Michelson-Morley, Fisher, and Occam: The Radical Implications of Stable Inflation at the Zero bound
– Also –
Stepping on a Rake: the Fiscal Theory of Monetary Policy

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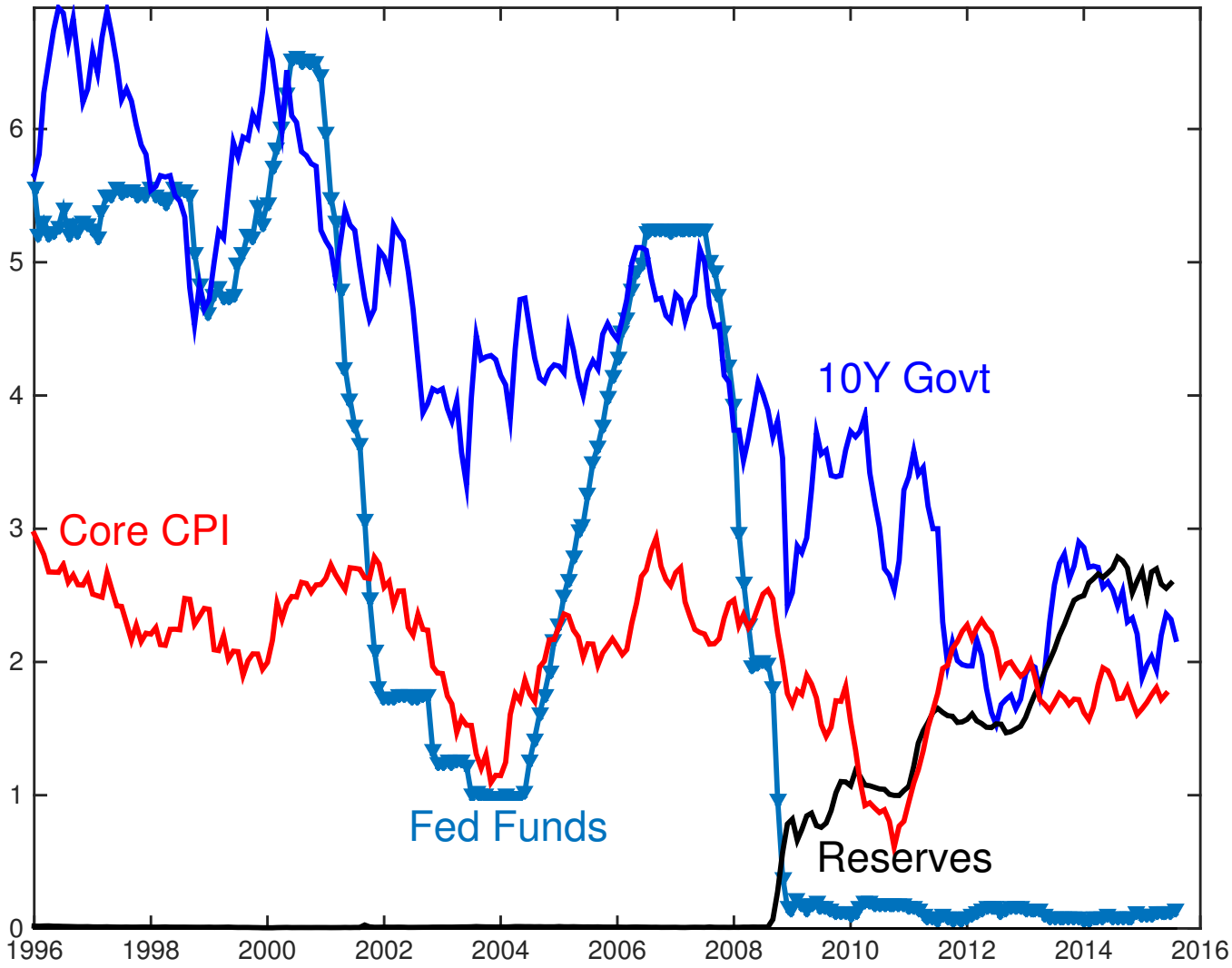
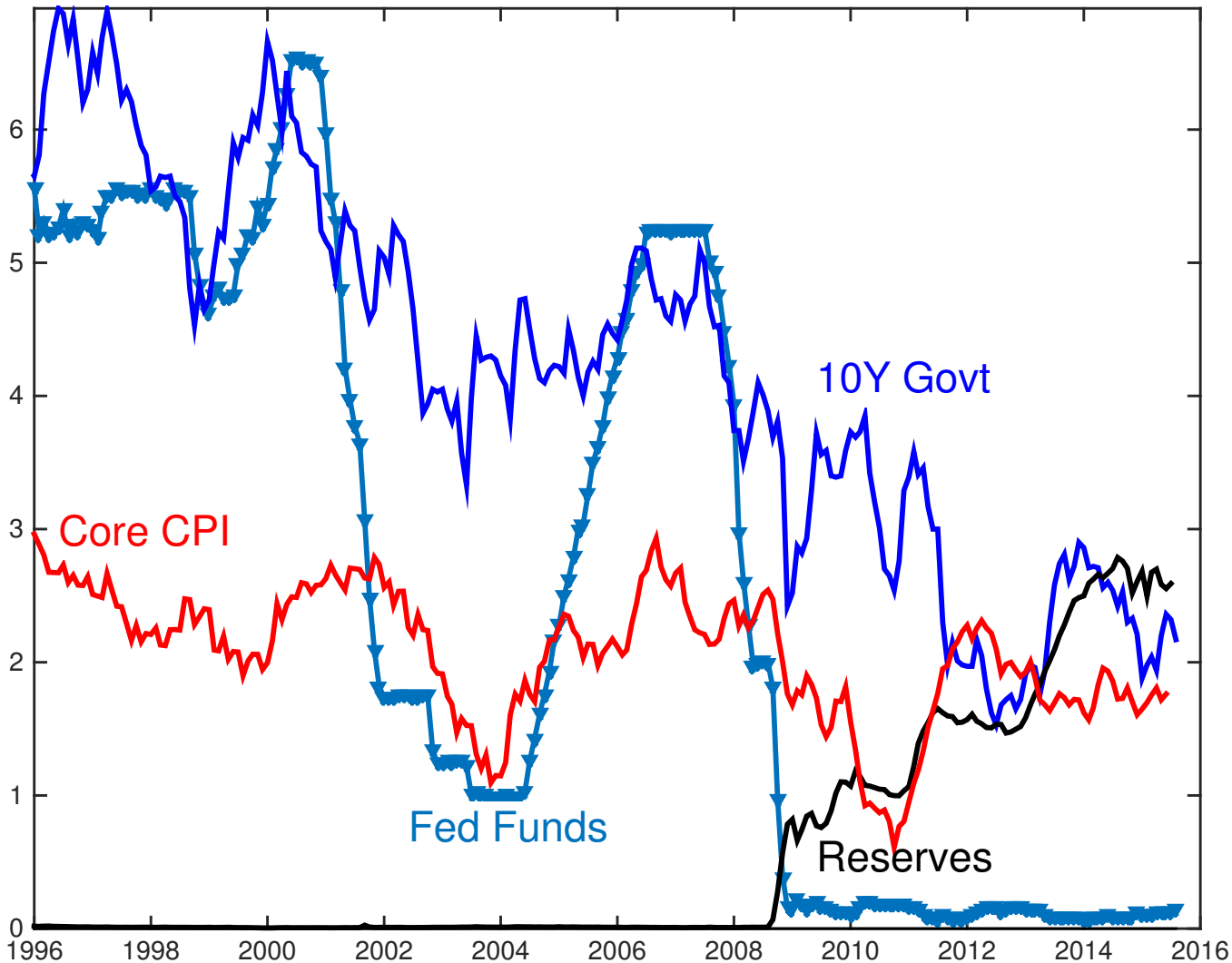
Michelson-Morley; The long quiet ZLB



