

The Fiscal Theory of the Price Level - A Short Introduction

Livio Maya

Precursors and Intellectual Landscape

Notes based on Cochrane (2022b): you should read yourself!

- Old-Keynesian Models (adaptive expectations, little economics)
 - Interest peg is unstable
 - Taylor rule $i_t = \phi \pi_t$ with $\phi > 1$ recovers stability by "adjusting aggregate demand"
- New-Keynesian Models (rational expectations, micro-founded)
 - Interest peg **stable** but **indeterminate**
 - Rule $i_t = i_t^* + \phi(\pi_t - \pi_t^*)$ with $\phi > 1$ threatens spiral, selects π_t^*
- Theoretical issues: How to rule out spirals? Where does $\Delta E_t \pi_t^*$ come from? Forward guidance puzzle?
- Empirical issues: Why rule out spirals? Do CBs threaten spirals? Zero Lower Bound?

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- Household budget constraint: $B_0 + P_1 y_1 = P_1 c_1 + P_1 s_1 + M_1$
- Equilibrium conditions $y_1 = c_1$ and $M_1 = 0$ imply:

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 - "Too much money chasing too few goods" ✓
 - "Strong aggregate demand" ✓

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 - "Too much money chasing too few goods" ✓
 - "Strong aggregate demand" ✓
- *"A prince, who should enact that a certain proportion of his taxes be paid in a paper money of a certain kind, might thereby give a certain value to this paper money"* - Wealth of Nation, Adam Smith

FTPL in a Two-Period Model

Now, let's consider decisions in period zero.

- Households inherit B_{-1} bonds, government charges s_0 in taxes and sells B_0 new bonds at discount Q_0
- Given equilibrium conditions $y_0 = c_0$ and $M_0 = 0$:

$$B_{-1} = P_0 s_0 + Q_0 B_0 \implies \frac{B_{-1}}{P_0} = s_0 + \frac{Q_0 B_0}{P_0}$$

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- Fisher equation $Q_0 = \frac{1}{1+i_0} = \frac{1}{R} E_0 \left(\frac{P_0}{P_1} \right)$ and $\beta = \frac{1}{R}$:

$$\text{Real Bond Sales Revenue} = \frac{Q_0 B_0}{P_0} = \beta E_0 \left[\frac{B_0}{P_1} \right] = \beta E_0 [s_1]$$

- The valuation equation becomes

$$\frac{B_{-1}}{P_0} = s_0 + \beta E_0 [s_1]$$

and the price level P_0 is again determined.

FTPL in a Two-Period Model: Fiscal and Monetary Policy

Monetary Policy sets Q_0 by changing B_0

Fiscal Policy sets s_0 and s_1

$$\frac{B_0}{P_1} = s_1 \quad (1)$$

$$\frac{B_{-1}}{P_0} = s_0 + \frac{Q_0 B_0}{P_0} \quad (2)$$

$$Q_0 = \beta E_0 \left(\frac{P_0}{P_1} \right) \quad (3)$$

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■ What if $B_0 \uparrow$?

- Real bond sales revenue unchanged at $\beta E_0[s_1] \implies P_0$ constant
- Since $Q_0 B_0$ is constant, $Q_0 \downarrow$ (the government raises nominal interest)
- By the Fisher equation, monetary policy controls **expected** inflation

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 - Therefore $P_0 \uparrow$ (**unexpected** inflation)
- What if $s_1 \downarrow$?
 - In $t = 1$: Lower surpluses soak up less $B_0 \implies P_1 \uparrow$ (**unexpected** inflation)
 - In $t = 0$: Real bond sales revenue $\beta E_0[s_1]$ declines $\implies P_0 \uparrow$ (**unexpected** inflation)
 - If monetary policy fixes Q_0 : expected inflation $E_0(P_0/P_1)$ constant

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FTPL: Infinite Periods

- Let $\beta_t = Q_t P_{t+1} / P_t$ be the *ex-post* real discount for public bonds, and $\beta_{t,t+k} \equiv \prod_{\tau=t}^{t+k} \beta_\tau$
- As long as $\lim_{k \rightarrow \infty} \beta_{t,t+k} \frac{B_{t+k}}{P_{t+k+1}} = 0$ at every t (No-Ponzi, optimality)

$$\frac{B_{t-1}}{P_t} = \sum_{k=0}^{\infty} E_t [\beta_{t,t+k-1} s_{t+k}]$$

- This is a valuation equation, not a budget constraint. It holds in all micro-founded models!
 - **Standard NK:** causality from left to right, $PDV(\{s, \beta\})$ adjusts to P_t
 - **FTPL:** causality from right to left, P_t adjusts to $PDV(\{s, \beta\})$
- Which theory asks more from the government? What about Japan? Reading of 2021/22 inflation?

