Monetary and Fiscal Policies: Fiscal Limits and Default

Behzad Diba

Georgetown University

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Concerns with fiscal sustainability and the Eurozone crisis have renewed interest in modeling sovereign default risk. One active area of research, motivated by sovereign spreads in the Eurozone, revisits models with multiple equilibria. In most models of sovereign debt, the government can choose to repay its debt or to default (and suffer some consequences like exclusion from the international bond market). An unrealistic implication of some early contributions was that the "government" in the model would opt to default in good times. The more recent models, following Arellano (2008), do not share this implausible implication—the new models imply that the government may default in bad times. Some models, like Uribe (2006), consider a rational-expectations equilibrium in which the government may be forced to default under some realizations of exogenous shocks (like low tax revenues).
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Multiple Equilibria

Can speculation about sovereign default cause a fiscal crisis? If so, what role should policymakers assume in helping the markets select a good equilibrium?

Cole and Kehoe (2000) developed a model, with multiple equilibria, for rolling over short-term debt. This model can generate lack of demand at a bond auction and capture some elements of, say, the 1982 Mexican crisis. It is not a model for the type of gradually widening spreads, say, in Italy during the summer of 2011.

Calvo (1988) developed a model of multiple equilibria with a La¨ger curve for debt. This has inspired some recent discussions of the Eurozone crisis, using models like the one in Reis (2013). Again, it seems hard to think of these as models of gradually widening spreads, but this is a topic of work in progress (by Guido Lorenzoni and Ivan Werning).
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- $\Phi(c)$ is increasing and concave, representing the "diabolic loop" that may link sovereign default to bank failures, a recession, and larger deficits
- $c$ is determined by

$$\frac{cb^P}{P} = \Phi(c) + \delta$$

where $P$ is the price level determined by the central bank
Good and Bad Equilibria

- Without help from the central bank (with $P = 1$ and $\delta = 0$)

Potential drawbacks of Reis' s model, and other models following Calvo (1988):

- The bad equilibrium is typically not stable
- It seems hard to make a case that this is behind small increases in spreads
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Figure 1: Equilibrium Debt Repudiation
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The central bank can help eliminate the bad equilibrium by raising $\delta$ (and Reis discusses the restrictions that limit the ECB's flexibility) by inverting away the debt (which is the familiar "bottom line" about how the central bank can help) or by coordinating expectations to focus on the good equilibrium.

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Argentina in 2001-2002

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But a prolonged recession led to doubts about the government’s ability to maintain a Ricardian fiscal policy in 2001 since the price level was not free to “jump” (as the FTPL would have it). A debt crisis ensued with the risk premium on government bonds climbing to 1800 basis points (compared to US bonds). Partial default in December 2001 was soon followed by outright default.
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- countries guarantee each other's debt and stabilize total debt, while an active monetary policy sets the nominal anchor
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Table 2: Output multipliers for government spending from new Keynesian model with fluctuating monetary and fiscal policy rules. AM: active monetary policy; PM: passive monetary policy; PF: passive tax policy; AF: active tax policy. Source: Davig and Leeper (2010b).

<table>
<thead>
<tr>
<th>Regime</th>
<th>5 quarters</th>
<th>10 quarters</th>
<th>25 quarters</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>M: AM/PF</td>
<td>.79</td>
<td>.80</td>
<td>.84</td>
<td>.86</td>
</tr>
<tr>
<td>F: PM/AF</td>
<td>1.72</td>
<td>1.58</td>
<td>1.40</td>
<td>1.36</td>
</tr>
</tbody>
</table>

Conditional on being in Regime M, the government spending multipliers are modest—less than unity—at all horizons [table 2, row labeled M: AM/PF]. These estimates are close to the ones that emerge from neo-classical growth models without monetary policy. But when monetary policy is passive, the same spending impulse is substantially more stimulative, with output multipliers nearly twice as large [row labeled F: PM/AF]. Accounting for monetary policy behavior, and modeling that behavior explicitly, is essential to determine the potency of fiscal policy.18

Multipliers in themselves are not directly interesting to policymakers. But multipliers are a critical input to predict a particular legislation’s consequences, about which policymakers do care. Davig and Leeper (2010b) feed into their model the path of government spending associated with the ARRA—as calculated by Cogan et al. (2009)—to compute the resulting paths of macro variables. Solid lines labeled AM/PF in figure 6 condition on being in Regime M with monetary policy actively targeting inflation and fiscal policy passively raising taxes.

