The Fiscal Theory of the Price Level in a World of Low Interest Rates

Marco Bassetto[1] Wei Cui[2]

[1]Federal Reserve Bank of Chicago and IFS

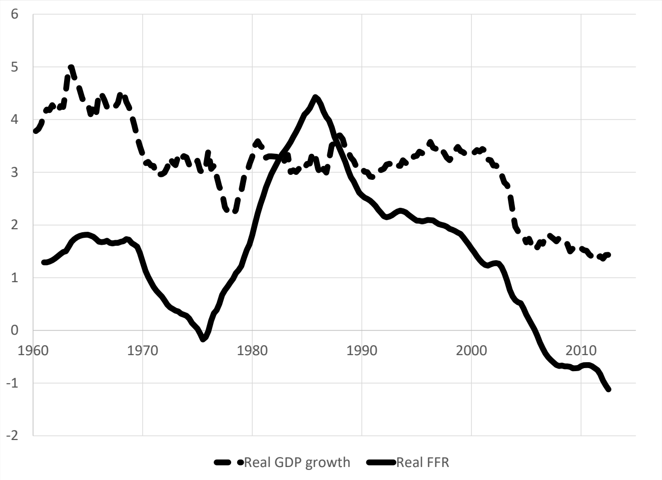
[2]UCL

The Fiscal Theory of the Price Level

$$\frac{B_t}{P_t} = E_t \sum_{s=t}^{\infty} \frac{z_t}{z_s} \tau_s$$

- Debt must be equal to the present value of taxes
- Committing to a sequence of real taxes $\Longleftrightarrow$ Pin down P_t
- Important now:
  - Solution to ZLB issues;
  - Phillips curve dead, need alternative

Interest Rates vs. Growth Rate in the United States



The FTPL in a World of Low Interest Rates

- If $r < g$, does
$$\frac{B_t}{P_t} = E_t \sum_{s=t}^{\infty} \frac{z_t}{z_s} \tau_s$$
still apply?
- How do we deal with convergence?
- What happens to the FTPL?
- Is it still true that low prices can be cured with an unbacked fiscal expansion?

Plan of the Talk

- What can we learn just looking at the budget constraint?

- 3 classes of models deliver low rates, probe validity of the FTPL in prototypical case of each:
  1. Gov't debt risk-free (or favorable risk), high risk premium
  2. Gov't debt has a high liquidity premium (gov't debt like money)
  3. The economy is dynamically inefficient (all assets are like money);

Plan of the Talk

- What can we learn just looking at the budget constraint?
  - Low rates $\Longrightarrow$ Government runs primary deficit "on average" $\Longrightarrow$ need Bassetto (2002) fix
- 3 classes of models deliver low rates, probe validity of the FTPL in prototypical case of each:
  1. Gov't debt risk-free (or favorable risk), high risk premium
     - ⋆ FTPL just fine, after deficit fix
  2. Gov't debt has a high liquidity premium (gov't debt like money)
     - ⋆ FTPL selects range, not unique price level
  3. The economy is dynamically inefficient (all assets are like money);
     - ⋆ FTPL selects range, not unique price level

The Government Budget Constraint

- Nominal, period by period:

$$\frac{B_{t+1}}{1+R_t} = B_t - P_t \tau_t,$$

- Rescale by nominal GDP:

$$\frac{B_{t+1}}{P_{t+1}y_{t+1}} = \frac{(1+R_t)P_t y_t}{P_{t+1}y_{t+1}} \left(\frac{B_t}{P_t y_t} - x_t \right) = \frac{1+r_t}{1+g_t} \left(\frac{B_t}{P_t y_t} - x_t \right).$$

x_t: Taxes (primary surplus)/GDP

A Deterministic Economy

- What can we say if

$$\frac{(1+R_t)P_t y_t}{P_{t+1}y_{t+1}} < \alpha < 1?$$

- Get

$$\frac{B_t}{P_t Y_t} = \frac{B_0}{P_0 Y_0}\prod_{s=1}^{t}\left(\frac{1+r_s}{1+g_s}\right) - \sum_{s=0}^{t-1} x_s \prod_{v=s+1}^{t}\left(\frac{1+r_v}{1+g_v}\right)$$
$$< \alpha^t \frac{B_0}{P_0 Y_0} - \sum_{s=0}^{t-1} x_s \prod_{v=s+1}^{t}\left(\frac{1+r_v}{1+g_v}\right).$$