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- Which theory asks more from the government? What about Japan? Reading of 2021/22 inflation?
- Let v_t be *end-of-period* real debt. Linearize law of motion of public debt (around $v = 1$):

$$v_t + s_t = \underbrace{\frac{1}{\beta} (v_{t-1} + i_{t-1} - \pi_t)}_{\text{Beginning-of-period } V_{t-1}/P_t}$$

Frictionless Model

- Flexible prices, constant output, interest peg i^*
- From valuation equation:

$$\frac{B_{t-1}}{P_{t-1}} \Delta E_t [\Pi^{-1}] = \Delta E_t \left[\sum_{k=0}^{\infty} \beta_{t,t+k-1} s_{t+k} \right]$$

- Fiscal theory model:

$$E_t \pi_{t+1} = i_t^*$$

$$\Delta E_t \pi_t = -\varepsilon_{s,t}$$

Frictionless Model

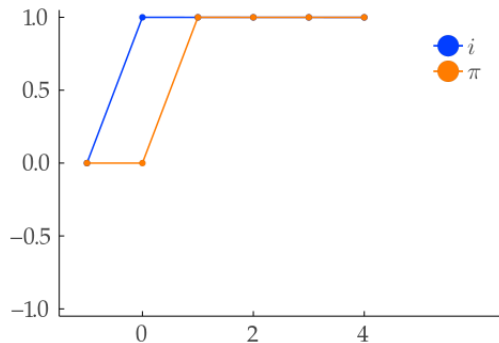
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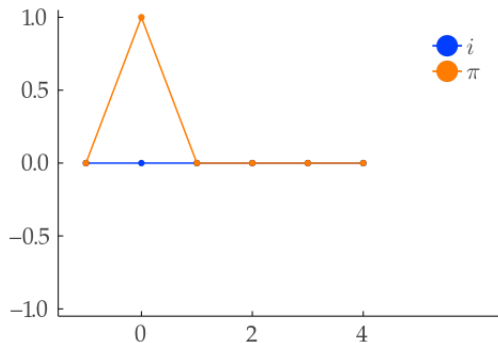
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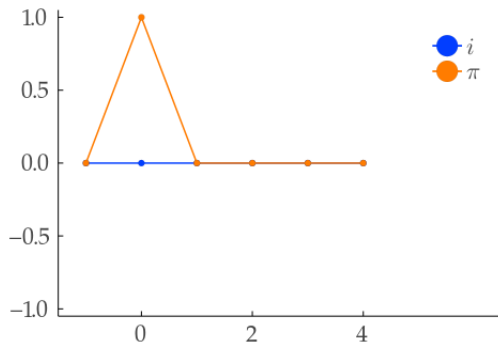
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- This is a **Fisherian** model
- Spiral threat model:

$$\begin{aligned} i_t &= i_t^* + \phi(\pi_t - \pi_t^*) \quad \phi > 1 \\ \pi_t^* &= i_{t-1}^* + \Delta E_t \pi_t^* \end{aligned}$$

generates same equilibrium



Basic NK Model

- Private sector and debt law of motion:

$$y_t = E_t y_{t+1} - \gamma (i_t - E_t \pi_{t+1})$$

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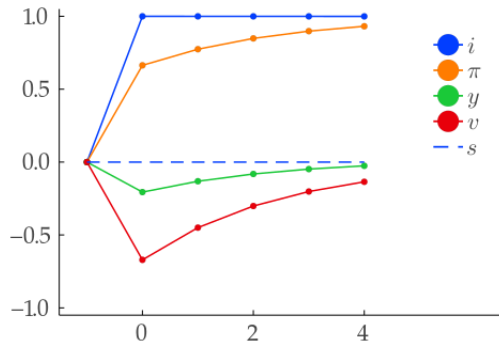
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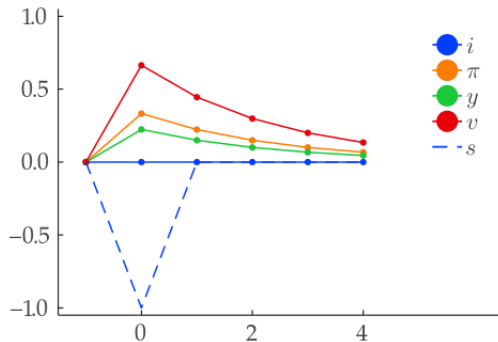
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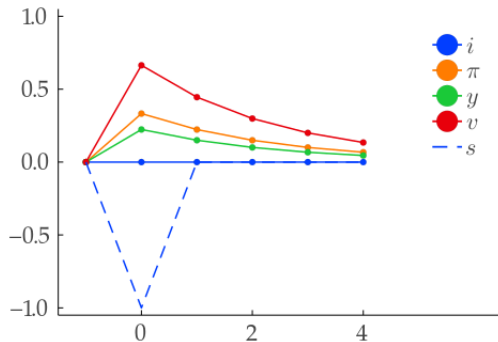
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- Inflation jumps at $t = 0$: **SUPER-Fisherian** model
- Spiral threat:

$$i_t = i_t^* + \phi(\pi_t - \pi_t^*) \quad \phi > 1$$

$$s_t = \alpha v_t - \varepsilon_{s,t}$$

- Empirically, $\alpha > 0$. Is that a problem for the FTPL?
Cochrane (2022a)



Long-Term Debt

- In practice, governments finance themselves through long-term debt
- This is important because, with long-term bonds, higher interest rate can reduce the **market value** of debt
- Multiple maturities $n = 1, 2, 3, \dots$ (until now, we only had $n = 1$)

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where $R_t^N = \sum Q_t^{n-1} B_{t-1}^n / \sum Q_{t-1}^{n-1} B_{t-1}^n$ is the *ex-post* nominal return on the public debt portfolio.

