Fiscal and Debt Sustainability

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Jan Gottschalk
TAOLAM

Outline

I. Introduction

II. Fiscal Sustainability: Maintaining Solvency

III. Debt Dynamics

IV. Debt Sustainability Analysis
The government is able to achieve a fiscal stance that allows it to service public debt in the short, medium and long run... without the need to undertake policy adjustments that are implausible from an economic or political standpoint...

...without debt default or renegotiation...

...given financing costs and conditions it faces

**Introduction—Defining Fiscal Sustainability**

- **Solvency**: refers to an entity’s ability to pay its debt/meet its long-term financial obligations
  - Fiscal and debt sustainability is (mostly) about maintaining solvency for the government
  - We will discuss in more detail what this requires

- **Liquidity**: An entity is (il)liquid if, regardless of whether it satisfies the solvency condition, its liquid assets and available financing are (in)sufficient to meet or roll-over its maturing liabilities

- **Vulnerability**: Risk that the liquidity or solvency conditions are violated and the borrower enters a crisis

**Introduction—Fiscal Sustainability Concepts**
Introduction—Fiscal Sustainability Coverage

- Focus on public debt:
  - Domestic
  - External

- Awareness of contingent liabilities:
  - Debt guarantees
  - Sub-national governments
  - State-owned enterprises
  - Spillovers from financial institutions
  - Public-private partnerships

Fiscal Sustainability: Why Worry?

- Excessive debt (debt overhang) is bad for growth and development.
- A rising share of revenues devoted to debt-service payments weakens a government’s ability to implement desired policies.
- Heavy debt service obligations make a country more vulnerable to interruption of commercial or official flows (sudden stops, shift in aid policies).
- Debt restructuring can be highly disruptive to economic activity and undermines the development of a credit culture.
Fiscal Unsustainability: Adverse Consequences

A potentially vicious circle:

- Higher interest payments
- Deficit

- Increase in debt
- Borrowing

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What does maintaining solvency require? Condition 1:

**Debt limit:** debt-to-GDP ratio will never exceed a certain threshold.

What is this threshold? We don’t know! There are many rule of thumbs but no inviolable threshold.

Practical implication: aim for a stable or declining debt-to-GDP ratio; failing that, keep debt ratio below a ceiling.

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What does maintaining solvency require? Condition 2:

**No-Ponzi game:** the government does not service its debt by issuing new debt on a regular basis.

Debt and interest payments cannot be postponed forever!

Practical implication: debt and interest are not rolled over systematically.
Fiscal Sustainability: Maintaining Solvency

What does maintaining solvency require? Condition 3:

Solvency: the government has enough resources in the future to service the debt accumulated from the past.

Existing debt, including accumulated interest, is eventually paid in full through future fiscal surpluses.

Practical implication: eventually the budget will have to aim for (primary) surpluses.

Fiscal Sustainability: Maintaining Solvency

What does maintaining solvency require? Putting it all together:

• Debt and interest are not rolled over systematically.
• Existing debt, including accumulated interest, is eventually paid in full through future fiscal surpluses.
• The debt ratio is kept below a ceiling.

These rules do not have to be followed strictly each year → they are a guide for fiscal policy in the long run.
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Debt Dynamics

Overall balance and debt:

\[
\text{Total revenues and grants} - \text{Total expenditures} = \text{Overall balance}
\]

Financing:

\[
D_t - D_{t-1} = -OB_t
\]

\[
D_t = D_{t-1} - OB_t
\]

if \( OB > 0 \) assets ↑ or debt ↓:

net debt ↓

if \( OB < 0 \) assets ↓ or debt ↑:

net debt ↑
Develop a path for the overall balance that reduces the public debt stock to approximately zero after 50 years!

Also plot the overall balance and the debt stock: what is the relationship between the two?