- If debt stays positive (and bounded away from zero), taxes must be negative, at least eventually

How the FTPL Works with Positive Surpluses

With positive taxes:

- Gov't commits to repay debt with money
- Gov't commits to real surpluses to withdraw money
- Strategy just fine independently of what private sector does
- Prices must adjust
- Just like Microsoft stock: price of stock = PV of dividends
- If Microsoft stock mispriced, it's the market's problem

What Happens with Deficits?

- AIG in 2008: think they have positive NPV
- ... but the market disagrees...
- ... and they need cash-flow injection...
- Similar problem for gov't (full details in Bassetto, 2002)
- So, having primary deficits most of the time is a big deal for the theory
- Can be fixed, but much less appealing

Stochastic Economy

- Low rate condition becomes

$$E_t\left[\frac{(1+R_t)P_t y_t}{P_{t+1}y_{t+1}}\right] < \alpha < 1.$$

- Evolution of expected debt

$$E_0\frac{B_t}{P_t y_t} = E_0\left\{\frac{B_0}{P_0 y_0}\prod_{s=1}^{t}\left(\frac{1+r_s}{1+g_s}\right) - \sum_{s=0}^{t-1} x_s \prod_{v=s+1}^{t}\left(\frac{1+r_v}{1+g_v}\right)\right\}$$
$$< \alpha^t \frac{B_0}{P_0 y_0} - E_0\left[\sum_{s=0}^{t-1} x_s \prod_{v=s+1}^{t}\left(\frac{1+r_v}{1+g_v}\right)\right].$$

- With low rates, must have recurring primary deficits

Setup of the First Economy

- Preferences:

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma} - 1}{1-\gamma}$$

- Endowment: y_t (stochastic), nonstorable
- Gov't:
  - Sets (real) exogenous taxes τ_t
  - Sets nominal interest rate R, fixed and exogenous
  - What matters: lack of feedback

No-Ponzi and transversality condition

- no Ponzi:

$$W_t \geq -\limsup_{n\to\infty} \sum_{s=t}^{n} E_t[z_{t,s}(P_s(y_s - \tau_s)]$$

- Transversality condition:

$$W_t = -\limsup_{n\to\infty} \sum_{s=t}^{n} E_t[z_{t,s}(P_s(y_s - \tau_s)]$$

- If RHS is infinite, then we cannot have an equilibrium

The FTPL still works

- Can iterate on consumer budget constraint
- Infinite sums must still convergence for household optimization, even though

$$E_t\left[\frac{(1+R)P_t y_t}{P_{t+1}y_{t+1}}\right] < \alpha < 1.$$

- Obtain

$$\frac{B_t}{P_t} = \mathbb{E}_t \sum_{s=0}^{\infty}\left[\frac{z_{t+s}}{z_t}\tau_{t+s}\right].$$

- $z_t := \beta^t u'(y_t)$

Example of low rates

- You could get $E_t \tau_{t+1} < 0$ in all periods!
- Example:

$$\log y_{t+1} = \log y_t + \log \Delta + \epsilon_{t+1}$$

  ϵ_{t+1} negative exponential with parameter λ, $\Delta < 1$ (so $\log \Delta < 0$)
- Real one-period risk-free rate:

$$\frac{\Delta^\gamma(\gamma + \lambda)}{\beta\lambda}$$

- Need

$$\frac{\gamma + \lambda}{\beta(\lambda + 1)} < \Delta^{1-\gamma} < \frac{\lambda + \gamma - 1}{\beta\lambda}$$

  LHS ensures low rates, RHS that utility is bounded
- Inequalities mutually compatible iff $\gamma > 1$
- Need large risk aversion (γ) and/or risk (λ) to get real rate , but not too large (otherwise $U = -\infty$)

Casting some doubt on this story

- For stocks, we expect low return if they have low beta
- Low beta means delivering cookies in bad times
- Gov'ts run big deficits in bad times $\Longrightarrow$ gov't debt does not deliver those cookies

What if Debt has a Liquidity Role?