18“Modeling that behavior explicitly” means that the details of how monetary policy accommodation is handled matter. In table 2, it is the policy rule that changes and, because agents know rules can change, possible fluctuations in rules are embedded in their expectations. An alternative modeling strategy would be to posit an active monetary policy rule, such as $R_t = R^* + \alpha(\pi_t - \pi^*) + \varepsilon_t$ with $\alpha > 1$ and $\varepsilon_t$ an exogenous stochastic process. In the face of a fiscal expansion, the modeler could suspend this rule temporarily by feeding in a sequence of $\varepsilon_t$'s that allow $R_t$ to track any desired interest rate path. This is a completely different exercise than regime change because agents in the model base their expectations on the active monetary policy rule and the realized path of the nominal interest rate comes as a surprise to the agents. Substantive issues rest on the details of the thought experiment. Researchers are not always clear about how their experiments are conducted.
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- The most recent applications consider unfunded fiscal liabilities and fiscal limits.
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Fiscal Limits

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- unfunded fiscal liabilities associated with (pension and health) entitlement programs are the largest (but not the only) challenge, as Leeper and Walker (2011) discuss
**Worldwide “Unfunded Liabilities”**

<table>
<thead>
<tr>
<th>Country</th>
<th>Aging-Related Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>482</td>
</tr>
<tr>
<td>Canada</td>
<td>726</td>
</tr>
<tr>
<td>France</td>
<td>276</td>
</tr>
<tr>
<td>Germany</td>
<td>280</td>
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<td>Italy</td>
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<td>Japan</td>
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<td>Korea</td>
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<td>Spain</td>
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<td>United Kingdom</td>
<td>335</td>
</tr>
<tr>
<td>United States</td>
<td>495</td>
</tr>
<tr>
<td>Advanced G-20 Countries</td>
<td>409</td>
</tr>
</tbody>
</table>

Net present value of impact on fiscal deficit of aging-related spending, in percent of GDP. Source: IMF
What to Expect?

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fiscal regime described above, but from date \( T \) on, tax policy has no option but to become active, with \( \tau_t = \tau_{\text{max}} \) for \( t \geq T \). If monetary policy remained active, neither authority would stabilize debt, and debt would explode. Existence of equilibrium requires that monetary policy switch to being passive, which stabilizes debt.\(^{14}\) Table 1 summarizes the assumptions about policy behavior.

To solve for this equilibrium, I break the intertemporal equilibrium condition into two parts:

\[
\frac{B_0}{P_0} = E_0 \sum_{j=1}^{T-1} \beta^j s_j + E_0 \sum_{j=T}^{\infty} \beta^j s_j, \tag{14}
\]

where the function for the primary surplus, \( s_t \), changes at the fiscal limit,

\[
s_t = \begin{cases} 
\tau^* - \gamma(B_{t-1}/P_{t-1} - b^*) - z_t, & t = 0,1,...,T-1 \\
\tau_{\text{max}} - z_t, & t = T,...,\infty.
\end{cases} \tag{15}
\]

Table 1. Monetary-Fiscal Policy Regimes Before and After the Fiscal Limit at Date \( T \)

<table>
<thead>
<tr>
<th></th>
<th>Regime 1 ( t=0,1,...,T-1 )</th>
<th>Regime 2 ( t=T,T+1,... )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary policy</td>
<td>( R_t^{-1} = R_t^{* -1} + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi} \right) )</td>
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</tr>
<tr>
<td>Tax policy</td>
<td>( \tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right) )</td>
<td>( \tau_t = \tau_{\text{max}} )</td>
</tr>
</tbody>
</table>

Source: Author’s elaborations.

