition to have the power to restrict particular adjustment margins. More specifically, we assume Party 1 can restrict adjustments along margin 1 and Party 2 can restrict adjustments along margin 2. In the extreme where this power results in no adjustments being made along the first two margins, all adjustments are made along the third margin: $m^*_{3,t+1} = \Delta pb^*_{t+1}$. And the total political cost of the adjustment is: $K_{t+1} = \frac{1}{2}\Delta pb^{*}_{t+1}{}^{2}$.

More generally, we allow the distribution of the adjustment to be determined by a "game" between the coalition parties, where each party can choose the size of the adjustment on the margin over which it has control, but the size of the optimal adjustment is a positive function of the adjustment chosen by the other party in the coalition along the margin over which it has control. Thus the first two adjustment margins are "strategic complements". This could be explained by the capacity of each party to "give more" if the other party is willing to give more. (Similar results can be obtained where the two margins are "strategic substitutes".)

Under strategic complementarity, the reaction functions of the two parties are, (A.1.5) Party 1: $m^{*}_{1,t+1} = \frac{\vartheta}{3}\Delta pb^{*}_{t+1} + \alpha m^{*}_{2,t+1}$, and

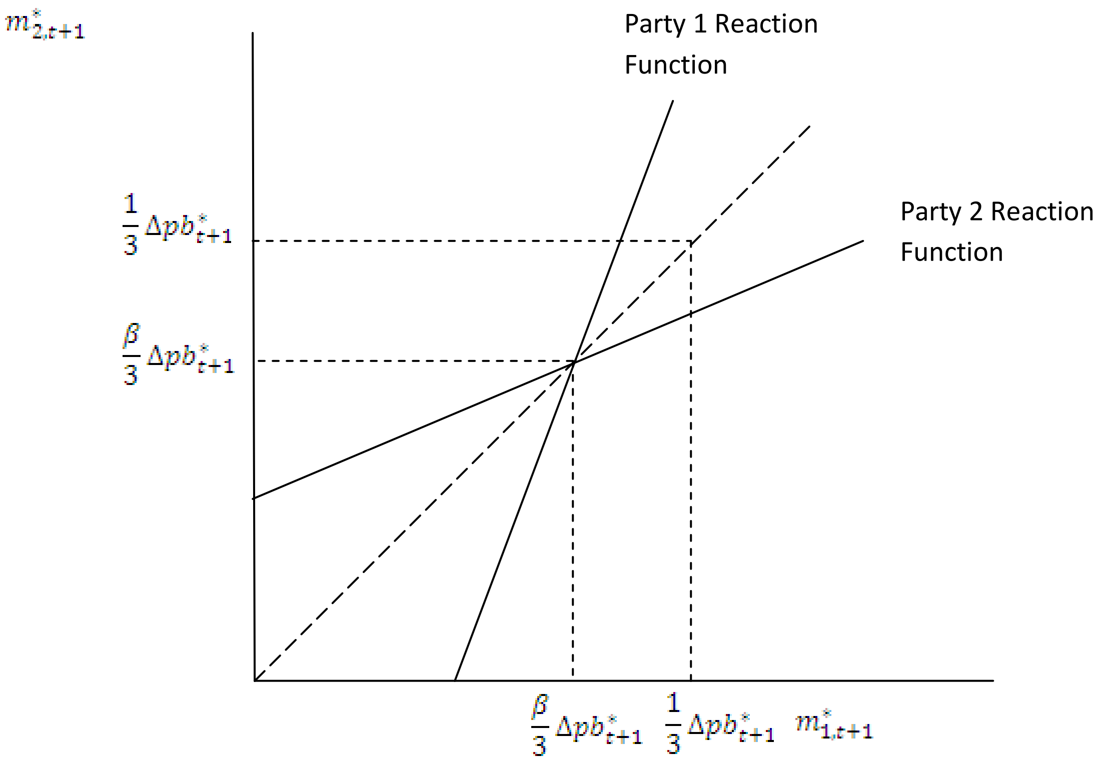
(A.1.6) Party 2: $m^{*}_{2,t+1} = \frac{\vartheta}{3}\Delta pb^{*}_{t+1} + \alpha m^{*}_{1,t+1}$,

where we assume $0 \leq \vartheta < 1$ and $0 \leq \alpha < 1$. The reactions functions are graphed in Figure A.1.1. The non-cooperative equilibrium between the two parties is then given by,

(A.1.7) $m^{*}_{1,t+1} = m^{*}_{2,t+1} = \frac{\beta}{3}\Delta pb^{*}_{t+1}$,

where $\beta = \frac{1+\alpha}{(1-\alpha)^2}\vartheta$. We assume that this non-cooperative equilibrium results in an equal or lesser amount of adjustment being made along the first two margins than in the case where no party has the power to influence the distribution of the adjustment; that is, $\beta \leq 1$.