- Get rid of uncertainty
- Preferences:

$$\sum_{t=0}^{\infty} \beta^t [u(q_t) + c_t - \ell_t]$$

- q_t: "bond" good, must be bought with government bonds

$$B_t \geq P_t q_t$$

- c_t: credit good and $P_t c_t + B_{t+1}/(1+R) \leq P_t(\ell_t - \tau_t) + B_t$
- The paper: morning market, evening market
- Linear production of either good, labor is ℓ_t
- Taxes set in real terms again, say constant τ
- R constant again

Debt is Like Money

- We are interested in equilibria in which the real rate on government debt is negative:
$$(1+R)P_t/P_{t+1} \leq 1$$
- Can import old results about money (e.g. Sargent DMT)
- Gov't BC
$$\frac{B_{t+1}}{P_{t+1}} = \frac{B_t}{P_t}\left[(1+R)\frac{P_t}{P_{t+1}}\right] - \tau$$
- HH optimality
$$u'\left(\frac{B_{t+1}}{P_{t+1}}\right) = \frac{P_{t+1}}{\beta P_t(1+R)} = \frac{1}{\beta(1+r_{t+1})}$$

Characterizing Competitive Equilibria

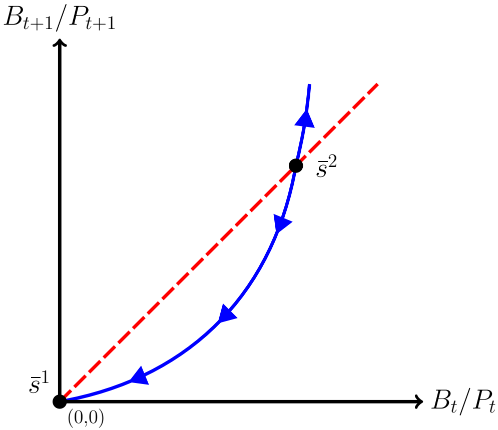
- Define $s_{t+1} := \frac{B_{t+1}}{P_{t+1}}$
- Invert HH optimality, get $r_{t+1} = r\left(s_{t+1}\right)$, assume increasing
- Substitute into gov't BC, get

$$s_{t+1} = (1 + r(s_t))s_t - \tau$$

- Initial condition

$$s_1 = \frac{B_0}{P_0} - \tau$$

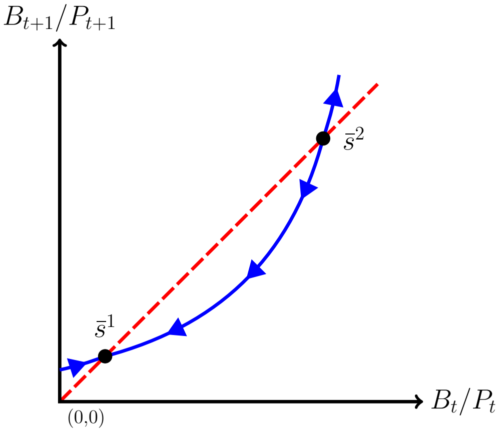
Evolution of Real Debt with $\tau = 0$



Equilibria with $\tau = 0$

- One SS with constant B_{t+1}/P_{t+1};
- A continuum of equilibria where $B_{t+1}/P_{t+1} \to 0$
- Given B_0, equilibrium price level $P_0 \in [\underline{P}, \infty)$

