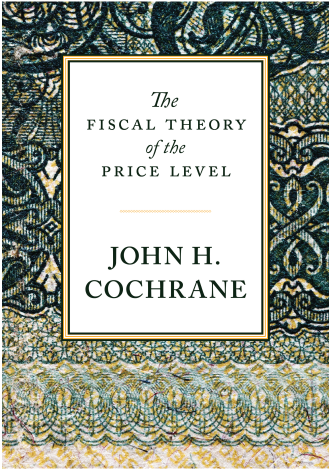
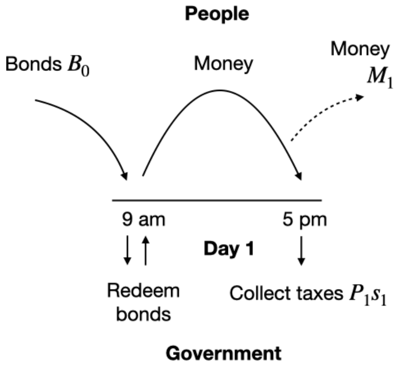


"A prince, who should enact that a certain proportion of his taxes be paid in a paper money of a certain kind, might thereby give a certain value to this paper money." (Adam Smith, *Wealth of Nations*).

Also "Fiscal Histories," "Expectations and the Neutrality of Interest Rates," "The Fiscal Theory of Inflation," "Inflation Past, Present and Future," all at johnhcochrane.com. Goal: Make FTPL *useful*. Supplant (fix) new-Keynesian model as monetary economics workhorse.

One Period Fiscal Theory



- AM: Redeem B_0 for M. PM: Pay net taxes $P_1 s_1$.

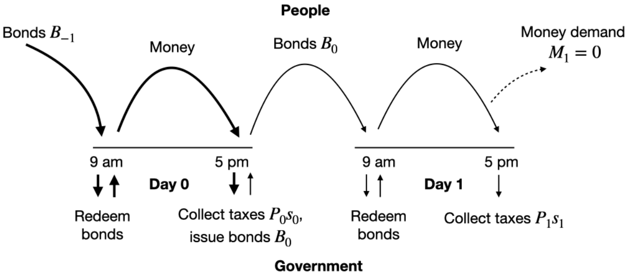
$$B_0 = P_1 s_1 \ (+M_1)$$

- Equilibrium: Money has no value to consumer ex post $M_1 = 0$.

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

- We determine the price level. Flexible prices, no money demand, gold, Phillips curve, frictions. Can add frictions, but not necessary.
- May feel like "aggregate demand" or $MV = PY$.
- A "backing" theory of money.

Two-period fiscal theory and fiscal policy



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

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

$$Q_0 = \frac{1}{1+i_0} = \beta E_0\left(\frac{P_0}{P_1}\right)$$

$$\frac{B_{-1}}{P_0} = s_0 + \beta E_0\left(\frac{1}{P_1}\right) B_0$$

$$\boxed{\frac{B_{-1}}{P_0} = s_0 + \beta E_0(s_1)}$$

- *Present value of surpluses* matters for today's inflation, not just s_0.
- "Normal fiscal policy." Borrow $s_0 < 0$, raise B_0, repay $s_1 > 0$, no inflation. →"s shaped" surplus MA. Debt, deficit vary, no inflation.
- *No* necessary strong correlation of debt, deficits, inflation.
- Expectations matter, inflation seems to come from nowhere.
- Discount rates matter (a lot).
- "Money as stock." (Really bonds.)

A complete model

$$\max E u(c_0) + \beta u(c_1) s.t.$$
$$M_{t-1} + B_{t-1} + P_t y = P_t c_t + P_t s_t + M_t + Q_t B_t;\ \ t = 0, 1$$
$$B_t / P_t > 0; M_t / P_t > 0 (\text{esp.} t = 1; \rightarrow \text{transversality})$$

Govt B.C.

$$M_{t-1} + B_{t-1} = P_t s_t + M_t + Q_t B_t;\ \ t = 0, 1.$$

Markets clear

$$c_0 = y; c_1 = y$$

FOC + clearing:

$$Q_0 = \frac{1}{1 + i_0} = \beta E_0 \left(\frac{P_0}{P_1} \right)$$
$$B_1 = M_1 = 0; M_0 = 0$$

FOC + clearing + B.C.

$$B_{-1} / P_0 = s_0 + \beta E_0 (s_1)$$
$$B_0 / P_1 = s_1$$

Monetary policy – B_0? i target?

$$\text{Time 1}: \frac{B_0}{P_1} = s_1.$$

$$\text{Time 0}: \frac{B_{-1}}{P_0} = s_0 + \frac{1}{1+i_0}\frac{B_0}{P_0} = s_0 + \beta E_0\left(\frac{P_0}{P_1}\right)\frac{B_0}{P_0} = s_0 + \beta E_0(s_1)$$

- More B_0 with no change in s_0, s_1? Raise P_1, i_0. No change in P_0. Share split, currency reform. (Vs. B_0 with s_1, equity issue.)
- Interest rate target i_0? (Holding $\{s_t\}$ fixed). *Monetary policy can set a nominal interest rate target, by selling government debt at a fixed rate with no* Δs*.*
- *Interest rate target (Fed) sets expected inflation.* $i_t = E_t \pi_{t+1}$.
- *Fiscal policy sets unexpected inflation*.

$$\frac{B_0}{P_0}(E_1 - E_0)\left(\frac{P_0}{P_1}\right) = (E_1 - E_0)s_1.$$

- Inflation is stable and determinate under an interest rate target, even a peg! (Contra Friedman 1968, ISLM, Sargent Wallace 1975).
- "Fiscal theory of monetary policy."

To FTMP

Intertemporal

$$\boxed{\frac{B_t}{P_{t+1}} = E_{t+1} \sum_{j=0}^{\infty} \beta^j s_{t+1+j}}$$

Linearized model for data, FTMP.

$$\frac{1}{1+i_t} = \beta E_t \left(\frac{P_t}{P_{t+1}} \right)$$

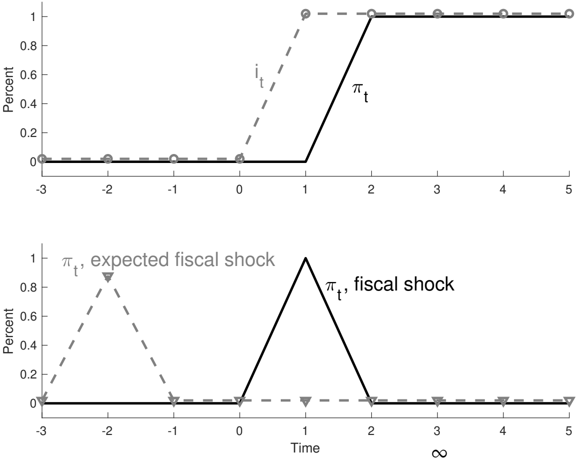
$$\boxed{i_t \approx E_t \pi_{t+1}}$$

$$\frac{B_t}{P_t} \left(E_{t+1} - E_t \right) \left(\frac{P_t}{P_{t+1}} \right) = \left(E_{t+1} - E_t \right) \sum_{j=0}^{\infty} \beta^j s_{t+1+j}.$$

$$\boxed{\Delta E_{t+1} \pi_{t+1} \approx -\Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j \tilde{s}_{t+1+j};} \; \tilde{s}_t \equiv \frac{s_t}{B/P}$$

Interest rate sets expected inflation, fiscal sets unexpected inflation.
A complete theory of inflation under interest rate targets.