Figure A.1.1. The Non-Cooperative Coalition Equilibrium

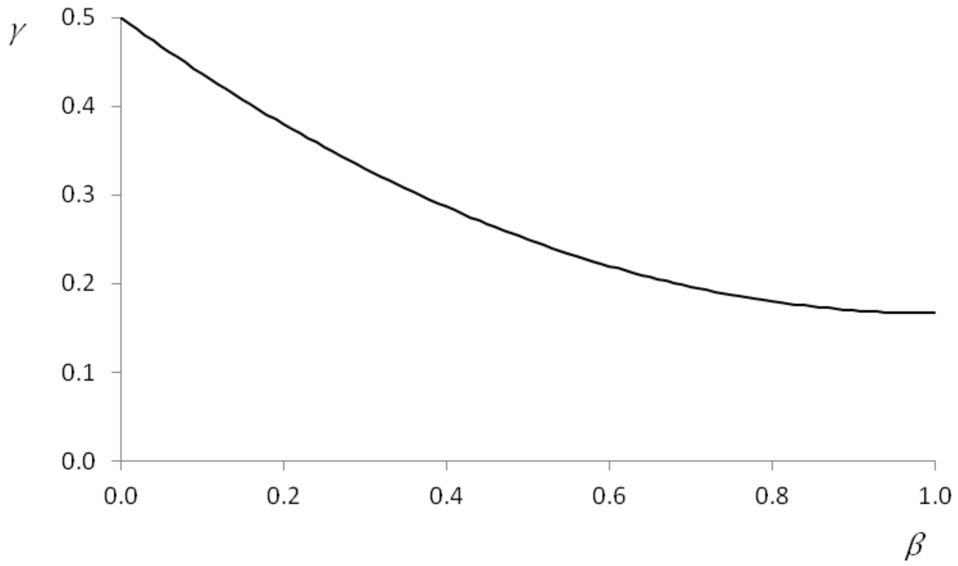


Substituting (A.1.7) into the total adjustment cost function (A.1.2) and imposing the constraint (A.1.1) yields,

(A.1.8) $k_{t+1} = \frac{1}{2}\left[\left(\frac{\beta}{3}\right)^2 + \left(\frac{\beta}{3}\right)^2 + \left(1 - \frac{2\beta}{3}\right)^2\right]\Delta pb^{*\,2}_{t+1}.$

Noting that $\gamma = \frac{1}{2}\left[\left(\frac{\beta}{3}\right)^2 + \left(\frac{\beta}{3}\right)^2 + \left(1 - \frac{2\beta}{3}\right)^2\right]$, the implied relationship between β and γ is graphed in Figure A.1.2. If β is strictly less than one – so that each of the coalition parties uses its power to lower the adjustment along the margin over which it has control compared with the no-power baseline – then the total political cost of any given total adjustment will rise compared with the "no-power" baseline; that is, $\gamma > \frac{1}{6}$.

Figure A.2.2. The Relationship Between β and γ



Appendix 2. Fiscal Feedbacks

This appendix develops a simple fiscal feedbacks model where nominal GDP depends on the primary balance through a deficit multiplier effect; and the nominal primary balance depends on nominal GDP through an automatic stabiliser effect. Abstracting from uncertainty, nominal GDP (Y_t) is given by

(A.2.1) $Y_t = Y_t^0 - mPB_t,$

where Y_t^0 is nominal GDP under a zero primary balance, PB_t is the nominal primary balance and *m* is the primary balance multiplier. In turn, the primary balance is given by,

(A.2.2) $PB_t = PB_t^* + bY_t,$

where PB_t^* is the structural primary balance and *b* is the automatic stabiliser coefficient.

Solving this pair of simultaneous equations yields reduced-form expressions for nominal GDP and the nominal primary balance,

(A.2.3) $Y_t = \varphi Y_t^0 - \theta PB_t,$ and

(A.2.4) $PB_t = \omega PB_t^* + \mu Y_t^0.$

Where:

$\varphi = \frac{1}{1+mb}$; $\theta = \frac{m}{1+mb}$; $\omega = \frac{1}{1+mb}$; and $\mu = \frac{b}{1+mb}$.

Taking first differences of (A.2.3) and (A.2.4) yields,

(A.2.5) $\Delta Y_{t+1} = \varphi \Delta Y^0_{t+1} - \theta \Delta PB_{t+1}$, and

(A.2.6) $\Delta PB_{t+1} = \omega \Delta PB^*_{t+1} + \mu \Delta Y^0_{t+1}$,

where changes refer to the difference between t and t+1. Now dividing across both equations by Y_t yields,

(A.2.7) $g_{t+1} \approx \varphi g^0_{t+1} - \theta \Delta pb^*_{t+1}$, and

(A.8) $\Delta pb_{t+1} \approx \omega \Delta pb^*_{t+1} + \mu \Delta g^0_{t+1}$,

where g_{t+1} is the growth rate for nominal GDP, $g^0_{t+1}$is the growth rate for nominal GDP in the absence of fiscal adjustments, Δpb_{t+1} is the change in the primary balance as a share of GDP, and $\Delta pb^*_{t+1}$is the change in the structural primary balance as a share of GDP (all changes between t and t+1). Note that (A.2.7) and (A.2.8) use the approximations: $\Delta pb_{t+1} \approx \frac{\Delta PB_{t+1}}{Y_t}$; and $\Delta pb^*_{t+1} \approx \frac{\Delta PB^*_{t+1}}{Y_t}$. These approximations will be small for reasonably low levels of growth and the primary and structural primary balances as a share of GDP. [17]

[17] Note that totally differentiating $\frac{PB}{Y}$ gives: $d\frac{PB}{Y} = \frac{dPB}{Y} - \frac{PB}{Y}g$. The approximation in the text is based on the second term on the right-hand side, which is the product of two small magnitudes, being small. A similar approximation is used for the change in the structural primary balance as a share of GDP.

