The Fiscal Theory of the Price Level - A Short Introduction

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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 $\phi > 1$ threats 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 threat spirals? Zero Lower Bound?

FTPL in a One-Period Model

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

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  - ”Too much money chasing too few goods” ✓
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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 $\beta R = 1$:

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

- 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

$$\frac{B_0}{P_1} = s_1 \tag{1}$$

$$\frac{B_{-1}}{P_0} = s_0 + \frac{Q_0 B_0}{P_0} \tag{2}$$

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

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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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- 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 $\lim_{k\to\infty} \beta_{t,t+k} \frac{B_{t+k}}{P_{t+k+1}} = 0$ at every t (No-Ponzi, optimality)

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

- 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 $PDV(\{s, \beta\})$
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- Let v_t be *end-of-period* real debt. Linearize law of motion of public debt (around $v = 1$):

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

Frictionless Model

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

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

- Fiscal theory model:

$$\begin{aligned} E_t \pi_{t+1} &= i_t^* \\ \Delta E_t \pi_t &= -\varepsilon_{s,t} \end{aligned}$$

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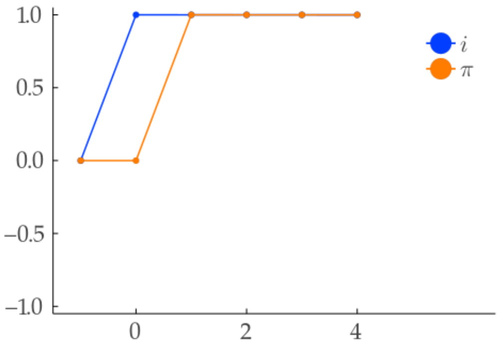

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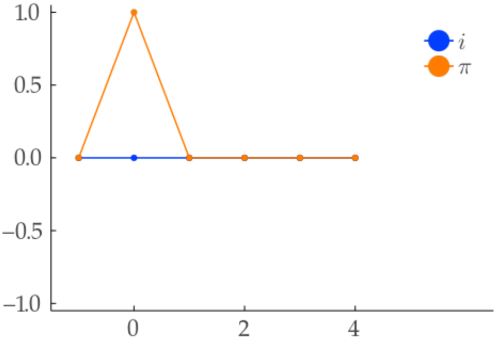

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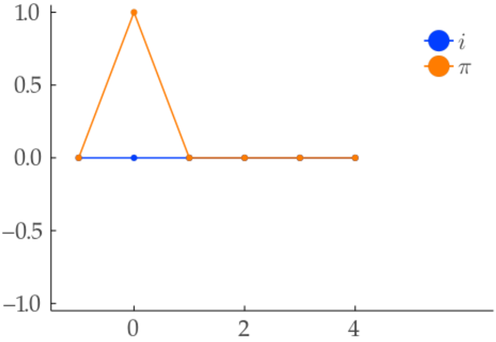
- Spiral threat model:

$$i_t = i_t^* + \phi(\pi_t - \pi_t^*) \qquad \phi > 1$$
$$\pi_t^* = i_{t-1}^* + \Delta E_t \pi_t^*$$

generates same equilibrium



Basic NK Model

- Private sector and debt law of motion:

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y_t &= E_t y_{t+1} - \gamma\left(i_t - E_t \pi_{t+1}\right) \\
\pi_t &= \beta E_t \pi_{t+1} + \kappa y_t \\
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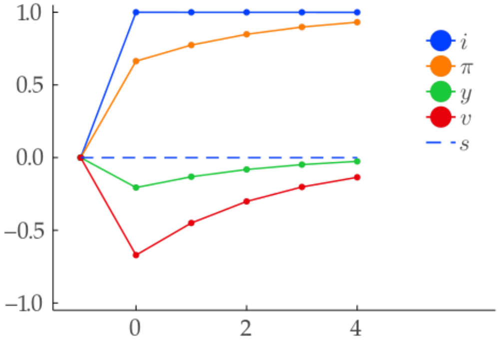
- Inflation jumps at $t = 0$: SUPER-Fisherian model



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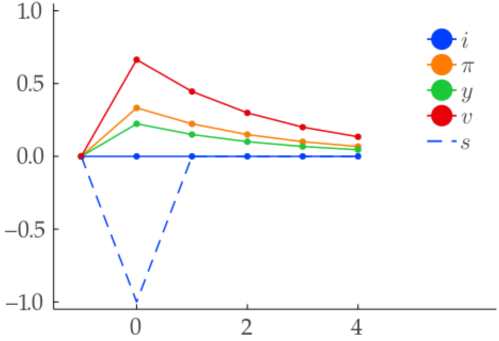

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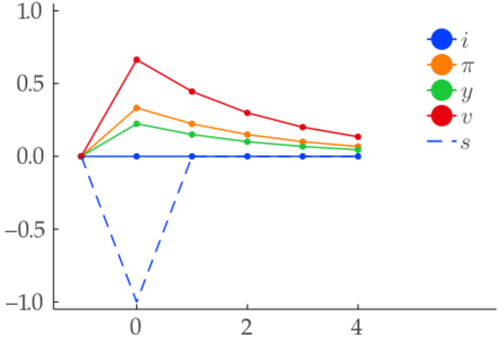
- Inflation jumps at $t = 0$: SUPER-Fisherian model
- Spiral threat:

$$
\begin{aligned}
i_t &= i_t^* + \phi(\pi_t - \pi_t^*) \qquad \phi > 1 \\
s_t &= \alpha v_t - \varepsilon_{s,t}
\end{aligned}
$$

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



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References

Cochrane, J. H. (2022a). A fiscal theory of monetary policy with partially-repaid long-term debt. *Review of Economic Dynamics*, 45:1–21.

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