Debt Dynamics

Primary balance and debt:

\[ D_t = D_{t-1} - OB_t \]
\[ D_t = D_{t-1} - (R_t - NIE_t - I_t) \]
\[ D_t = D_{t-1} + I_t - (R_t - NIE_t) \]
\[ D_t = D_{t-1} + I_{t-1} - PB_t \]
\[ D_t = (1 + i)D_{t-1} - PB_t \]
Debt Dynamics

Primary balance, interest and debt:

$t = 0$

- Primary Balance
- Int. exp
- Net borrowing
- $D_0$

$t = 1$

- Primary Balance
- Int. exp
- Net borrowing
- $D_1$

$t = 2$

- Primary Balance
- Int. exp
- Net borrowing
- $D_2$

Exercise

Now develop a path for the primary balance for an approximately zero public debt stock after 50 years!
Debt Dynamics

Debt dynamics in relation to GDP

Which of these countries has the highest debt?

<table>
<thead>
<tr>
<th>Country</th>
<th>Nominal Debt</th>
<th>GDP</th>
<th>Nominal Debt</th>
<th>GDP</th>
<th>Nominal Debt</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country A</td>
<td>200%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country B</td>
<td>125%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country C</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Debt dynamics in terms of GDP ratios: Overall Balance

\[ D_t = D_{t-1} - OB_t \]

\[ \frac{D_t}{GDP_t} = \frac{D_{t-1}}{GDP_{t-1}} - \frac{OB_t}{GDP_t} \]

\[ \frac{D_t}{GDP_t} = \frac{GDP_{t-1}}{GDP_t} \frac{D_{t-1}}{GDP_{t-1}} - \frac{OB_t}{GDP_t} \]

\[ \frac{GDP_t}{GDP_{t-1}} = 1 + n \]

Evolution of debt ratio depends on:

- Overall balance ratio
- (Nominal) GDP growth

\[ d_t = \frac{1}{1 + n} d_{t-1} - ob_t \]
**Exercise**

Derive debt dynamics for primary balance in terms of GDP ratios:

- First, take a piece of paper and a pen
- Second, start with the following relationship:

$$D_t = (1+i_t) D_{t-1} - PB_t$$

- Third, proceed as before

**Debt Dynamics**

Debt dynamics in terms of GDP ratios: Primary Balance

$$d_t = \frac{1+i}{1+n} d_{t-1} - pb_t$$

- $1+i = (1+r)(1+\pi)$
- $1+n = (1+g)(1+\pi)$

$r$ is real interest rate
$g$ is real growth rate
$\pi$ is GDP deflator inflation

Autonomous component of debt dynamic
Consider the case where $pb = 0$ (i.e., we abstract from fiscal policy):

Debt dynamics in terms of GDP ratios: Autonomous component

The interest rate determines the rate of increase in debt.

GDP growth is the rate at which GDP grows.

Think of debt-to-GDP as an aerostatic balloon:

- Interest rate is like hot air: it pushes debt-to-GDP up.
- GDP growth is like the sand bags: it helps bring the debt-to-GDP down.

If interest rate > GDP growth, debt-to-GDP tend to ↑
If interest rate < GDP growth, debt-to-GDP tend to ↓
Consider the role of autonomous component for debt dynamics using numerical examples:

- What happens when $r > g$?
- Assuming that the $r-g$ differential is 2 percentage points, what is the primary balance that would stabilize the debt ratio?

Exercise (continued)

Consider the role of autonomous component for debt dynamics using numerical examples:

- What happens when $r < g$?
- Assuming that the $r-g$ differential is -2 percentage points, what is the primary balance that would stabilize the debt ratio?
Debt Dynamics—Useful Formulas

Decomposition of debt dynamics:

From \( d_t = \frac{1+r}{1+g} d_{t-1} - pb_t \) the change in debt becomes

\[
d_t - d_{t-1} = \frac{r-g}{1+g} d_{t-1} - pb_t
\]

One can attribute the change in debt-to-GDP to:

- Interest rates \( \frac{r}{1+g} d_{t-1} \)
- Growth \( -\frac{g}{1+g} d_{t-1} \)
- Fiscal policy \( -pb_t \)

Exercise

Add the formulas for the debt decomposition to the debt projection spreadsheet
Debt Dynamics—Useful Formulas