Frictionless, neutral benchmark



$$i_t = E_t \pi_{t+1}; \;\; \Delta E_{t+1} \pi_{t+1} = -\Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j s_{t+1+j}$$

- Monetary shocks (i, no s): Fisherian. *Neutral*. i_t raises π_{t+1}.
- Fiscal shocks (s, no i): one period inflation (price jump). Mix?
- $\rightarrow$ Long-term debt, sticky prices, discount rates, policy rules.

Ingredients: Long term debt and discount rates

Was:

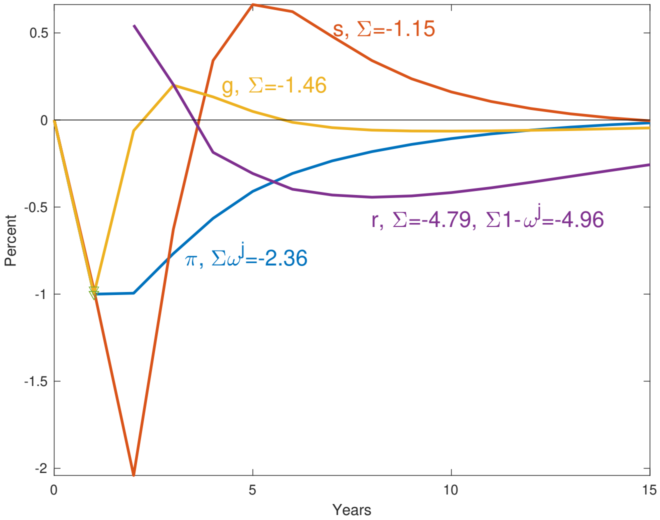
$$\Delta E_{t+1}\pi_{t+1} = -\sum_{j=0}^{\infty} \rho^j \Delta E_{t+1}\tilde{s}_{t+1+j}.$$

Add long term debt, discount rates. Generalizes to Algebra

$$\sum_{j=0}^{\infty} \omega^j \Delta E_{t+1}\pi_{t+1+j} = -\sum_{j=0}^{\infty} \rho^j \Delta E_{t+1}\tilde{s}_{t+1+j} + \sum_{j=1}^{\infty} (\rho^j - \omega^j)\Delta E_{t+1} r_{t+1+j}.$$

- Higher *discount rate* lowers PV, causes inflation. (= Interest cost)
- Fiscal shock → *persistent* inflation not 1-time jump.
- $i_t = E_t\pi_{t+1}$ monetary policy can smooth fiscal shocks.
- Higher π_{t+j} → less π_{t+1}. Unpleasant arithmetic. A persistent higher i → lowers π!
- Lower $\sum \omega^j \pi_{t+j}$ needs RHS. Words: 1) Windfall to bondholders 2) interest costs on the debt 3) overcome lost seigniorage. 1 & 2 far outweigh 3, large now.
- Short debt view still applies to the long run.

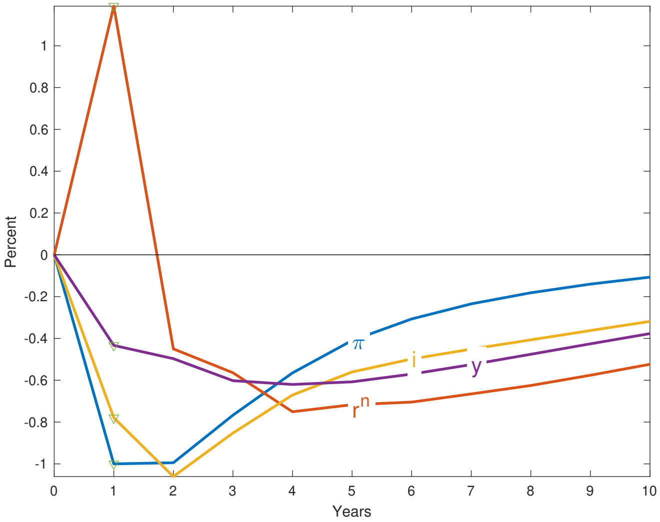
Aggregate demand shock – 2008?



$$\sum_{j=0}^{\infty} \omega^j \Delta E_1 \pi_{1+j} = -\sum_{j=0}^{\infty} \Delta E_1 \tilde{s}_{1+j} - \sum_{j=0}^{\infty} \Delta E_1 g_{1+j} + \sum_{j=1}^{\infty} (1-\omega^j) \Delta E_1 (r^n_{1+j} - \pi_{1+j})$$

Disinflation in recession comes from discount rates!

Aggregate demand shock – details



- Looks like a recession

Sticky-price FTMP model

- Add: Sticky prices, long-term debt, policy rules

$$
\begin{aligned}
x_t &= E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1}) \\
\pi_t &= \beta E_t \pi_{t+1} + \kappa x_t \\
i_t &= \theta_{i\pi} \pi_t + \theta_{ix} x_t + u_{i,t} \\
\rho v_{t+1} &= v_t + r^n_{t+1} - \pi_{t+1} - \tilde{s}_{t+1} \\
E_t r^n_{t+1} &= i_t \\
r^n_{t+1} &= \omega q_{t+1} - q_t
\end{aligned}
$$

- Explanation:

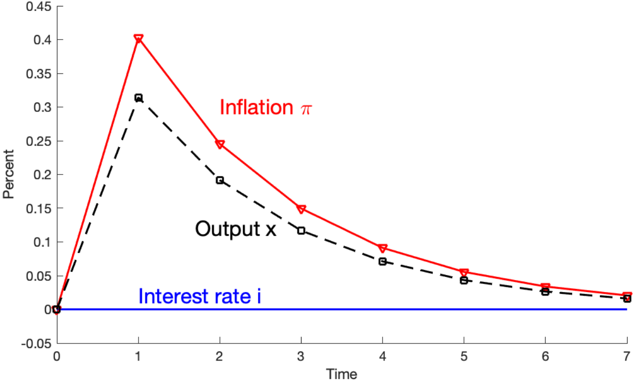
$$
v_t = \sum_{j=1}^{\infty} \rho^{j-1} (\tilde{s}_{t+j} - r^n_{t+j} - \pi_{t+j})
$$

$$
q_t = \sum_{j=1}^{\infty} \omega^j r^n_{t+j}
$$

$\Delta E_{t+1}(\cdot)$ gives inflation identity.

- Easy to adapt any NK model to FTPL!

Fiscal shock with sticky prices



Response to a deficit shock equal to 1% of outstanding debt; no *i* change.

- Persistent inflation. Much debt devaluation from low real rates.
- Inflation eventually goes away.