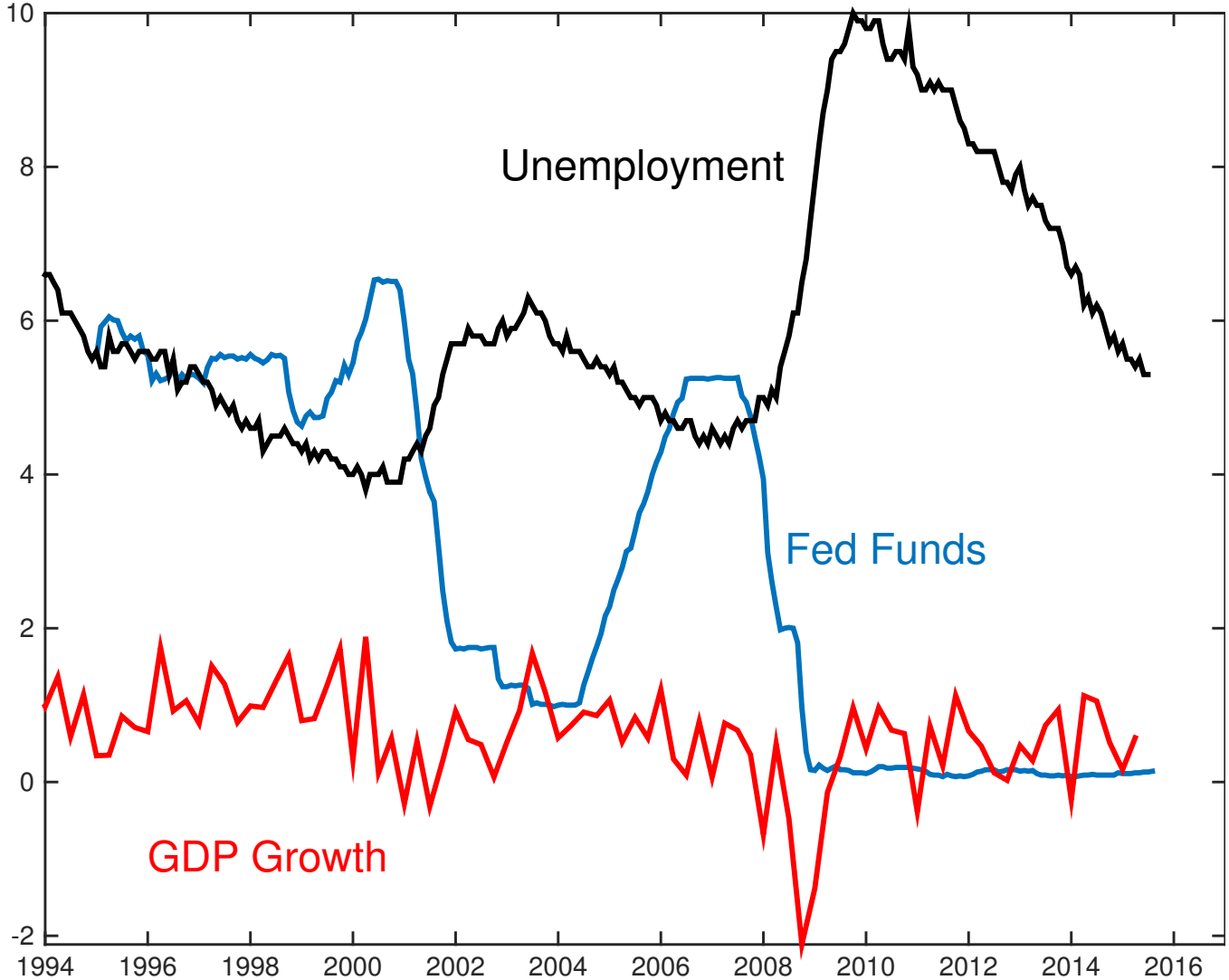
- What happens at the ZLB? *Nothing*.

