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General Setup

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The FTPL combines the government budget equation with two equilibrium conditions implied by the representative household’s optimization problem:

- the Euler equation
- the transversality condition, which implies that households will plan to satisfy (exhaust) their present value budget constraint.
Recall that we wrote the government budget equation,

\[ M_{t+1} + \frac{B_{t+1}}{(1 + i_t)} = M_t + B_t + P_t (G_t - \tau_t), \]

as

\[ \frac{M_{t+1} + B_{t+1}}{(1 + i_t)} = M_t + B_t + P_t (G_t - \tau_t) - \frac{i_t M_{t+1}}{1 + i_t}, \]  

(1)

and defined nominal liabilities as \( L_t = M_t + B_t \)
The Euler equation for a nominal one-period bond is

$$\frac{u'(C_t)}{P_t} = \beta (1 + i_t) E_t \left\{ \frac{u'(C_{t+1})}{P_{t+1}} \right\} ,$$
The Euler equation for a nominal one-period bond is

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Substituting this in (1) gives

\[ \frac{u'(C_t) L_t}{P_t} = \beta E_t \left[ \frac{u'(C_{t+1}) L_{t+1}}{P_{t+1}} \right] \]

\[ + u'(C_t) \left[ \tau_t + \left( \frac{i_t}{1 + i_t} \right) \left( \frac{M_{t+1}}{P_t} \right) - G_t \right] \]
Using the households’ Euler equation, we have

\[
\frac{1}{(1+i_t)} = \beta E_t \left[ \frac{u'(C_{t+1})}{P_{t+1}} \right] \left[ \frac{u'(C_t)}{P_t} \right]^{-1},
\]

and plugging this in the budget equation,

\[
\beta E_t \left[ \frac{u'(C_{t+1})}{P_{t+1}} \right] L_{t+1} = \frac{u'(C_t)}{P_t} \left[ L_t + P_t (G_t - \tau_t) - \frac{i_t M_{t+1}}{1+i_t} \right]
\]

and

\[
\beta E_t \left[ \frac{u'(C_{t+1})L_{t+1}}{P_{t+1}} \right] = \frac{u'(C_t)L_t}{P_t} + u'(C_t) \left[ G_t - \tau_t - \left( \frac{i_t}{1+i_t} \right) \left( \frac{M_{t+1}}{P_t} \right) \right]
\]
An Equilibrium Condition

- Iterating (2) forward and imposing the household’s transversality condition,

\[ \lim_{n \to +\infty} \beta^n E_t \left\{ \frac{u'(C_{t+n})L_{t+n}}{P_{t+n}} \right\} = 0 \]

we get

\[ \frac{u'(C_t)L_t}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j u'(C_{t+j}) \left[ S_{t+j} + \left( \frac{i_{t+j}}{1 + i_{t+j}} \right) \left( \frac{M_{t+j+1}}{P_{t+j}} \right) \right] \quad (3) \]

where \( S_t = \tau_t - G_t \) is the primary surplus exclusive of central-bank transfers
Let
\[ z_t = \frac{u'(C_t)L_t}{P_t} \]
and
\[ x_t = u'(C_t) \left[ \tau_t + \left( \frac{i_t}{1+i_t} \right) \left( \frac{M_{t+1}}{P_t} \right) - G_t \right] \]
to get
\[ z_t = \beta E_t z_{t+1} + x_t \]
Iterating forward, we get
\[ z_t = \beta^2 E_t z_{t+2} + \beta E_t x_{t+1} + x_t \]
\[ = \beta^3 E_t z_{t+3} + \beta^2 E_t x_{t+2} + \beta E_t x_{t+1} + x_t \]
\[ = \ldots \]
\[ = \beta^n E_t z_{t+n} + E_t \sum_{j=0}^{n-1} \beta^j x_{t+j} \]
Let \( n \) tend to infinity and impose the transversality condition
\[ \lim_{n \to +\infty} \beta^n E_t z_{t+n} = 0 \]
to get
\[ z_t = E_t \sum_{j=0}^{+\infty} \beta^j x_{t+j} \]
Or
\[ \frac{u'(C_t)L_t}{P_t} = E_t \sum_{j=0}^{+\infty} \beta^j \left\{ u'(C_{t+j}) \left[ \tau_{t+j} + \left( \frac{i_{t+j}}{1+i_{t+j}} \right) \left( \frac{M_{t+j+1}}{P_{t+j}} \right) - G_{t+j} \right] \right\} \]
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where $S_t = \tau_t - G_t$ is the primary surplus exclusive of central-bank transfers

- Recall that the level of nominal public-sector liabilities $(L_t = M_t + B_t)$ is predetermined
The government’s "PVBC" is actually a valuation equation for public-sector liabilities.
An Interpretation