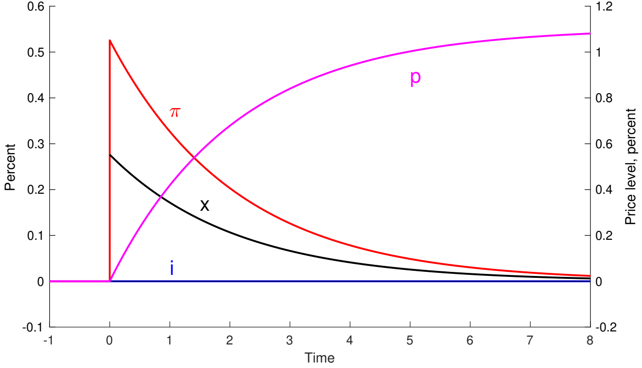
Continuous Time

$$
\begin{aligned}
E_t dx_t &= \sigma(i_t - \pi_t)dt \\
E_t d\pi_t &= (\rho\pi_t - \kappa x_t)\, dt \\
dp_t &= \pi_t dt \\
dv_t &= (rv_t + i_t - \pi_t - \tilde{s}_t)\, dt + (dq_t - E_t dq_t) \\
E_t dq_t &= [(r+\omega)\, q_t + i_t]\, dt \\
d\tilde{s}_t &= -\eta_s \tilde{s}_t + d\varepsilon_{s,t} \\
di_t &= -\eta_i i_t + d\varepsilon_{i,t}.
\end{aligned}
$$

Inflation may jump/diffuse. Price level may not. FTPL?
Note discrete time equivalent:

$$
\begin{aligned}
x_t &= E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1}) \\
\pi_t &= \beta E_t \pi_{t+1} + \kappa x_t \\
\rho v_{t+1} &= v_t + (\omega q_{t+1} - q_t) - \pi_{t+1} - \tilde{s}_{t+1} \\
E_t r^n_{t+1} &= E_t(\omega q_{t+1} - q_t) = i_t \\
\tilde{s}_t &= \eta_s \tilde{s}_{t-1} + \varepsilon_{s,t} \\
i_t &= \eta_i i_{t-1} + \varepsilon_{i,t}
\end{aligned}
$$

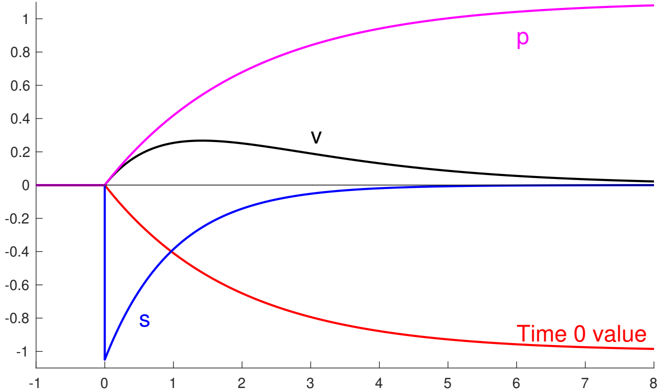
Fiscal shock in continuous time



Response to a deficit shock equal to 1% of outstanding debt; no *i* change.

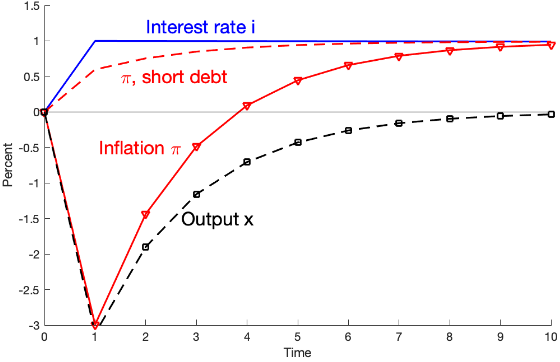
- No P jump! No devaluation of outstanding short debt. All devaluation from low real rates. Fiscal theory of *inflation*.

Fiscal shock in continuous time



- Initial bondholders lose 1.

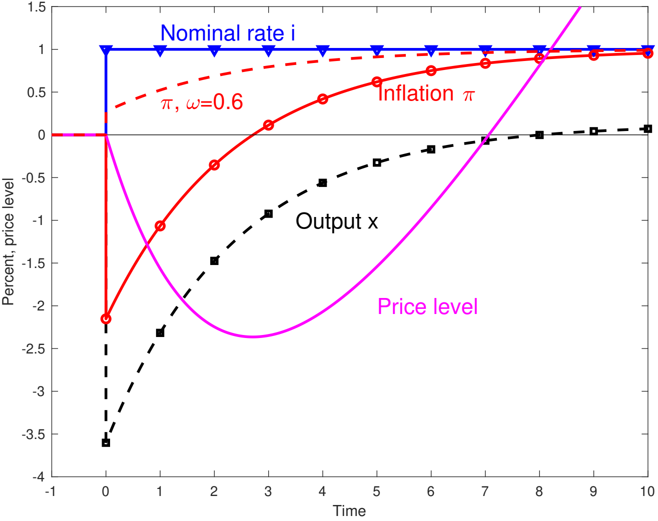
Monetary shock with sticky prices



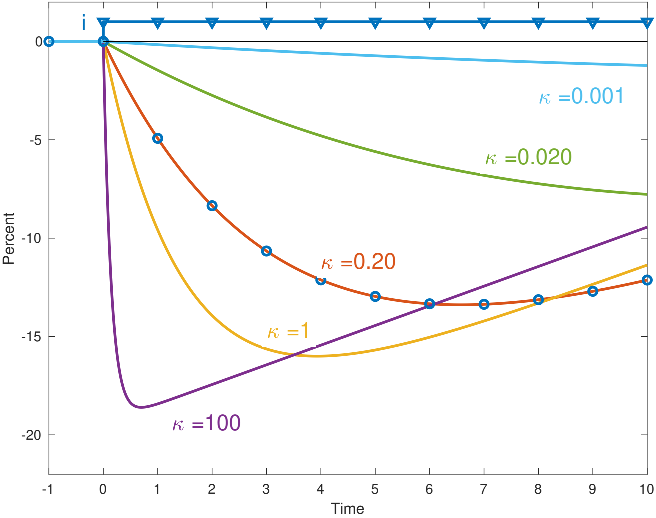
Response to a monetary policy shock with no change in s; no policy rule.

- Sticky prices just smooth Fisherian response. Negative short run?
- Long-term debt can produce a negative response. Better model?
- Smooths, not eliminate a fiscal shock. Unpleasant arithmetic.
- Long-run neutrality. Monetary policy controls long-run E(P).

Monetary shock in continuous time

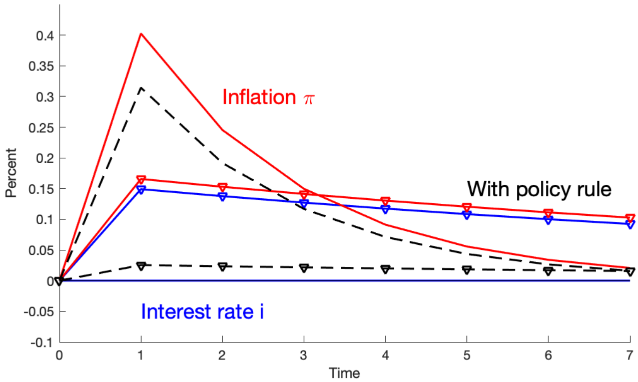


Price level response in continuous time



- Smoothly approaches downward price level jump

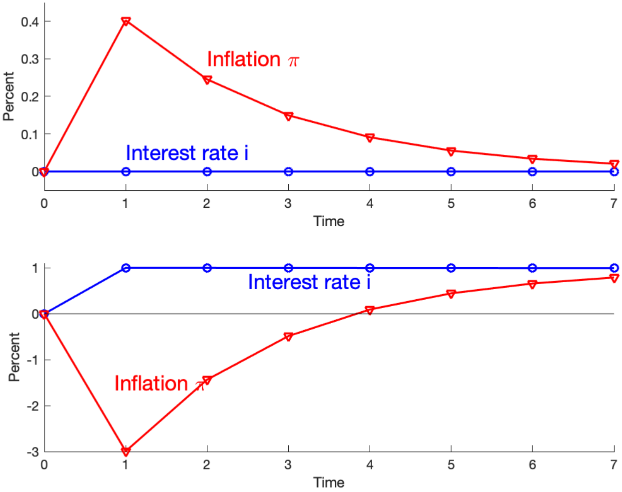
Response to fiscal shock with monetary policy rule



Response to a 1% deficit shock, with a monetary policy rule. $i_t = 0.9\pi_t$.