Michelson-Morley; The long quiet ZLB



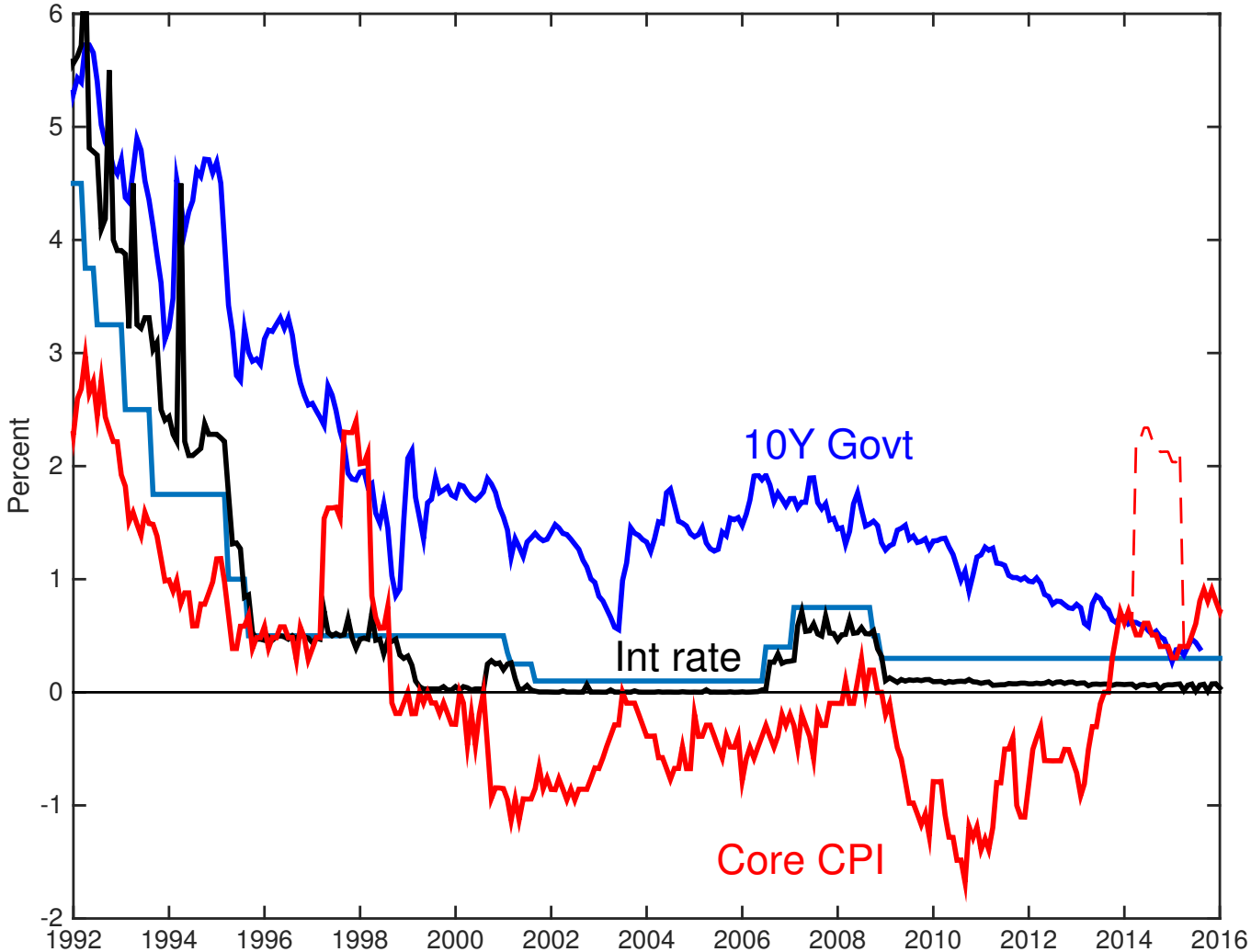
- Quiet, stable π at long period of $i \approx 0$, $\phi << 1$, huge M.
- No deflation spiral. No M/QE inflation. No sunspot volatility. No change in π dynamics. $\sigma(\pi)$ lower?