The debt-stabilizing primary balance:
If government wants to keep debt stable so that \( d_t = d_{t-1} \) then:

\[
d_{t-1} = \frac{1+r}{1+g} d_{t-1} - pb_t
\]

\[
pb_t = \frac{1+r}{1+g} d_{t-1} - d_{t-1}
\]

\[
pb_t = \frac{r - g}{1+g} d_{t-1}
\]

- The larger the difference between \( r \) and \( g \) and the larger the initial debt, the greater the primary surplus/deficit needed to stabilize the debt
- One can revert the formula to compute at which level debt will stabilize if a certain balance was kept forever

Exercise

Compute the debt-stabilizing primary balance for our previous exercise—does it look familiar?
Debt Dynamics—Useful Formulas

**Deriving the primary balance for targeting a debt level:**

Consider the formula of the debt dynamic:

\[ d_t = \frac{1 + r}{1 + g} d_{t-1} - pb_t \]

\[ d_t = \beta d_{t-1} - pb_t \]

Starting from \( d_0 \):

\[ d_1 = \beta d_0 - pb_1 \]

\[ d_2 = \beta^2 d_0 - \beta pb_1 - pb_2 \]

\[ d_3 = \beta^3 d_0 - \beta^2 pb_1 - \beta pb_2 - pb_3 \]

\[ \ldots \]

\[ d_t = \beta^t d_0 - \sum_{i=1}^{t} \beta^{t-i} pb_i \]

*Given \( d_0 \):* What will debt be if the \( pb \) is kept constant forever?

*Given \( d_0 \):* What is the constant \( pb \) that allows reaching a target debt to GDP \( d^* \) in \( T \) years?

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Debt Dynamics—Useful Formulas

**Deriving the primary balance for targeting a debt level:**

From \[ d_t = \beta^t d_0 - \sum_{i=1}^{t} \beta^{t-i} pb_i \] it follows that

\[ d_t = \beta^t d_0 - pb \frac{1 - \beta^t}{1 - \beta} \]

If \( \beta < 1 \) then debt will eventually converge to

\[ d^* = -pb \frac{1}{1 - \beta} \]

The constant \( pb \) that allows reaching a target debt to GDP \( d^* \) in \( T \) years is

\[ pb = \frac{1 - \beta}{1 - \beta^T} (\beta^T d_0 - d^*) \]
Debt Dynamics—Useful Formulas

Adding foreign currency/external debt:
Suppose part of debt is denominated in foreign currency. Let:

• \( e_t \) be the exchange rate at time \( t \) (units of local currency per 1 unit of foreign currency)
• \( i^F \) be the interest rate on foreign currency denominated debt, including risk premium
• \( D_t \) be total debt, \( D_t^N \) be debt denominated in local currency, and \( D_t^F \) be the local currency value of the debt denominated in foreign currency

With this notation, the debt stock comprising domestic and foreign-currency debt can be written as:

\[
D_t = D_t^N + e_t D_t^F
\]

\( D_t^N \) = Local currency-denominated debt
\( D_t^F \) = Foreign currency-denominated debt
\( e \) = Nominal exchange rate (local currency per $)

Debt Dynamics—Useful Formulas

Adding foreign currency/external debt (continued):
Let \( \varepsilon_t \) be the exchange rate depreciation and \( \alpha_t \) be the share of debt denominated in foreign currency to total debt

\[
D_t = (1 + i)(1 - \alpha_{t-1})D_{t-1} + (1 + i^F)(1 + \varepsilon_t)\alpha_{t-1}D_{t-1} - PB_t
\]

Expressing all nominal variables in terms of GDP this becomes:

\[
d_t = \left[ (1 + i)(1 - \alpha_{t-1}) + (1 + i^F)(1 + \varepsilon_t)\alpha_{t-1} \right] \frac{d_{t-1}}{1 + n} - pb_t
\]

\[
1 + i(1 - \alpha_{t-1}) + i^F\alpha_{t-1} + (1 + i^F)\varepsilon_t\alpha_t
\]

\[
d_t = \frac{1 + i^*}{1 + n}d_{t-1} - pb_t + \frac{(1 + i^F)}{1 + n}\varepsilon_t\alpha_{t-1}d_{t-1}
\]