References

Abbas, Ali S., Fuad Hasanov, Paolo Mauro, and Junhyung Park (2011), "The Performance of Large Fiscal Adjustment Plans in the European Union: A Cross-Country Statistical Analysis," in *Chipping Away at Public Debt: Sources of Failure and Keys to Success in Fiscal Adjustment*, Paolo Mauro, editor, John Wiley & Sons, New Jersey: 213-248.

Alesina, Albero, Alessandro Prati, and Guido Tabellini, (1990) "Public Confidence and Debt Management: A Model and a Case Study of Italy," in Public Debt Management: Theory and History, Rudiger Dornbusch and Mario Draghi editors, Cambridge University Press: Cambridge: 94-108.

Bolton, Patrick, and Olivier Jeanne (2009), "Structuring and Restructuring Sovereign Debt: The Role of Seniority," *Review of Economic Studies*, 76: 879-902.

Borensztein, Eduardo, and Ugo Panizza (2009), "The Costs of Sovereign Default," *IMF Staff Papers*, 56(4): 683-741.

Broner, Fernando, Alberto Martin, and Jaume Ventura (2010), "Sovereign Risk and Secondary Markets," *American Economic Review*, 100(4): 1523-1555.

Bulow, Jeremy, and Kenneth Rogoff (1989), "A Constant Recontracting Model of Sovereign Debt," *Journal of Political Economy*, 97(1): 155-178.

Calmfors, Lars, and Simon Wren-Lewis (2011), "What Should Fiscal Councils Do?" *Economic Policy,* 649-695.

Calvo, Guillermo (1998), "Servicing the Public Debt: The Role of Expectations," *American Economic Review*, 78(4): 647-661.

Cole, Harold, and Timothy Kehoe (1998), "Models of Sovereign Debt: Partial versus General Reputations," *International Economic Review*, 39(1): 55-70.

Cole, Harold, and Timothy Kehoe (2000), "Self-Fulfilling Debt Crises" *Review of Economic Studies*, 67(1): 91-116.

De Grauwe, Paul (2011), “The Governance of a Fragile Eurozone,” Working Paper, University of Leuven.

Dooley, Michael (2000), “International Financial Architecture and Strategic Default: Can Financial Crises be Less Painful, “Carnegie-Rochester Conference Series on Public Policy, 53(1): 361-377.

Eaton, Jonathan, and Mark Gersovitz (1981), “Debt with Potential Repudiation: Theoretical and Empirical Analysis,” *Review of Economic Studies*, 48(2): 289-309.

Eichengreen, Barry (2003), “Restructuring Sovereign Debt,” *Journal of Economic Perspectives*, 17(4): 75-98.

Grossman, Herschel, and John Van Huyck (1988), “Sovereign Debt as a Contingent Claim: Excusable Default, Repudiation, and Reputation,” *American Economic Review*, 78(5): 1088-1097.

International Monetary Fund (2012), “Article IV and Seventh Review Under the Extended Arrangement—Staff Report; Informational Annex, Staff Supplement; and Public Information Notice,” Washington, D.C.

Irish Fiscal Advisory Council (2012a), *Fiscal Assessment Report, April 2012*, Irish Fiscal Advisory Council: Dublin.

Irish Fiscal Advisory Council (2012b), *Fiscal Assessment Report, September 2012*, Irish Fiscal Advisory Council: Dublin.

Jeanne, Olivier (1997), “Are Currency Crises Self-Fulfilling? A Test,” *Journal of International Economics*, 43: 263-286.

Krugman, Paul (1996), “Are Currency Crises Self-Fulfilling?” *NBER Macroeconomics Annual*, 11: 345-378.

Obstfeld, Maurice (1996), “Models of Currency Crises with Self-Fulfilling Features,” *European Economic Review*, 40: 1037-1047.

Ostry, Jonathan, Atish Ghosh, and Jun I. Kim, and Mahvash S. Qureshi (2010), “Fiscal Space,” IMF Staff Position Note, SPN/10/11.

Panizza Ugo, Federico Sturzenegger, and Jeromin Zettelmeyer (2009), "The Economics and Law of Sovereign Debt and Default," *Journal of Economic Literature*, 47(3): 1-47.

Shleifer, Andrei (2003), "Will the Sovereign Debt Market Survive," *American Economic Review, Papers and Proceeding*s, 85-90.

Von Hagen, Jurgen and Ian Hardin (1995), "Budget Processes and Commitment to Fiscal Discipline," *European Economic Review*, 39: 771-779.

Zettelmeyer, Jeromin, Christopy Trebesch, and Mitu Gulati (2012), "The Greek Debt Exchange: An Autopsy," Working Paper.