US unemployment and GDP



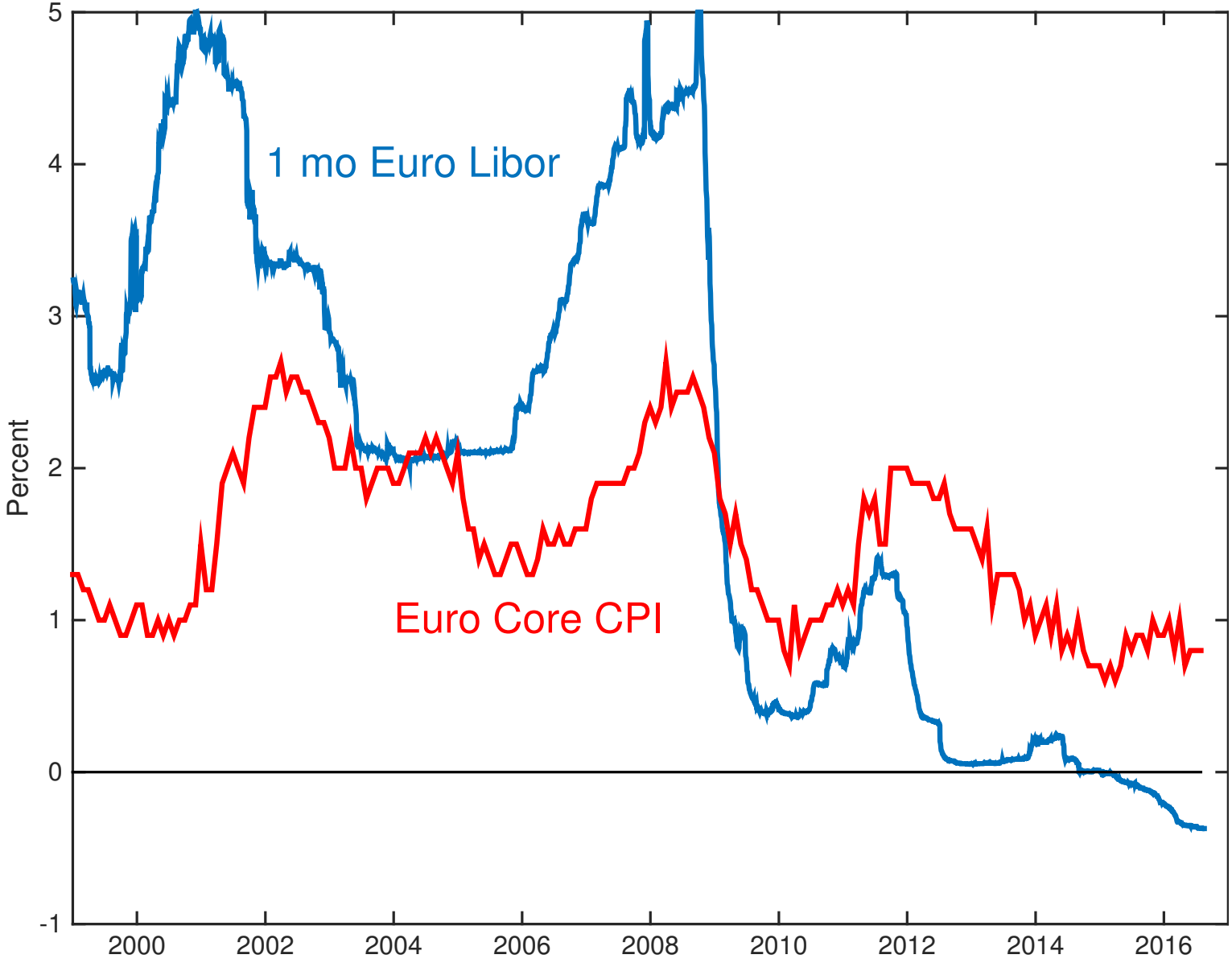
- Larger shock but same dynamics. Faster decline in u, lower $\sigma(\Delta Y)$? $E(\Delta Y)$ is too low, but is that monetary policy?

Japan



- 20+ years at $i \approx 0$ with no spiral, sunspot $\sigma(\pi)$.
- Spiral fear understandable in 2001.

Europe



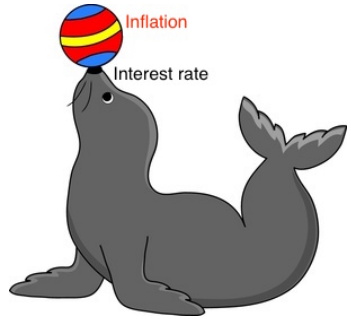
- Lower rates $\leftrightarrow$ lower inflation.

Core Monetary Doctrines / ZLB predictions

- Old K/Adaptive E: ZLB $\rightarrow$ *Deflation spiral.*
  - (Friedman 68) ZLB, i peg, or passive ϕ is *unstable*.

$$\pi_{t+1} = (\lambda > 1)\pi_t + \text{ shocks.}$$

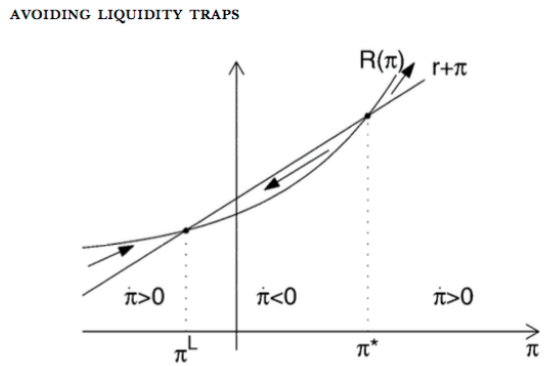
  - Taylor $\phi > 1$ stabilizes. ZLB $\rightarrow \phi < 1$.



