Monetary and Fiscal Policies: Sustainable Fiscal Policies

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Empirical assessments of the fiscal stance are complicated by the fact that we don’t have a precise definition of fiscal sustainability. For example, the debt-to-GDP ratio may grow in a particular sample, but this does not mean it will continue to grow in the future. Or, the ratio may be stable, while (say) the effects of an aging population and unfunded fiscal obligations pose a future challenge. Much of the existing empirical research has focused on developing econometric tests of whether or not the government PVBC is satisfied, given the trends we can detect from data.
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A more useful approach may provide measures of the fiscal outlook without attempting a formal test for sustainability.
"Testing" for the PVBC?

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2. We now understand (following the FTPL) that the "PVBC" is an equilibrium condition; there is no formal theoretical motivation for an "alternative hypothesis" that the PVBC does not hold.
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2. We now understand (following the FTPL) that the "PVBC" is an equilibrium condition; there is no formal theoretical motivation for an "alternative hypothesis" that the PVBC does not hold.

3. It is not clear what satisfying the PVBC has to do with fiscal sustainability, as the following example illustrates.
An Example

As discussed in CCD (2010), the government's PVBC is derived using the transversality condition (TC) of households (lenders).

\[
\lim_{n \to +\infty} \beta^n E_t L_t + n P_t + n C_t = 0,
\]

stating that the ratio of nominal public debt to nominal consumption, discounted at the lenders' rate of time preference, is expected to converge to zero; standard calibrations set \( \beta \approx 0.99 \) per quarter. The ratio of debt to aggregate consumption can grow exponentially (at any rate less than 4% per annum) without violating the PVBC but most of us would probably consider such a fiscal policy, making the debt-to-GDP ratio grow forever, unsustainable.

In the model (with simplifying features like infinite horizons, a lump-sum tax, etc.), an equilibrium can involve an ever-growing debt-to-GDP ratio, but this implication is not robust to changes in the model (like considering overlapping generations of households).
As discussed in CCD (2010), the government’s PVBC is derived using the transversality condition (TC) of households (lenders).

In a benchmark model with logarithmic utility, the TC implies

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\lim_{n \to +\infty} \beta^n E_t \left\{ \frac{L_{t+n}}{P_{t+n} C_{t+n}} \right\} = 0,
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Dynamics of Debt/GDP

Let $b_t$ denote the real value of government bonds outstanding at time $t$, and let $r_t$ denote the ex-post real return on bonds, debt dynamics are governed by

$$b_t = (1 + r_t) b_{t-1} + G_t - T_t,$$

where $T_t$ is tax revenues inclusive of seigniorage.
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The evolution of the debt-to-GDP ratio is governed by

$$ \frac{b_t}{Y_t} = (1 + \rho_t) \frac{b_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}, \quad (1) $$

with

$$ 1 + \rho_t = (1 + r_t) \left( \frac{Y_{t-1}}{Y_t} \right) $$
Steady-state Equilibrium

- Standard calibrations used for policy analysis assume, and standard asset pricing models imply, that the real return on debt exceeds the real growth rate in the long run (on the balanced growth path).
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  - for example, the "benchmark scenarios" of IMF (2010) assume the real interest rate exceeds the real growth rate by one percentage point per annum

\[ \rho_b Y = T_G Y, \]

which implies that a government with positive debt must run a primary surplus (inclusive of seigniorage) that services the debt and keeps the debt-to-GDP ratio constant
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- With \( \rho > 0 \), the steady-state version of (1) is

\[
\rho \left( \frac{b}{Y} \right) = \frac{T - G}{Y},
\]

which implies that a government with positive debt must run a primary surplus (inclusive of seigniorage) that services the debt and keeps the debt-to-GDP ratio constant.
We can log-linearize (1) near a steady state (with $\rho_t = \rho$, etc.) to get

$$\log \left( \frac{b_t}{Y_t} \right) = \Phi + \phi_g \log \left( \frac{G_t}{Y_t} \right) - \phi_\tau \log \left( \frac{T_t}{Y_t} \right) + \phi_\rho \log \left( 1 + \rho_t \right)$$

$$+ (1 + \rho) \log \left( \frac{b_{t-1}}{Y_{t-1}} \right)$$

with coefficients $\Phi, \phi_g > 0, \phi_\tau > 0$, and $\phi_\rho > 0$ that depend only on the point of approximation.
Log-linear Approximation

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- Iterating on this linear equation, Polito and Wickens (2012) analyze the change in the debt-to-GDP ratio, over finite horizons.
The log-linear relationship links the growth in the debt-to GDP ratio to components reflecting revenues, expenditures, and the discount rate ($\rho_t$).
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It is instructive to plot these components and interpret historical changes in the debt-to-GDP ratio, as Polito and Wickens (2012) do.
Figure 1: The United States: data plot

Figure 2: The United Kingdom: data plot
Figure 3: Germany: data plot

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- we may speculate about some correlations in the data.
change in the debt-GDP ratio is stronger.

Table 1: Correlation coefficients between the level and the change in the debt-GDP ratio and the variables in \( z_t \) for the US, the UK, Germany and Greece, 1970-2009.