Average interest rate \( (i^*) \)

Equation similar to previous, except for effect of \( \varepsilon \) on interest payment and stock of debt
Debt Dynamics

Adding foreign currency/external debt (continued):

Remembering that we could rewrite

\[ d_t = \frac{1+i}{1+n} d_{t-1} - pb_t \]

as

\[ d_t = \frac{1+r}{1+g} d_{t-1} - pb_t \]

We can express the corresponding formula with foreign currency debt as

\[ d_t = \frac{1+r^*}{1+g} d_{t-1} - pb_t + \frac{(1+i^F)}{1+n} e_t \alpha_{t-1} d_{t-1} \]

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Debt Sustainability Analysis

Basic approach:
Project debt in the medium and long term under:
• Current fiscal policy, including announced changes that will credibly be implemented
• Projections on long-term interest rates, growth rates, exchange rate, composition of debt, etc.

Consider also the major fiscal and macroeconomic vulnerabilities and project debt under different shocks scenarios:
• Increase interest rates
• Decrease growth
• Depreciation
• Materialize contingent liabilities
• Worse fiscal balances

Is debt sustainable under current policies? Does it explode? Will it stay below or breach comfortable levels under shocks?

Debt Sustainability Analysis

Debt thresholds in IMF/WB DSA for LICs:
Countries operating in a weaker institutional and policy environment are likely to experience debt distress at significantly lower debt ratios.

<table>
<thead>
<tr>
<th>Debt-burden indicators for external public debt</th>
<th>Assessment of institutional strength and quality of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weak</td>
</tr>
<tr>
<td>1. PV of Debt/GDP</td>
<td>30</td>
</tr>
<tr>
<td>2. PV of Debt/Exports</td>
<td>100</td>
</tr>
<tr>
<td>3. PV of Debt/Revenue</td>
<td>200</td>
</tr>
<tr>
<td>4. Debt service/Exports</td>
<td>15</td>
</tr>
<tr>
<td>5. Debt service/Revenue</td>
<td>25</td>
</tr>
</tbody>
</table>

Debt Sustainability Analysis

What are Present Values (PVs)?

• Debt stock can be thought of as the sum of all future principal (amortization) payments
• Present value is the sum of all future discounted debt service payments
• Why are PVs used? Because they capture the concessionality of debt:
  ✓ A loan that is repaid in 40 years, at a low interest rate, is much less burdensome than a loan that has to be repaid next year at a high interest rate.
  ✓ The nominal debt stock computed today is indifferent between these two loans if the outstanding debt is the same, but the PV captures that the first loan is less burdensome.

Exercise

Let’s explore the PV of debt with some examples ...
You have encountered today (most) of the concepts used by the IMF for its LIC DSAs:

Take a look at the IMF/WB DSAs for your respective countries!

Debt Sustainability Analysis

Tools for debt sustainability analysis—references:

- Debt sustainability analysis for market-access countries: http://www.imf.org/external/pubs/ft/dsa/mac.htm
- DSAx -- Online course on debt sustainability analysis:
  - https://www.edx.org/school/imfx
Appendix

Extra slides ...

Debt Dynamics

Debt dynamics in terms of GDP ratios: Primary Balance

\[ D_t = (1 + i) D_{t-1} - PB_t \]

\[ \frac{D_t}{GDP_t} = (1 + i) \frac{D_{t-1}}{GDP_t} - \frac{PB_t}{GDP_t} \]

\[ \frac{D_t}{GDP_t} = (1 + i) \frac{GDP_{t-1}}{GDP_t} \frac{D_{t-1}}{GDP_{t-1}} - \frac{PB_t}{GDP_t} \]

\[ \frac{GDP_t}{GDP_{t-1}} = 1 + n \]

\[ \frac{D_t}{GDP_t} = \frac{1 + i}{1 + n} \frac{D_{t-1}}{GDP_{t-1}} - \frac{PB_t}{GDP_t} \]

\[ d_t = \frac{1 + i}{1 + n} d_{t-1} - pb_t \]

Autonomous component of debt dynamic