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- $v_t = V_t / P_t$ = real end-of-period market value of public debt

$$\frac{R_t^N}{\Pi_t} v_{t-1} = s_t + v_t \quad \Rightarrow \quad \boxed{\frac{R_t^N}{\Pi_t} v_{t-1} = \sum_{k=0}^{\infty} E_t [\beta_{t,t+k-1} s_{t+k}]}$$

Now: **market value** of debt = discounted surpluses

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- Linearizing:

$$r_t^N = \omega q_t - q_{t-1} \tag{6}$$

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- Next, we need a pricing model. I assume a constant risk premium $E_t r_{t+1}^N = i_t$ (embeds expectations hypothesis)

$$q_t = \omega E_t q_{t+1} - i_t = - \sum_{k=0}^{\infty} E_t i_{t+k} \quad (7)$$

- Monetary tightening: $i \uparrow \implies q \downarrow \implies r^N \downarrow \implies$ Market Value of Debt \downarrow
 - We can get deflation even if discounted surpluses decline!

Basic NK Model with Long-Term Debt

- Private sector, debt and bonds:

$$y_t = E_t y_{t+1} - \gamma (i_t - E_t \pi_{t+1})$$

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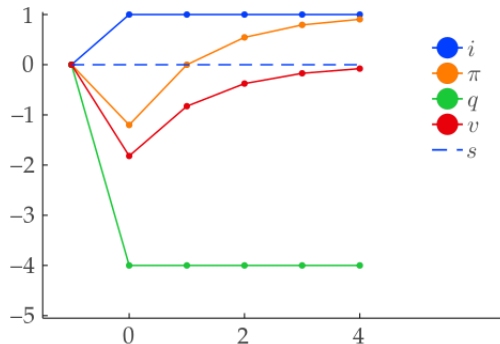
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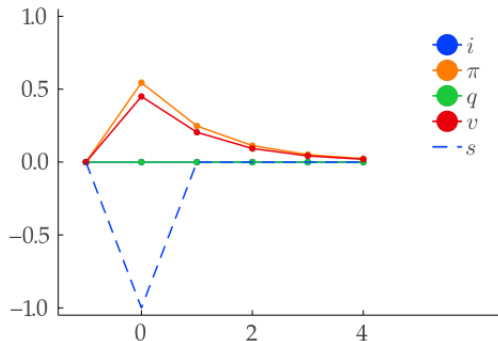
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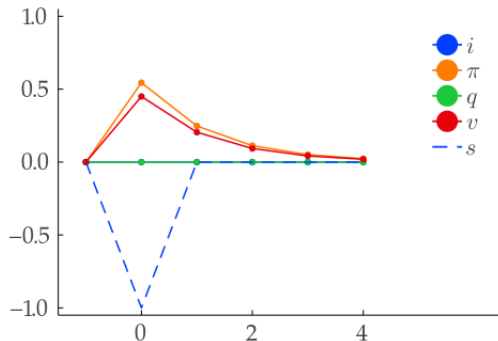
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■ Spiral threat:

$$i_t = i_t^* + \phi(\pi_t - \pi_t^*) \quad \phi > 1$$

$$s_t = \alpha v_t - \varepsilon_{s,t}$$



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with $a_0 = 1$ so that $\Delta E_t s_t = \varepsilon_t$

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- **Be careful with $s \sim \text{AR}(1)$!** In that case, deficits follow deficits: $a(\beta) = (1 - \beta\rho)^{-1} > 1$
 - In the AR(1) case, the government does *not* raise revenue by selling bonds to finance deficits...
 - ... and a deficit *reduces* the market value of debt (why?)

Concluding Remarks

- The FTPL:
 - determines the price level through the volume of surpluses backing nominal debt
 - determines unexpected inflation in rational expectations models (or provides the additional unstable root)
- **Observational Equivalency**: in equilibrium, FTPL = Spiral Threat; "regime" identification requires strong assumptions
- Why is the FTPL appealing?
 - Fully neoclassical. Money not necessary or "special". It works in the absence of frictions and under interest pegs.
 - FTPL brings fiscal policy back to the center stage
 - FTPL offers an opportunity cost for unexpected inflation ("*stable inflation or emergency COVID transfers?*")
 - Compatible with policy experience. Central banks do not threat spirals. Fiscal policy does not (and cannot) accomodate arbitrary changes in the price level ("*spending cut promises in deflationary recessions?*")
 - Story telling meets theory
 - No ZLB inconsistency: constrained zero interest is stable and determinate. Not vulnerable to Forward Guidance Puzzle

References

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- Cochrane, J. H. (2022b). The Fiscal Theory of the Price Level.