- NK/Rational E: ZLB $\rightarrow \pi$ is *stable* but *volatile*;
  - "Self-confirming fluctuations," "sunspots."

$$E_t\pi_{t+1} = (\lambda \leq 1)\pi_t;\ \pi_{t+1} = E_t\pi_{t+1} + \delta_{t+1}.$$

  - Taylor $\phi > 1$ makes unstable, hence determinate.
  - $\phi < 1$ volatility a core prediction. 70/80; Japan ZLB.



- MV=PY: ZLB, $i \approx 0$ is irrelevant. M \$50b $\rightarrow$ \$3,000b means *hyperinflation*. Velocity is "stable." QE "injects liquidity."

Simple models

$$x_t = E_t x_{t+1} - \sigma(r_t - v_t^r) \qquad \text{IS}$$
$$i_t = r_t + \pi_t^e \qquad \text{Fisher}$$
$$\pi_t = \pi_t^e + \kappa x_t \qquad \text{Phillips}$$
$$i_t = \phi \pi_t + v_t^i \qquad \text{Slides}$$
$$i_t = \max\left[r^* + \pi^* + \phi\left(\pi_t - \pi^*\right) + v_t^i, 0\right] \qquad \text{Taylor}$$

Eliminate i_t, r_t, x_t,

$$\left(1 + \phi\sigma\kappa\right)\pi_t = \left(1 + \sigma\kappa\right)\pi_t^e + \sigma\kappa(v_t^r - v_t^i)$$

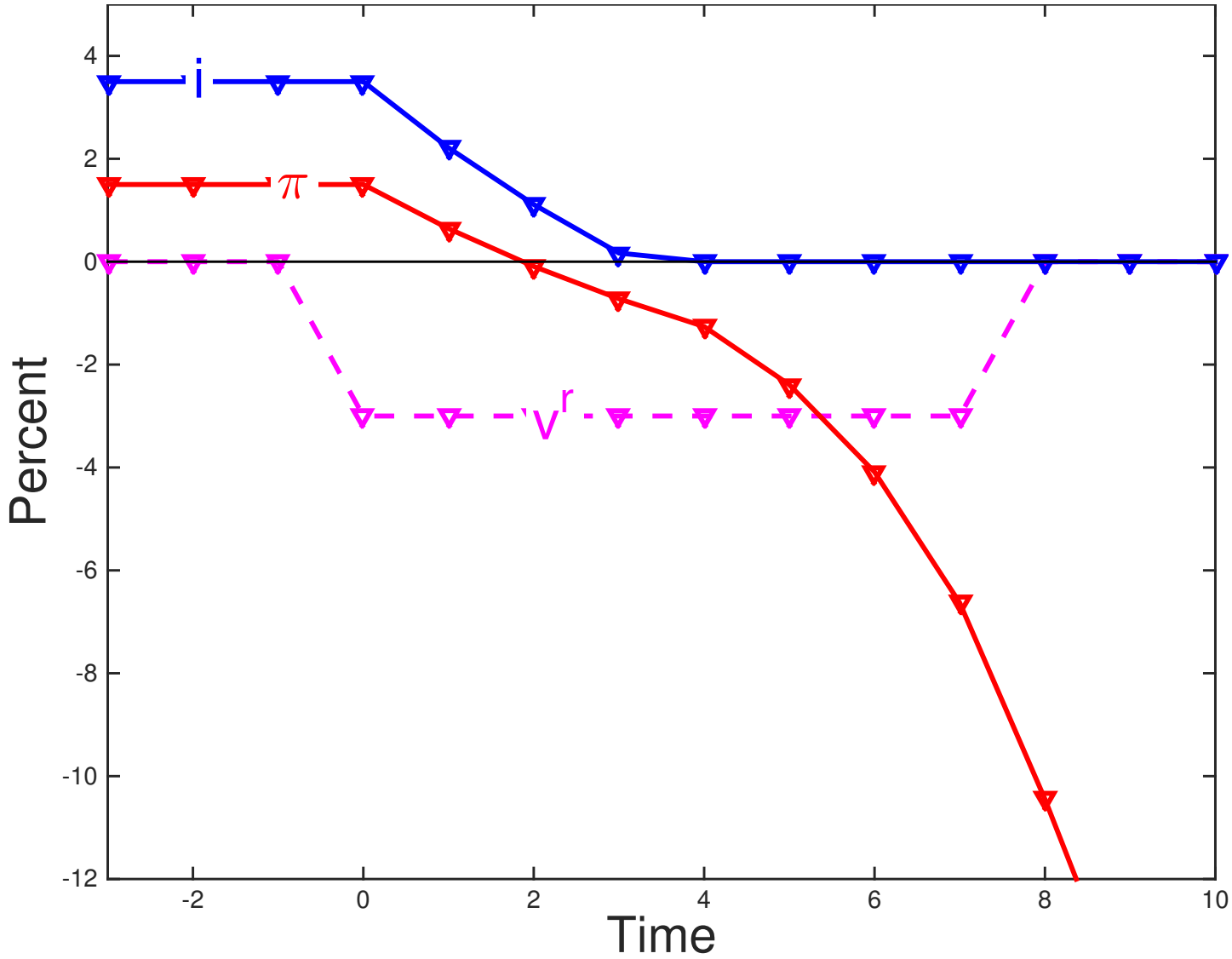
Old Keynesian, $\pi_t^e = \pi_{t-1}$; $\phi < 1$ unstable:

$$\pi_t = \frac{1 + \sigma\kappa}{1 + \phi\sigma\kappa}\pi_{t-1} + \frac{\sigma\kappa}{1 + \phi\sigma\kappa}(v_t^r - v_t^i)$$