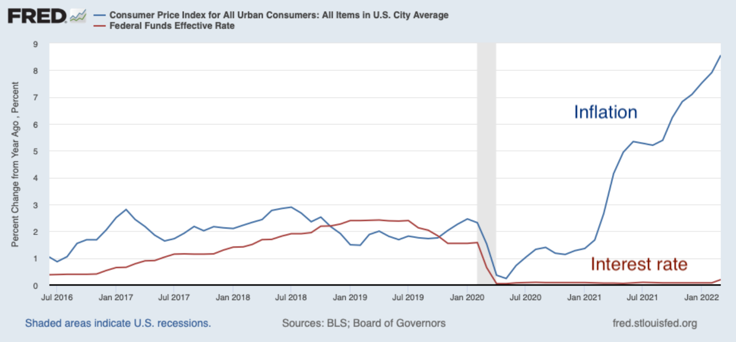
- M policy smooths fiscal shock. (Wanted or unwanted!) Exploits unpleasant arithmetic. Taylor rule reduces volatility, not determinacy/stability. Does not eliminate inflation.

Summary. Sticky prices and long term debt



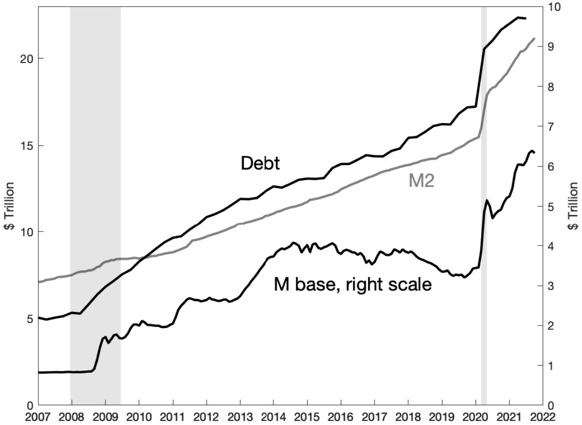
Response to other (IS, PC) shocks? Responses in more realistic models?
Urgent: A better model of short-run negative effect!

Current events: inflation



- Where did inflation come from? (Fiscal shock.)
- The Fed is very slow to react. Still thinks inflation will go away with no period of interest rate $\gg$ inflation. (Fed follows FTPL!)
- Many economists think we need $i \gg \pi$, e.g. 10% or more to keep inflation from spiraling away.

Current events: fiscal shock!

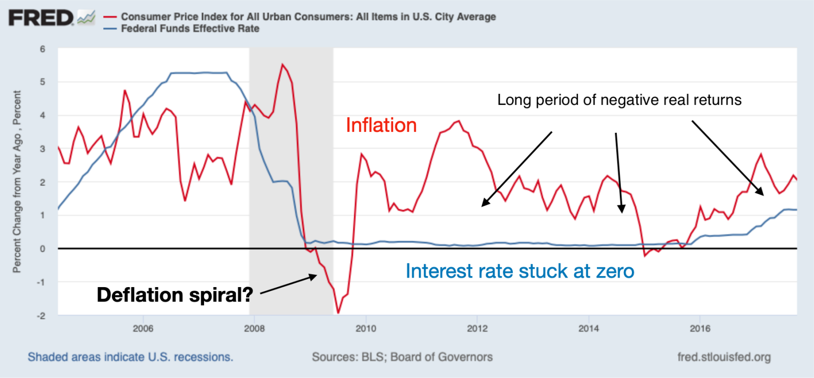


- 30% of GDP/debt helicopter drop!

Quantity	Q4/12 2019	Q3/9 2021	Difference
A. Debt held by the public	\$17,187	\$22,304	\$5,117
B. Monetary base (H.6)	\$3,427	\$6,389	\$2,962
C. Fed hold Treasurys (H 4.1)	\$2,329	\$5,431	\$3,102
A+B-C	\$18,285	\$23,262	\$4,977
M2	\$15,325	\$20,994	\$5,669

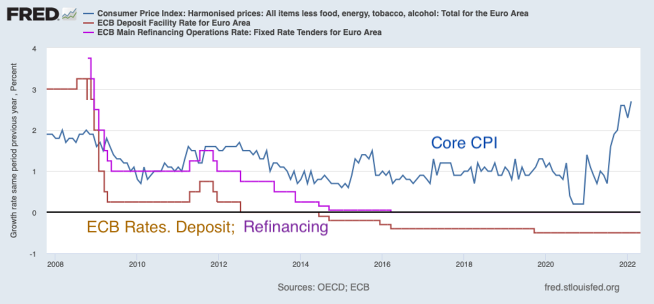
- A huge fiscal helicopter drop. Print money, send people checks.
- $\Delta E_{t+1}\pi_{t+1} \approx -\Delta E_{t+1}\sum_{j=0}^{\infty}\rho^j \tilde{s}_{t+1+j}$.
- Negative s_t, big B_t, no future s, people don't think it will be repaid.
- Why this time? Statements? Lower rates? Heterogeneity? Cash is "not repaid?"
- Money or fiscal?
- ISLM (Summers) flow vs. FTPL stock, present value?

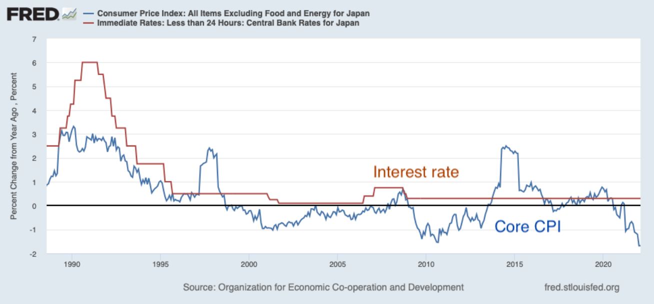
The missing deflation spiral and long quiet zero bound



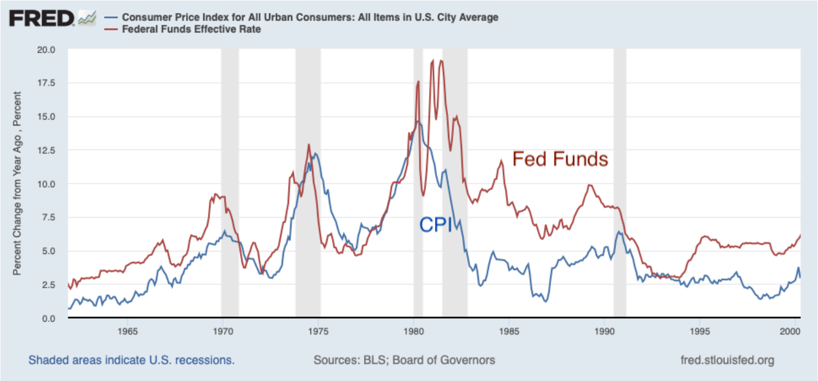
- Classic view: ZLB=deflation spiral. i peg is unstable.
- NK view: i peg gives indeterminate sunspot volatility.
- FTPL $B/P = EPV(s)$. 1) Congress will not respond to deflation. ("Active" is reasonable.) 2) $i = E\pi$ is stable and determinate at zlb. 3) Now is the reverse (without more fiscal shocks).

ZLB in Europe and Japan–27 years!