- The government’s "PVBC" is actually a valuation equation for public-sector liabilities.
- The analogy is more transparent if we recall the stochastic discount factor of the consumption-based capital asset pricing model and write (3) as:

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\frac{L_t}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j \left[ \frac{u'(C_{t+j})}{u'(C_t)} \right] \left[ S_{t+j} + \left( \frac{i_{t+j}}{1 + i_{t+j}} \right) \left( \frac{M_{t+j+1}}{P_{t+j}} \right) \right]
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- Real public-sector liabilities must equal the expected present value of primary surpluses inclusive of central-bank transfers; much like stock prices are related to the expected present value of dividends.
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- Real public-sector liabilities must equal the expected present value of primary surpluses inclusive of central-bank transfers; much like stock prices are related to the expected present value of dividends.
- Cochrane (2005): debt holders are the "residual claimants" on primary surpluses.
A Convenient Specification

To get a specification with fiscal variables expressed relative to GDP (for policy applications), assume logarithmic utility from consumption and set $G_t = gy_t$ (i.e. assume the government purchases a constant fraction of output) in our CIA setup.
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$$\frac{L_t}{P_t y_t} = \beta E_t \left[ \frac{L_{t+1}}{P_{t+1} y_{t+1}} \right] + \frac{\tau_t}{y_t} - g + \left( \frac{i_t}{1 + i_t} \right)$$

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- In our model with exogenous output, we can analyze price determination (as we did above).
We can also think of

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- If we consider a model with price rigidity, like the standard New Keynesian (NK) model, the adjustment of nominal GDP will involve an increase in output.

  - Ricardian Equivalence does not hold.
  - Implications about fiscal multipliers can be quite different from those of the NK model under (i.e., implicitly assuming!) a Ricardian fiscal regime.
We can use

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We will discuss fiscal multipliers later
Criticisms of the FTPL

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The proponents of the FTPL [e.g., Cochrane (2005)] respond to these criticisms, but the details of the theory are beyond the scope of our course
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- The proponents of the FTPL [e.g., Cochrane (2005)] respond to these criticisms, but the details of the theory are beyond the scope of our course

- The current policy-oriented interest in the FTPL arises from the broad (somewhat informal) implication that expectations about future fiscal imbalances may hamper the ability of central banks to control inflation
The FTPL’s emphasis on the transversality condition of households, and the equilibrium condition (3) is natural in the context of the formal model but seems too "generous" for defining sustainable fiscal policies in reality.
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We may define (somewhat informally) sustainable fiscal policies as those that keep the debt-to-GDP ratio suitably bounded.
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- We may define (somewhat informally) sustainable fiscal policies as those that keep the debt-to-GDP ratio suitably bounded.

- For policy applications, we may also consider fiscal reaction functions that adjust the surplus-to-GDP ratio in response to changes in the debt-to-GDP ratio.
Define

\[ l_t \equiv \frac{L_t}{P_t y_t}, \quad s_t = \frac{S_t}{y_t}, \quad \text{and} \quad \delta_t = \frac{i_t}{1 + i_t} \]
Evolution of Debt/GDP

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- Consider fiscal reaction functions with
  \[ s_t = \phi l_t + x_t, \quad 0 \leq \phi \leq 1 \]

  where \( \{x_t\} \) is an exogenous stochastic process, capturing the effects of the political process and other factors on the surplus-to-GDP ratio
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where \( \{x_t\} \) is an exogenous stochastic process, capturing the effects of the political process and other factors on the surplus-to-GDP ratio.

The dynamics of \( l_t \) are governed by
\[ l_t = \left( \frac{\beta}{1 - \phi} \right) E_t l_{t+1} + \frac{x_t + \delta_t}{1 - \phi} \]
Passive Fiscal Policy

- Following Leeper (1991), we define a passive fiscal policy as a policy with

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Under such a policy, the response of $s_t$ to $l_t$ is larger than the steady-state real interest rate; more precisely (for the version I use here), we have:

$$\phi > 1 - \beta$$
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This strong response keeps the debt-to-GDP ratio bounded, for any bounded sequence \( \{x_t + \delta_t\} \), in any backward-looking solution to

\[
E_t l_{t+1} = \left( \frac{1 - \phi}{\beta} \right) l_t - \frac{x_t + \delta_t}{\beta}
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Active Fiscal Policy

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The fiscal policy is active in the sense that it sets the nominal anchor (as long as we confine our analysis to bounded solutions).
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If both policies are active, we have over-determinacy and the possibility of explosive equilibria
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- Expectations of the private sector about the likelihood of future regimes (binding fiscal limits, the possibility of default) can evolve.

These extensions make room for news about fiscal policy to be inconsequential during some periods and lead to big equilibrium adjustments during others, as we will see later.
Cochrane’s (2005) asset-valuation interpretation is useful for thinking about the implications of default risk and long-term debt.
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We will discuss default risk later, but more remains to be done on this topic.