New Keynesian $\pi_t^e = E_t\pi_{t+1}$, ; $\phi < 1$ stable, indeterminate:

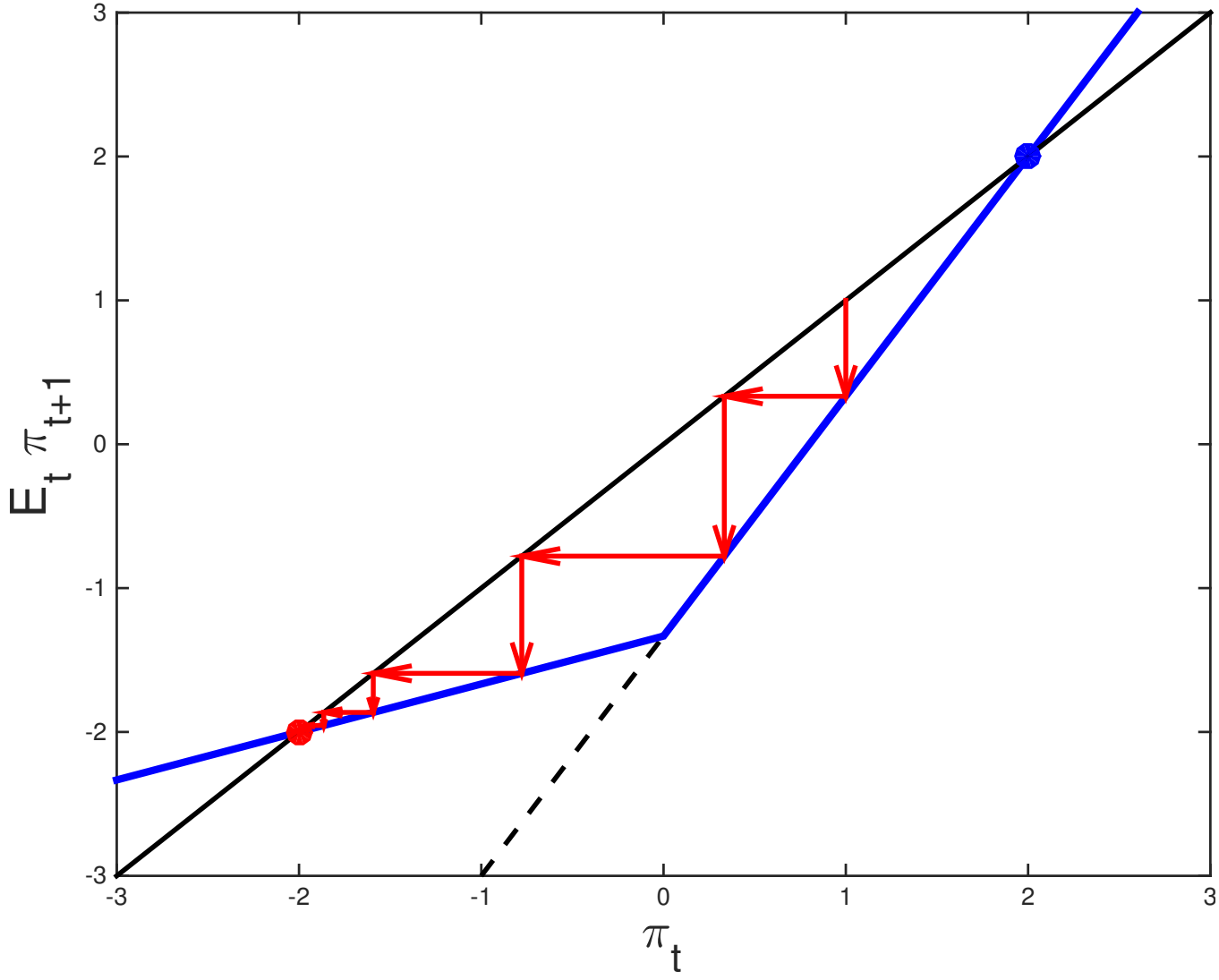
$$E_t\pi_{t+1} = \frac{1 + \phi\sigma\kappa}{1 + \sigma\kappa}\pi_t + \frac{\sigma\kappa}{1 + \sigma\kappa}(v_t^i - v_t^r).$$

Adaptive/Old-Keynesian Spiral



$$x_t = -\sigma(i_t - \pi_{t-1} - v_t^r);\ \pi_t = \pi_{t-1} + \kappa x_t;\ i_t = \max[i^* + \phi(\pi_t - \pi^*), 0]$$

Rational E / New-Keynesian stable but indeterminate



$$E_t(\pi_{t+1} - \pi^*) = \frac{1 + \phi\sigma\kappa}{1 + \sigma\kappa}(\pi_t - \pi^*) \; / \; E_t\pi_{t+1} = \frac{1}{1 + \sigma\kappa}\pi_t - \frac{\sigma\kappa}{1 + \sigma\kappa}r$$

Michelson-Morley

Michelson-Morley. Experiment:

- Inflation can be stable, quiet, at ZLB, $\phi < 1$. Even a peg.
- Huge excess reserves paying market interest are not inflationary.
- $\phi > 1$ vs. $\phi < 1$, ZLB, is not a key state variable for $\sigma(\pi)$, dynamics.

Implications

- ~~Old-Keynesian~~. No spiral.
- ~~New-Keynesian~~. No sunspots.
- ~~MV=PY~~. No hyperinflation.