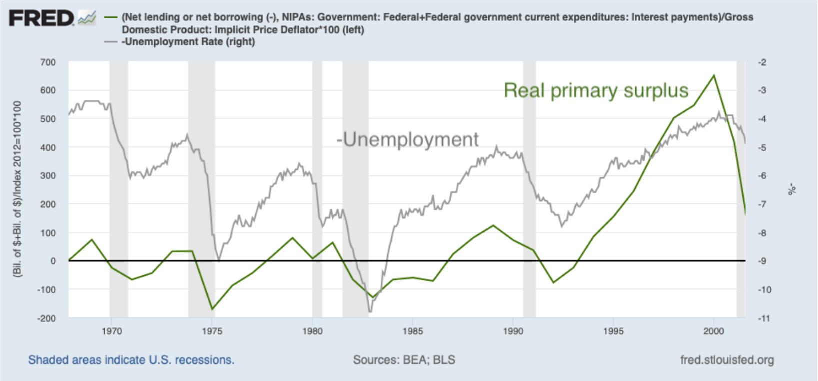




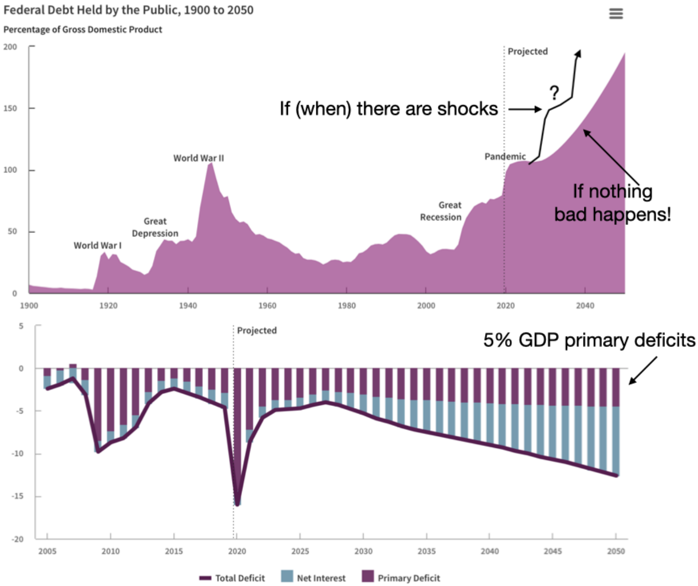
The 1970s and 1980s



The 1970s and 1980s



The fiscal challenge



FTPL Book and Project Overview

$$\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j s_{t+j}$$

- Real value of nominal debt = EPV of primary surpluses.
- Determines the price level P_t, even in an economy with no frictions.
- Understand how it works.
- Generalize: long-term debt, money, liquidity, default, discount rates, sticky prices, indexed & foreign currency debt, etc. ...
- Integrate with monetary policy, interest rate target, policy rules.
- *Make it useful*. Understand data (discount rates). Understand episodes (ZLB, 2022 inflation). Understand institutions (gold standard). Merge with new-Keynesian models. Realistic impulse-response functions. Fiscal–monetary interactions. Simple stories: interest costs; bondholder windfall.
- Rethink classic monetary doctrines and institutions. Control M vs. B? i target unstable/indeterminate?
- Theoretical controversies. Active and passive, observational equivalence, contrast with new-Keynesian, monetarist models.
- Empirical procedures: Testing for active/passive or discounting surplus forecasts is pointless.

Part II: Paths and pitfalls. How to do and how not to do FTPL research.

1. Institutions.
2. Empirical procedures; Surplus processes.
3. New-Keynesian models; active and passive.
4. Observational equivalence–a feature not a bug .
5. Old-Keynesian models.
6. Neutrality, the only theory we have, and the great unanswered question.
7. Research paths.
8. (Monetarism and observational equivalence.)
9. (Using FTPL to solve ZLB puzzles.)

Institutions

$$\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j s_{t+j}$$

- Central problem. What's $E_t \sum_{j=0}^{\infty} \beta^j s_{t+j}$? Precommitments, institutions. (Pledge s so you can borrow without inflation?)
- Indexed or foreign-currency debt.
- Pegs and gold standard.
- Corporate finance of government debt. Domestic/foreign or indexed?
- Long vs. short maturity; target vs. peg. Precommitments and runs.
- Default – ex post, and expected.
- Independent central banks, central bank vs. treasury.
- Inflation targets
- Fiscal rules $s(P)$?
- $i_t = r_t + E_t \pi_{t+1}$. Target the spread? Fix the price of *indexed* debt?

Empirical procedures; surplus process

- $$\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \frac{\Lambda_{t+j}}{\Lambda_t} s_{t+j}$$

  Forecast (or VAR) $\{s_t\}$, make a discount factor model, compute B/P, compare to data, "puzzle?"
- This is a *terrible* idea; it took asset pricing 30 years to figure out why, don't repeat errors.
- Absent arbitrage there exists a $\Lambda_{t,t+j}$,... $1 = E(R_{t+1}^{-1} R_{t+1})$.
- Surplus process

  $$\frac{B_{t-1}}{P_t} = s_t + \frac{B_t}{P_t} = s_t + \beta s_{t+1} + \beta^2 s_{t+2}$$

  $$\frac{B_t}{P_t} = \beta s_{t+1} + \beta^2 s_{t+2} + ...$$

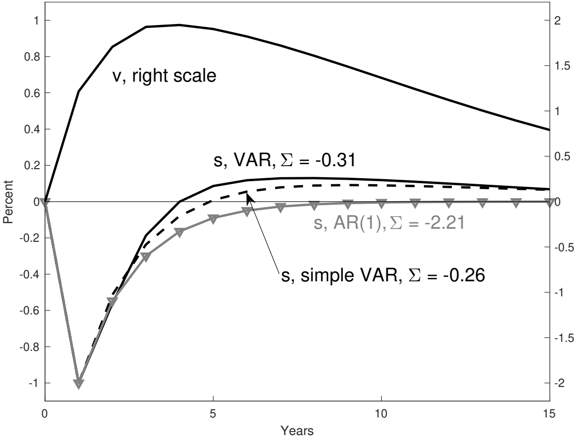
  Governments want lower s_t with higher debt B_t/P_t, no inflation, hence higher s_{t+j}. "s-shaped" process.
- AR(1) is *terrible*: Lower s_t with lower s_{t+j} means *lower* B_t/P_t, lots of inflation with every deficit. Horribly counterfactual!

Empirical procedures

- Hansen Roberds Sargent (1991). VAR without B/P is *wrong*.
- Example: $s_t = (1+\theta)\varepsilon_t$. For steady P, $\theta = -\beta^{-1}$. $s_t = -1$, $s_{t+1} = \beta^{-1}$. Deficit financed by debt, repaid. But $s_t = (1+\beta^{-1})\varepsilon_t$ is *noninvertible*. With s_t on s_{t-j}, you estimate $\theta = \beta$.
- Agents have more information than us. $B/P = E(s|\Omega) \rightarrow B/P = E(s|I \subset \Omega)$ only if $B/P \in I$.
- Must include B/P in the VAR, but then PV is an identity, no "test."
- Modern (1990s) finance (Campbell-Shiller). $p_t - d_t = \sum \rho^{j-1}[\Delta d_{t+j} - r_{t+j}]$ is an identity. Estimate VAR with $p-d$. *Which terms* vary? (Discount rates!) No "test."
- Us: $v_t = \sum \rho^j (s_{t+j} - r_{t+j})$ or

  $$\sum \omega^j \Delta E_{t+1}\pi_{t+1+j} = -\sum \rho^j \Delta E_{t+1}\tilde{s}_{t+1+j} + \sum (\rho^j - \omega^j)\Delta E_{t+1} r_{t+1+j}$$

  are identities. Estimate VAR with v_t. *Which terms* vary? (Discount rates!) No "test of present value relation" test of fiscal theory.
- *Lots* more VARs to run, better identification, models too.