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>UK</th>
<th>GER</th>
<th>GRE</th>
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</thead>
<tbody>
<tr>
<td>( A: b_t/y_t )</td>
<td>-0.2</td>
<td>-0.5</td>
<td>-0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>( \pi_t )</td>
<td>-0.8</td>
<td>0.0</td>
<td>-0.9</td>
<td>-0.6</td>
</tr>
<tr>
<td>( g_t/y_t )</td>
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<td>0.5</td>
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<td>1.0</td>
</tr>
<tr>
<td>( v_t/y_t )</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
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<tr>
<td>( IRL_t )</td>
<td>-0.6</td>
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<td>( B: \Delta b_t/y_t )</td>
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5.1.2 Econometric tests of fiscal sustainability

For the purposes of comparison, and before computing the index, we carry out some of the econometric tests of fiscal sustainability discussed earlier. Table 2 reports the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test statistics for the ratios of debt and the deficit to GDP under various assumptions about the discount rate.

The Hamilton and Flavin test described in equation (13) is based on the stationarity of the undiscounted processes \( \frac{d}{y_t} \) and \( \frac{b}{y_t} \); if they are not stationary then the fiscal stance is said to be unsustainable. They argue - and this was shown earlier - that, under the assumption of a positive constant interest rate, the discounted sum of future deficits is stationary if the undiscounted process \( \frac{d}{y_t} \) is stationary. Panel A gives the ADF and PP tests statistics for the undiscounted series \( b/y_t \) and \( d/y_t \). The hypothesis of a unit root cannot be rejected for the debt-GDP ratios at any conventional significance level, but the outcomes for the undiscounted processes \( d/y_t \) depend upon the choice of unit root test and on the significance level. Although the results for the debt-GDP ratio suggest that the fiscal stance is not sustainable, those for the deficit-GDP ratio create some ambiguity.

The test is repeated in Panel B using discounted series for \( b_t/y_t \) and \( d_t/y_t \) where the discount rate is a constant equal to the sample average of \( \rho_t \). In terms of the earlier discussion, these are tests of the transversality condition and the PVBC, equations (8) and (9) respectively. The results are now even more ambiguous. Using the ADF test the null hypothesis of a unit root is not rejected for any country but using the PP test the outcome is marginal. \( d_t/y_t \) appears to be non-stationary except for Germany. In Panel C the tests are repeated again only this time under the assumption of a time-varying discount rate. This
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Auerbach and Gale (2011) estimated a fiscal gap in the 3 to 6 percent range through 2060 for the US federal government. The estimates assumed an interest rate exceeding the GDP growth rate by one percentage point. Auerbach and Gale (2011) noted that the fiscal gaps can be significantly larger (as large as 10% of GDP) if interest rates rise relative to GDP growth or the horizon is extended beyond 2060.

Auerbach (2011) reports fiscal gaps for other advanced economies.
Calculating Fiscal Gaps

The evolution of debt implies

\[
\frac{B_T}{(1 + r)^{T-t}} = B_t + \sum_{s=t+1}^{T} \frac{D_s}{(1 + r)^{s-t}}
\]

where \(B\) is the stock of government bonds, \(D\) is the primary deficit, and \(r\) is the interest rate (assumed to be constant for simplicity).

The fiscal gap \(\Delta\) is the annual deficit reduction that keeps the debt-to-GDP ratio at the terminal date \(T\) equal to the current value at \(t\):

\[
\frac{B_T}{Y_T} = \frac{B_t}{Y_t}
\]

So, \(\Delta\) satisfies

\[
\frac{B_t Y_T}{Y_t (1 + r)^{T-t}} = B_t + \sum_{s=t+1}^{T} \frac{D_s - \Delta Y_s}{(1 + r)^{s-t}}
\]

which implies

\[
\Delta = \frac{B_t - B_t (Y_T/Y_t) (1 + r)^{T-t} + \sum_{s=t+1}^{T} (1 + r)^{t-s} D_s}{\sum_{s=t+1}^{T} (1 + r)^{t-s} Y_s}
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Auerbach (2011) reports fiscal gaps for other advanced economies
The fiscal gap calculations are versatile for quantifying the implications of alternative scenarios and assumptions.

Auerbach (2011) considers scenarios with no initial debt, net debt going to a 45% target recommended in IMF (2010), higher differentials between interest rates and GDP growth.

Notably, projected growth of health and pension expenditures (relative to GDP) contributes more than initial debt positions to fiscal gaps.

The Debt-to-GDP ratio may not be a very reliable measure of fiscal stress.
Fiscal Gaps

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Figure 3. Fiscal Gaps through 2060

Figure 4. Fiscal Gaps through 2060, Alternative Projections
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Notably, projected growth of health and pension expenditures (relative to GDP) contributes more than initial debt positions to fiscal gaps

The Debt-to-GDP ratio may not be a very reliable measure of fiscal stress
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Figure 1: The U.S. Public Debt, Nominal (line) and real (dotted), 1900-2003

Figure 2: The U.S. Public Debt in Percent of GDP 1791-2003
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<tr>
<th>Period:</th>
<th>With interest Deficit</th>
<th>Primary Deficit</th>
<th>Interest Charge</th>
<th>Nominal Growth Effect</th>
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<th>Inflation Effect</th>
<th>Change in Debt/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>1792</td>
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<td>1.2%</td>
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Table 2: Interest Rates on Public Debt versus Growth Rates

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<th>Period:</th>
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