Next theory? New Keynesian + Fiscal Theory.

- Inflation can be *stable* and *determinate*, (quiet) at ZLB, $\phi < 1$, and even a peg.

NK + FTPL

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

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

- Unexpected deflation $\leftrightarrow$ debt worth more $\leftrightarrow$ raise tax/cut spending.
- (1) solves spiral, indeterminacy/sunspots.

$$\delta_{t+1} = \pi_{t+1} - E_t \pi_{t+1} \leftrightarrow \text{fiscal policy.}$$

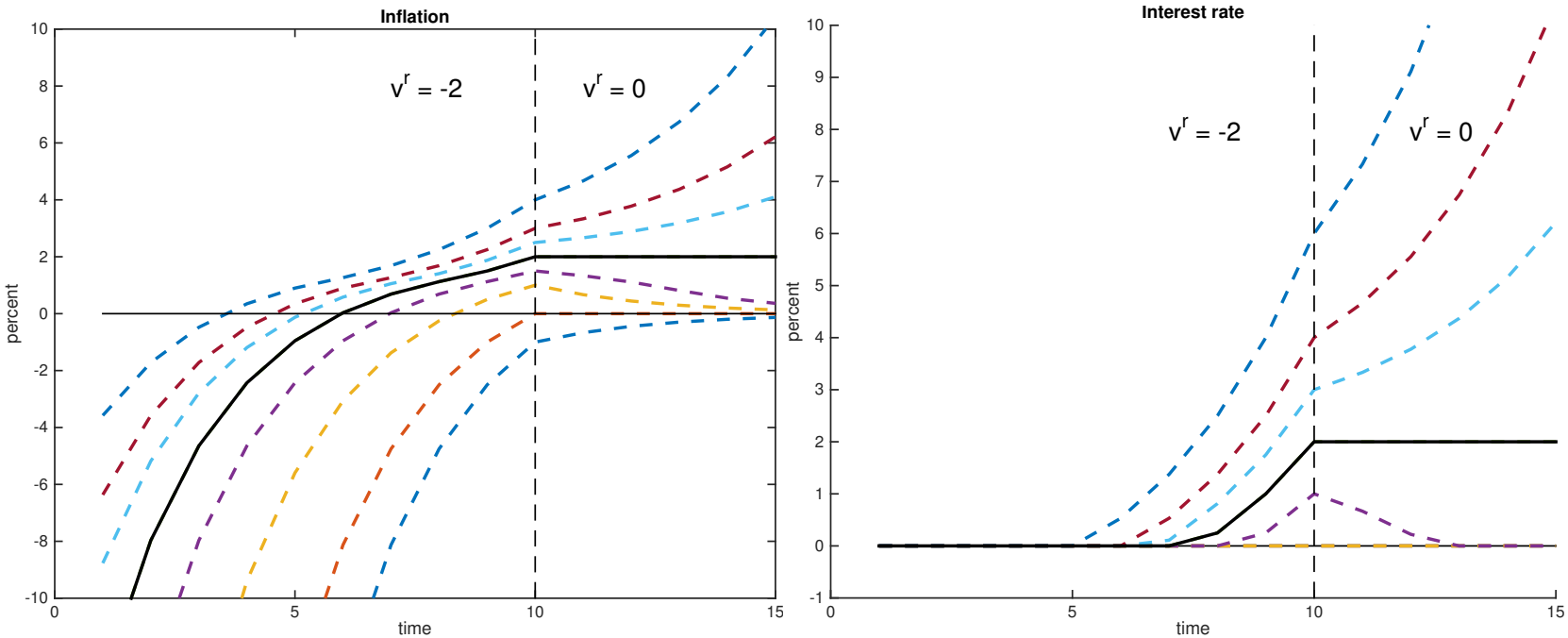
- i peg or $\phi < 1$ can be *stable* (NK) and (now) *determinate* and *quiet*.
- NK + FTPL is the only existing, simple, economic, theory left.
- Fiscal theory lite.

Occam: The (Long) Paper

What about...

- Variations to rescue instability, indeterminacy, M? (A: epicycles.)
  - Really unstable but QE offset deflation spiral?
  - NK Equilibrium selection from post-bound actions, not current $\phi\pi_t$?
  - Really active NK, not expected to last? (A: 7 Tails? Japan?)
  - Really unstable but slow to emerge (sticky wages, velocity)?
  - Reserves didn't leak to M1, M2. My point exactly.
  - More general models? (A: don't change stability, determinacy.)
- Fiscal theory objections?
  - Large deficits, debt, Japan? (A: Low r. Not deficits, debt $\leftrightarrow \pi$.)
  - Previous pegs, 1970/1980, other episodes?
    (A: Fiscal problems. "A peg *can* be stable.")
  - Why is $\sigma(\pi) = \sigma$(E fiscal policy) low? ("A peg *can* be quiet")
  - "Budget constraint," debt repayment means passive fiscal?
    (A: No; off equilibrium modeling just like NK.)
  - "Exogenous" surpluses? $s = \tau y$? $s(P)$? (A: No. Like dividends.)
  - Test FTPL? (A: Test MV=PY? P = EPV(D)?)
- A: Today: I only claim FTPL is *possible*, survives quiet ZLB test.
  I do not claim it *proved*, explains all history.