	$\tilde{s}_t$	v_t	$\sigma(\varepsilon)$	$\sigma(s)$
$\tilde{s}_{t+1} =$	0.55	0.027	5.46	6.60
std. err.	(0.07)	(0.016)		
$v_{t+1} =$	-0.54	0.96		
std. err.	(0.11)	(0.02)		
$\tilde{s}_{t+1} =$	0.55		5.55	6.60
std. err.	(0.07)			

AR(1) fits well, yet gives dramatically wrong sum of responses.

New-Keynesian Model

$$i_t = E_t \pi_{t+1}$$
$$i_t = \phi \pi_t + u_{i,t}$$
$$\Delta E_{t+1} \pi_{t+1} = -\Delta E_{t+1} \sum_{j=0}^{\infty} \beta^j s_{t+1+j} = -\varepsilon_{\Sigma s,t+1}.$$

Equilibrium:

$$E_t \pi_{t+1} = \phi \pi_t + u_{i,t}.$$

If $\|\phi\| < 1$, *stable indeterminate.*
If $\|\phi\| > 1$, unstable, except "unique locally bounded equilibrium"

$$\pi_t = -\sum_{j=0}^{\infty} \frac{1}{\phi^{j+1}} E_t \left(u_{t+j} \right)$$

With

$$u_{i,t} = \eta u_{t-1} + \varepsilon_{i,t},$$
$$\pi_t = -\sum_{j=0}^{\infty} \frac{\eta^j}{\phi^{j+1}} u_{i,t} = -\frac{u_{i,t}}{\phi - \eta}.$$

New-Keynesian Model

$$\pi_t = -\frac{u_{i,t}}{\phi - \eta}.$$

$$u_{i,t} = \eta u_{t-1} + \varepsilon_{i,t},$$

$$\Delta E_{t+1}\pi_{t+1} = -\frac{\varepsilon_{i,t+1}}{\phi - \eta}.$$

- Monetary policy shock lowers inflation.
- But it does so by generating a *fiscal* reaction.
- (Interest rates

  $$i_t = E_t\pi_{t+1} = -\frac{\eta}{\phi - \eta}u_{i,t}.$$

  also fall. Still "Fisherian.")

Active-passive temptation

- A model of "passive" surplus.

$$s_{t+1} = \gamma v_t + u_{s,t+1}$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - s_{t+1}$$
$$\rho v_{t+1} = (1-\gamma) v_t - \Delta E_{t+1} \pi_{t+1}$$

$\gamma > 0 \rightarrow \lim_{T\rightarrow\infty} E_{t+1} \rho^T v_T = 0 \; \forall \; \Delta E_{t+1} \pi_{t+1}$.

- Natural idea (Leeper 1991 and followers):

$$i_t = E_t \pi_{t+1}$$
$$i_t = \phi \pi_t + u_{i,t} \quad \text{(typically AR(1))}$$
$$s_{t+1} = \gamma v_t + u_{s,t+1} \quad \text{(typically AR(1))}$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - s_{t+1}$$
$$\lim_{T\rightarrow\infty} E_{t+1} \rho^T v_T = 0$$

- $\phi > 1$, $\gamma = 0$, "active fiscal, passive money." $\phi < 1$, $\gamma > 0$, "active money, passive fiscal."
- Estimate and test. Switch between "money dominant" and "fiscal dominant" regimes. Expected future ϕ, γ matter.
- This natural idea also turns out to be a false step. Don't do it!

NK models and observational equivalence

$$
\begin{aligned}
i_t &= E_t \pi_{t+1} \\
i_t &= i_t^* + \phi(\pi_t - \pi_t^*);\ i_t^* = E_t \pi_{t+1}^* (\leftrightarrow i_t = \phi \pi_t + u_{i,t}) \\
\text{or}\ \ i_t &= \theta \pi_t^* + \phi(\pi_t - \pi_t^*) + u_{i,t}\ (= \phi \pi_t + \hat{u}_{i,t})
\end{aligned}
$$

(passive fiscal; $\gamma > 0$)

- AM/PF $\phi > 1$, $\gamma > 0$, no π explosions. $\pi_t = \pi_t^*$ is unique.

$$E_{t+1}(\pi_{t+1} - \pi_{t+1}^*) = \phi(\pi_t - \pi_t^*)$$

- NK $\phi > 0$ is an *equilibrium-selection policy.* For any desired $\{\pi_t\}$. Fed chooses interest rate policy (observed) $i_t^* = E_t \pi_{t+1}^* = \theta \pi_t^* + u_{i,t}$ and equilibrium-selection threat (unobserved) $\phi(\pi_t - \pi_t^*)$ to determine $\Delta E_{t+1} \pi_{t+1}$.
- (Tool to reverse-engineer $\{u_{i,t}\}$. My monetary and fiscal shocks/responses = specific $\{u_{i,t}\}$)
- (Objection: The Fed does not do this!)
- $\pi_t - \pi_t^*$. ϕ is not identified. Cannot estimate, test.

NK models and observational equivalence

$$
\begin{aligned}
i_t &= E_t \pi_{t+1} \\
i_t &= \theta \pi_t^* + \phi(\pi_t - \pi_t^*) + u_{i,t} \\
s_{t+1} &= \alpha v_t^* + \gamma \left(v_t - v_t^* \right) + u_{s,t+1} \\
\rho v_{t+1}^* &= v_t^* - \Delta E_{t+1} \pi_{t+1}^* - s_{t+1} \\
\rho v_{t+1} &= v_t - \Delta E_{t+1} \pi_{t+1} - s_{t+1} \\
\rho(v_{t+1} - v_{t+1}^*) &= (v_t - v_t^*) - (\Delta E_{t+1} \pi_{t+1} - \Delta E_{t+1} \pi_{t+1}^*)
\end{aligned}
$$

- AF/PM $\phi < 1$, $\gamma = 0$.
- Idea: Respond to debt from past deficits (so you can borrow); respond to intended inflation. Do not respond to arbitrary, multiple equilibrium inflation/deflation. Example: 2008, 1933. Only the latter matters for AF. Encodes s-shape in VAR(1).
- $\pi_t = \pi_t^*$, $v_t = v_t^*$ in equilibrium. γ is also not identified.
- *Time series drawn from AM/PF and AF/PM equilibrium are observationally equivalent.*
- *Parameters ϕ and γ are not identified from equilibrium time series.*
- Identification e.g. $\theta = \phi$, $\alpha = \gamma$, $u \sim$ AR(1) don't make sense.

Observational equivalence is good news

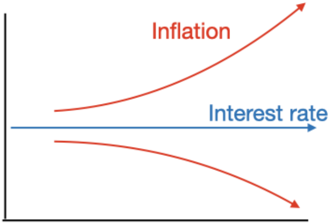
- Can instantly translate any NK model to FTMP. *Saves* NK models! Paper-writing recipe.
- Trivial? No, look at fiscal policy, write different policy rules, ask much different questions. ($u_i \rightarrow$) i shock with no fiscal response?
- Testing for regimes, "fiscal vs. monetary dominance" is a dead end.
- $\gamma > 0$, $\alpha = 0$, $u_s \sim A(R1)$ is disastrous. Deficits *lower* debt. $\rightarrow$Few AF/PM periods (1970s) when $i = \phi\pi$ is even worse.
- We can't reject fiscal theory for the whole sample!
- Whatabout Japan, etc.? $B/P = EPV(s)$ holds in both models.
- Distinguish regimes based on other information; laws, Fed statements, institutions; not formal time-series tests.
- AM: $\phi > 0$?
- AF: Is it reasonable that governments largely raise surpluses to repay debts resulting from past deficits, but refuse to raise surpluses in response to any deflation that comes along? (Gold standard, 1933, 2008; No deflation at ZLB.)
- Formal tests of whole theories never worked. ISLM/Monetarist/RBC/NK; behavioral vs. rational finance.
- FTPL prospers if it is *useful*, not F test. Healthy!
- OK to state "look if (passive) fiscal implications of NK make sense."