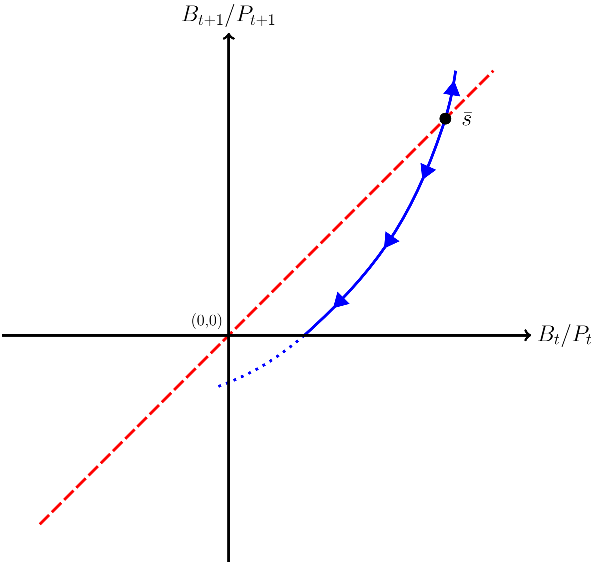
Evolution of Real Debt with $\tau < 0$



Equilibria with $\tau < 0$

- Two SS with constant B_{t+1}/P_{t+1};
- A continuum of equilibria where B_{t+1}/P_{t+1} converges to the low-debt equilibrium
- Given B_0, equilibrium price level $P_0 \in [\underline{P}, \infty]$

Evolution of Real Debt with $\tau > 0$



Equilibria with $\tau > 0$

- Unique steady state
- Globally unstable
- Fiscal theory holds, but $r > 0$

A dynamically inefficient economy

- Two-period OLG structure
- Preferences: $U(c_t^y, c_{t+1}^o)$
- Endowment: w^y when young, w^o when old
- Everybody alive pays taxes, fixed real amount τ_t

Household optimality

- Budget constraints:

$$P_t c_t^y + \frac{B_{t+1}}{1+R} \leq P_t w^y$$

$$P_{t+1} c_{t+1}^o \leq P_{t+1}(w^o - \tau_{t+1}) + B_{t+1}$$

- Solution: a saving rate f as a function of the real rate

$$\frac{B_{t+1}}{1+R} = P_t f(r_{t+1})$$

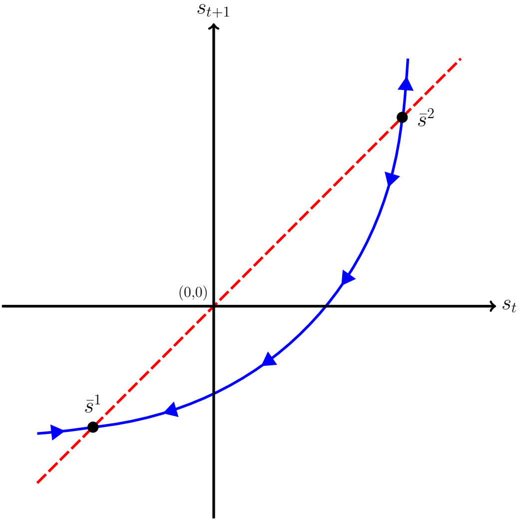
Dynamics of debt

- Assume f strictly increasing
- Substitute optimal saving into government budget constraint:

$$f(1 + r_{t+1}) = (1 + r_t) f(1 + r_t) - \tau_t$$

$$f(1 + r_1) = \frac{B_0}{P_0} - \tau_t$$

Dynamics of debt when $\tau > 0$



What Have We Learned?

- Low interest rates on debt indicative of primary deficits
- $\Longrightarrow$ Not a symptom of excessive fiscal discipline
- $\Longrightarrow$ Range in which FTPL requires more complicated strategies

What Have We Learned?

- Low interest rates on debt indicative of primary deficits
- $\Longrightarrow$ Not a symptom of excessive fiscal discipline
- $\Longrightarrow$ Range in which FTPL requires more complicated strategies
- Comparative statics tricky:
  - Validity of FTPL depends on reasons for why interest rates are low
  - It has to do with limiting behavior, and beliefs about it
  - Multiple equilibria possible