\(^{14}\) Monetary policy is forced to switch because the fiscal limit is assumed to be an absorbing state. Davig and Leeper (2009) display an equilibrium in which active fiscal policy is a recurring state, so that it is feasible for both policies to be active simultaneously, at least temporarily.
Leeper (2010) argues that public awareness of the possibility of hitting a fiscal limit may fundamentally change the interactions of fiscal and monetary policies:

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In model simulations, regime switching by itself (at a future date with no further uncertainty) leads to volatility in debt/GDP and inflation:

- active monetary policy leads to more volatility (in response to fiscal shocks) during the transition to a regime with active fiscal policy projections
expectations on the target values \((b^*, \pi^*)\) are most clearly seen in a simulation of the equilibrium. Figure 1 contrasts the paths of the debt-to-GDP ratio from two models: the fixed passive monetary/active tax regime in section 1.1.2 (dashed line) and the present model in which an active monetary/passive tax regime is in place until the economy hits the fiscal limit at date \(T\), when policies switch permanently to a passive monetary/active tax combination (solid line).\(^\text{16}\) The fixed regime displays stable fluctuations of real debt around the 50 percent steady-state debt-to-GDP, which the other model also produces once it hits the fiscal limit. Leading up to the fiscal limit, however, it is clear that the active monetary/passive tax policy combination does not keep debt near the target.

**Figure 1. Debt-to-GDP Ratios for a Particular Realization of Transfers in Models 1 and 2\(^a\)**

\[\text{Debt when fiscal limit at } T=50\]
\[\text{- - - - Debt in fixed regime passive monetary/active fiscal}\]
\[\text{Debt-to-GDP target}\]

\(a\). Model 1 is the fixed passive monetary/active tax regime described in section 1.1.2 (represented by the dashed line in the figure); in model 2, an active monetary/passive tax regime is in place until the economy hits the fiscal limit at date \(T\), when policy switches permanently to a passive monetary/active tax combination (solid line).

Expected inflation evolves according to equation (20). Since monetary policy is active leading up to the fiscal limit, with \(\alpha > 1/\beta\),

\(^\text{16}\). Figures 1 through 4 use the following calibration. Leading up to the fiscal limit, \(\alpha = 1.50\) and \(\gamma = 0.15\). At the limit and in the fixed-regime model, \(\alpha = \gamma = 0.0\). I assume steady-state values \(\tau^* = 0.19\), \(z^* = 0.17\), \(\pi^* = 1.02\) (gross inflation rate), and \(1/\beta = 1.04\), so that \(b^* = 0.50\). The transfer process has \(\rho = 0.90\) and \(\sigma = 0.003\). Identical realizations of transfers were used in all the figures.
there is no tendency for expected inflation to be anchored on the inflation target. Figure 2 plots the inflation rate from the fixed-regime model in section 1.1.2 (dashed line) and from the present model (solid line), along with expected inflation from the present model (dotted dashed line). Inflation in the fixed regime fluctuates around $1/\pi^*$, and expected inflation is anchored on target, given the pegged nominal interest rate. In the period leading up to the fiscal limit, however, the price level is being determined primarily by fluctuations in the real value of debt, which deviates wildly from $b^*$ as shown in figure 1. Expected inflation in that period, though not independent of the inflation target, is certainly not anchored by the target. Instead, under active monetary policy, the deviation of expected inflation from target grows with the deviation of actual inflation from target in the previous period. The figure shows how equation (20) makes expected inflation follow actual inflation, with active monetary policy amplifying movements in expected inflation.

Figure 2. Inflation for a Particular Realization of Transfers in Models 1 and 2

The result for periods $t = 0, 1, ..., T-1$ is reminiscent of Loyo’s (1999) analysis of Brazilian monetary-fiscal interactions in the 1980s. Throughout the 1970s, Brazilian tax policy was active and
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Models with market segmentation (e.g., liquid bonds) may have interesting implications that remain to be explored and understood in light of the Fed’s asset purchases in the aftermath of the financial crisis.