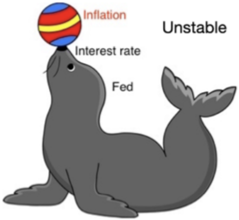
Expectations and the neutrality of interest rates

$$x_t = E_t x_{t+1} - \sigma(i_t - \pi_t^e)$$
$$\pi_t = \pi_t^e + \kappa x_t$$
$$\pi_t = (1+\sigma\kappa)\pi_t^e - \sigma\kappa i_t$$

Adaptive expectations $\pi_t^e = \pi_{t-1}$:

- Inflation is *unstable* under an interest rate peg (Friedman 1968). Higher i lowers π.
$$\pi_t = (1+\sigma\kappa)\pi_{t-1} - \sigma\kappa i_t$$
- Current affairs: Inflation will spiral until $i \gg \pi$.
- Taylor rule $i_t = \phi\pi_t$, $\phi > 1$ *Stabilizes* inflation
$$\pi_t = \frac{1+\sigma\kappa}{1+\sigma\kappa\phi}\pi_{t-1}$$





Expectations and the neutrality of interest rates

$$\pi_t = (1+\sigma\kappa)\pi_t^e - \sigma\kappa i_t$$

Rational expectations $\pi_t^e = E_t \pi_{t+1}$:

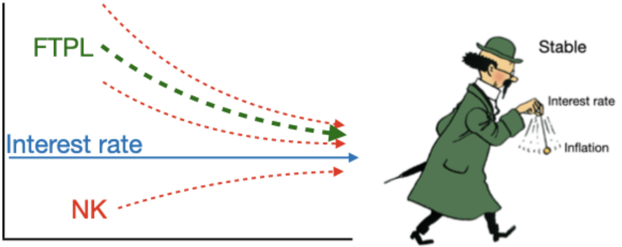
- Inflation is *stable, indeterminate* (volatile) under an interest rate peg (Sargent and Wallace 1975).

$$E_t\pi_{t+1} = \frac{1}{1+\sigma\kappa}\pi_t + \frac{\sigma\kappa}{1+\sigma\kappa} i_t$$

- NK $i_t = \phi\pi_t$, $\phi > 1$ *F*ed de-stabilizes to select (?) one equilibrium

$$E_t\pi_{t+1} = \frac{1+\sigma\kappa\phi}{1+\sigma\kappa}\pi_t$$

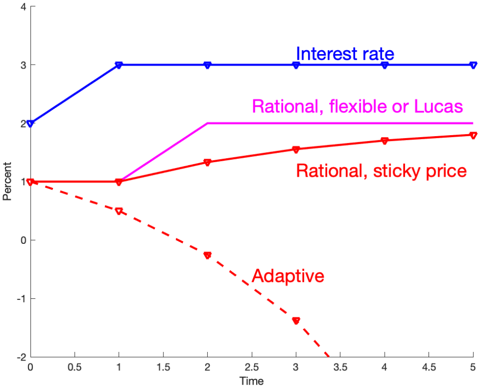
- FTPL $\pi_{t+1} - E_t\pi_{t+1} = \Delta E_{t+1}\sum_{j=0}^{\infty}\rho^j \tilde{s}_{t+j}$ solves indeterminacy.



Logical implications

- Rational expectations+FTPL: Inflation is stable and determinate under an interest rate target.
- A starting point! Like MV=PY; A complete theory of the price level under interest rate targets.
- Stable +determinate = long-run neutrality! Want theory with a neutral benchmark!
- Uncomfortable implications:
  - Inflation is stable and determinate under an interest rate peg. (With no fiscal shocks! History: Zero bound era.)
  - A k-percent rule can work, like k% money growth.
  - If the Fed does nothing, or reacts less than 1-1 to inflation, and there are no more shocks, inflation will eventually settle down on its own. (Not optimal, but possible.)
  - Higher interest rates must eventually lead to higher inflation. ("Fisherian" in the long run).
- Like MV=PY! Beautiful full model model, inexorable logic. Uncomfortable conclusions. (So was long-run neutrality in 1960s.)
- Agenda: Like Lucas 1972. Short run non-neutrality?

Non-neutrality?



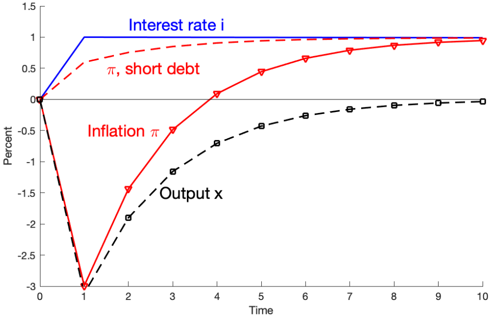
- Interest rate rise *without* change in fiscal policy.
- Adaptive gets sign, but loses long-run neutrality.
- Sticky prices give non-neutrality (output effects, Lucas) but not negative sign of inflation on interest rates.

Classic intuition?

$$x_t = E_t x_{t+1} - \sigma(i_t - \pi_t^e)$$
$$\pi_t = \pi_t^e + \kappa x_t$$

- Higher $i_t \rightarrow$ higher $r_t \rightarrow$ lower $x_t \rightarrow$ lower π_t?
- But if π_t^e is forward-looking, and $\kappa > 0$, lower π_t means inflation *rises* over time.
- Instead...

An imperfect model of short-run negative effect.



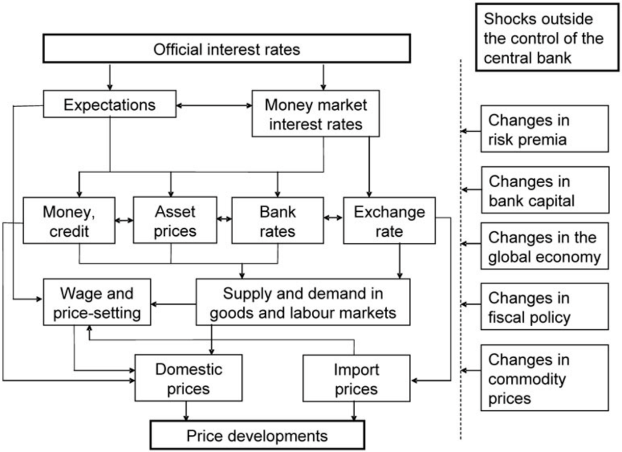
- Needs long-term debt. Fiscal mechanism. Explain to Fed, WSJ?
- Only unexpected, persistent rate rises.
- Stickier prices lower the effect. ($i - \pi$ raises interest cost).
- Too sudden/strong (VARs).
- Not Lucas holy water on monetarist/ISLM/adaptive intuition!
- Wanted: $i_t = r_t + E_t \pi_{t+1}$, r goes down *more than* i rises.

Urgent need

- Fact: We do not really have an agreed upon model of inflation under interest rate targets, nor solid understanding of how/if higher rates lower inflation! (Pretense of technocratic expertise is funny.)
- Urgent need: Better model of a short-run negative effect. Minimum robust *necessary* friction. Lucas (2022).
- Irrational expectations? FTPL + adaptive E? Stability, determinacy, long run neutrality are deep. Is monetary policy really just a conjuring trick, will disappear when people wake up?
- DSGE smorgasbord? Yes! What is the minimal, robust, economically necessary set of ingredients/frictions that delivers a short run negative effect?
- Phillips curve was developed for inflation $\rightarrow$ output. (Or $\leftarrow$?) Maybe not the central ingredient for $i \rightarrow \pi$.
- Is it true? VAR with i shock orthogonal to fiscal policy?

The pretense of technocratic expertise – ECB

The chart below provides a schematic illustration of the main transmission channels of monetary policy decisions.



Closing comments

Bottom line:

- Inflation is both fiscal and monetary!
- FTPL is the only economically coherent theory of the price level that we have, consistent with current institutions – interest rate targets, no money supply control, Fed does not make "equilibrium-selection threats." Use it!

Fertile research area! Good things to do:

- Mix FTPL with the rest of DSGE; including heterogeneity, financial frictions, imperfect expectations. Technically easy. Novel answers!
- Better Phillips curve! Better short-run negative effect. (Or is the negative effect there, controlling for fiscal shocks?)
- "Fiscal Histories." Stories. True? Serious empirical analysis. Serious narrative/institutional analysis.
- Better monetary/fiscal institutions.
- International, exchange rates. (Latin America Book).

Wastes of time (with 20/20 hindsight):

- "Test" fiscal theory. Estimate active-money vs. active-fiscal regimes, "dominance." (Observational equivalence).
- Forecast surpluses, model discount rates, predict debt value, proclaim "puzzle."

The End

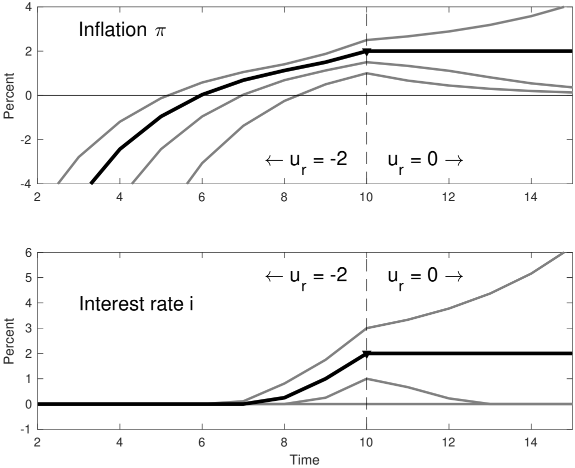
FTPL vs. money

$$\frac{B_{t-1}+M_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j \left[s_{t+j} + (i_{t+j} - i^m_{t+j}) \frac{M_{t+j}}{P_{t+j}} \right]$$

$$(M_t + M^i_t) V_t (i_t - i^m_t) = P_t Y_t$$

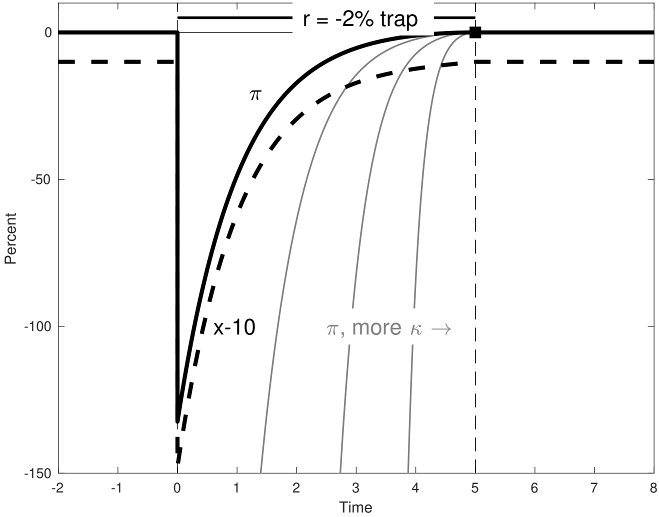
- Helicopter drop or finance deficits? Same. More M, less B effect?
- AM/PF Fed sets $M \to P$, s must follow.
- AF/PM FTPL sets s. i policy sets $B + M \to P$. M must follow.
- Observational equivalence! Think...
- We see passive money policies (i targets, real bills, $\phi < 1$). Our central banks do not control M. V is mush. Vast interest-paying reserves are debt.
- FTPL: Inside money M^i does not matter. *Composition* of M vs. B does not matter to first order, esp. as $i^m \to i$. Worry about overall debt vs. ability to repay, not M vs. B.
- Seigniorage is tiny. (This might change!) Devalue debt, interest cost channels larger today.

Zero bound new-Keynesian puzzles



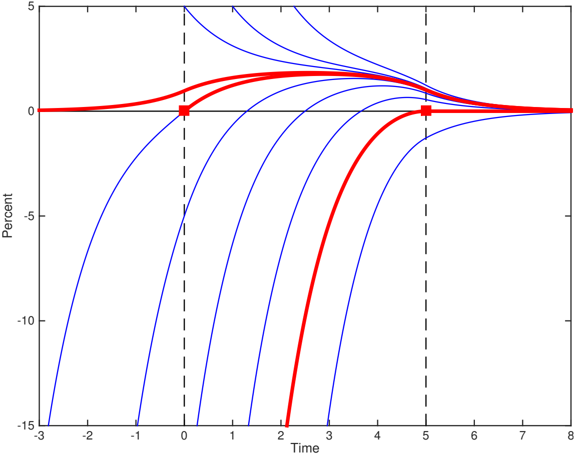
Equilibrium selection by policy after the end of the trap. Predicts jump to big deflation.

Strange frictionless limit



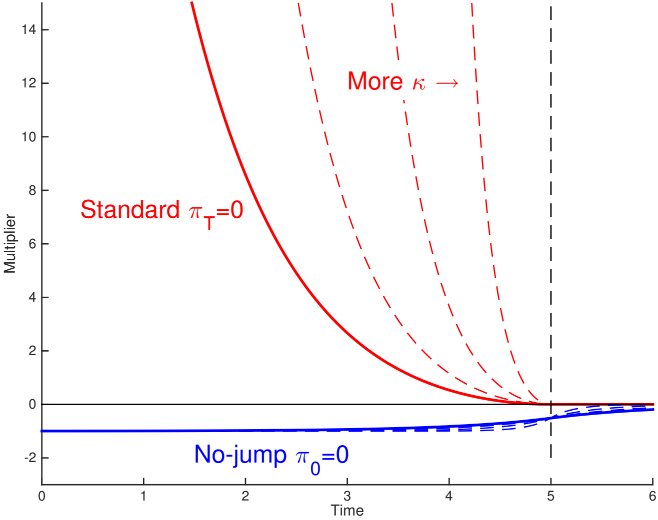
Serious commentary: Sticky prices are the problem, but don't make them less sticky.

FTPL solves zero bound puzzles



- NK: Big deflation. Gets worse as prices less sticky. Small promises in the far future have big effects. (Fwd guidance puzzle.)
- FTPL: No big deflation. Smooth frictionless limit. Promises in the far future have small effects.

Magical multipliers



Derivative $\partial x_t / \partial g$ for an increase in g, $0 < t < T$.

- Example of analysis that distinguishes theories despite observational equivalence, how FTPL (or looking at fiscal consequences) is useful.