Selection by future active policy

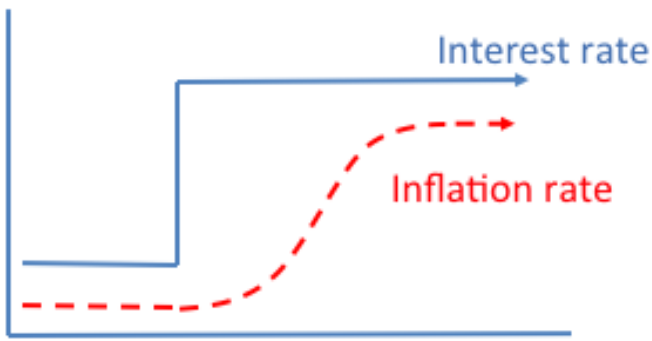


- $\phi = 0$ now, but expected ϕ in the far future can select equilibria.
- People expect the Fed to destabilize?
- Back to trap equilibria are still there.
- Puzzles. Jump at $t = 0$. Backward stable paradoxes.
- Small $\Delta E_t \pi_T$ have big effects, volatility?
- Is all monetary policy just talk about future threats? Why not 70s?
- FTPL stops jump at 0, selects benign equilibrium, solves paradoxes.

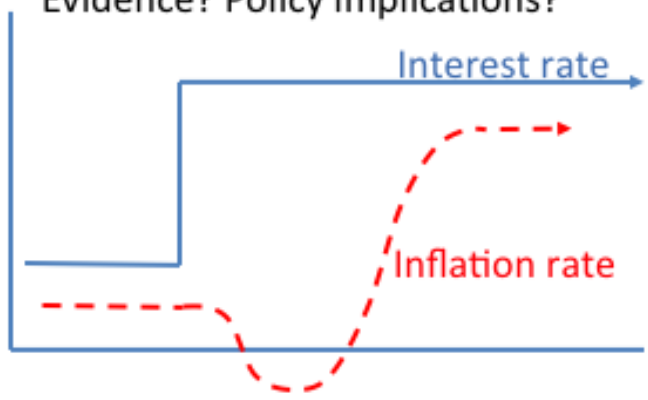
Fisher

- If π is *stable* at zero bound, hence peg, then if the Fed raises i, permanently, then π should eventually *rise*.
- Unavoidable consequence of stability.
- Vs. Friedman 1968 spiral.
- π could still decline in the *short run*. Does it?

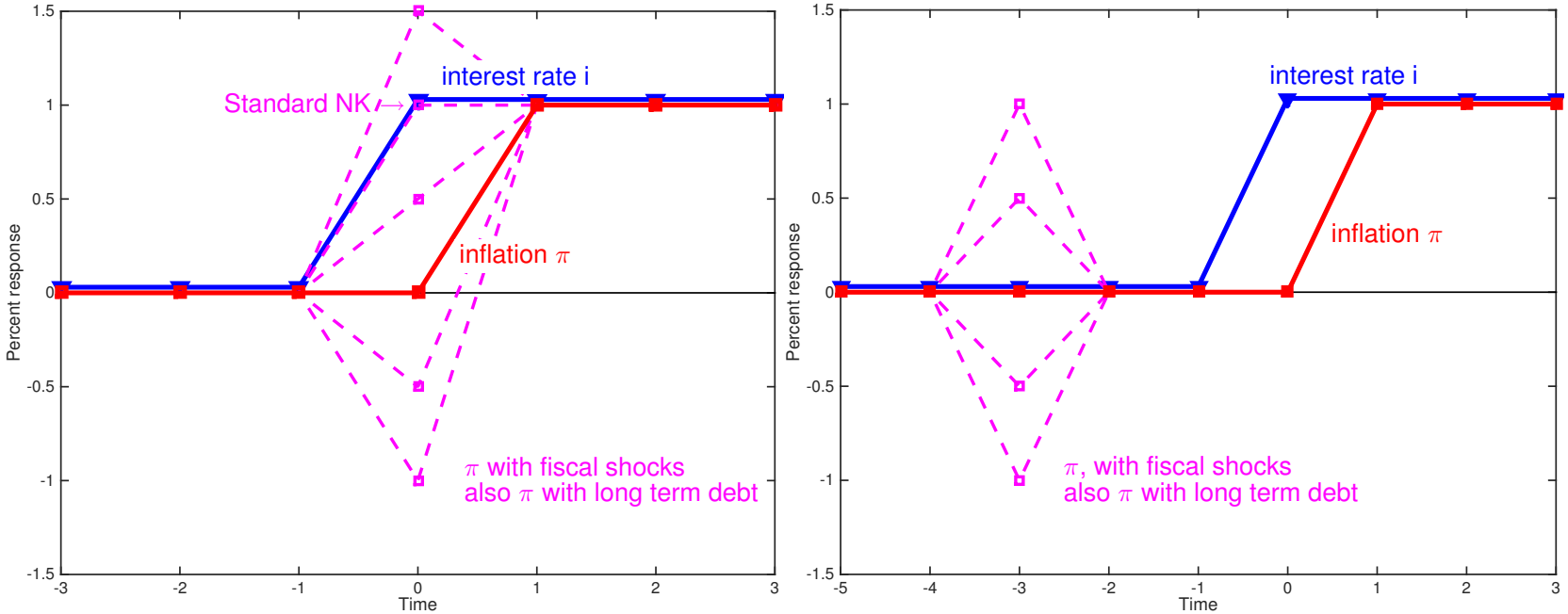
Implication of stability. Theory?



Minimum *necessary* assumptions?
Evidence? Policy implications?



Frictionless model



- Model

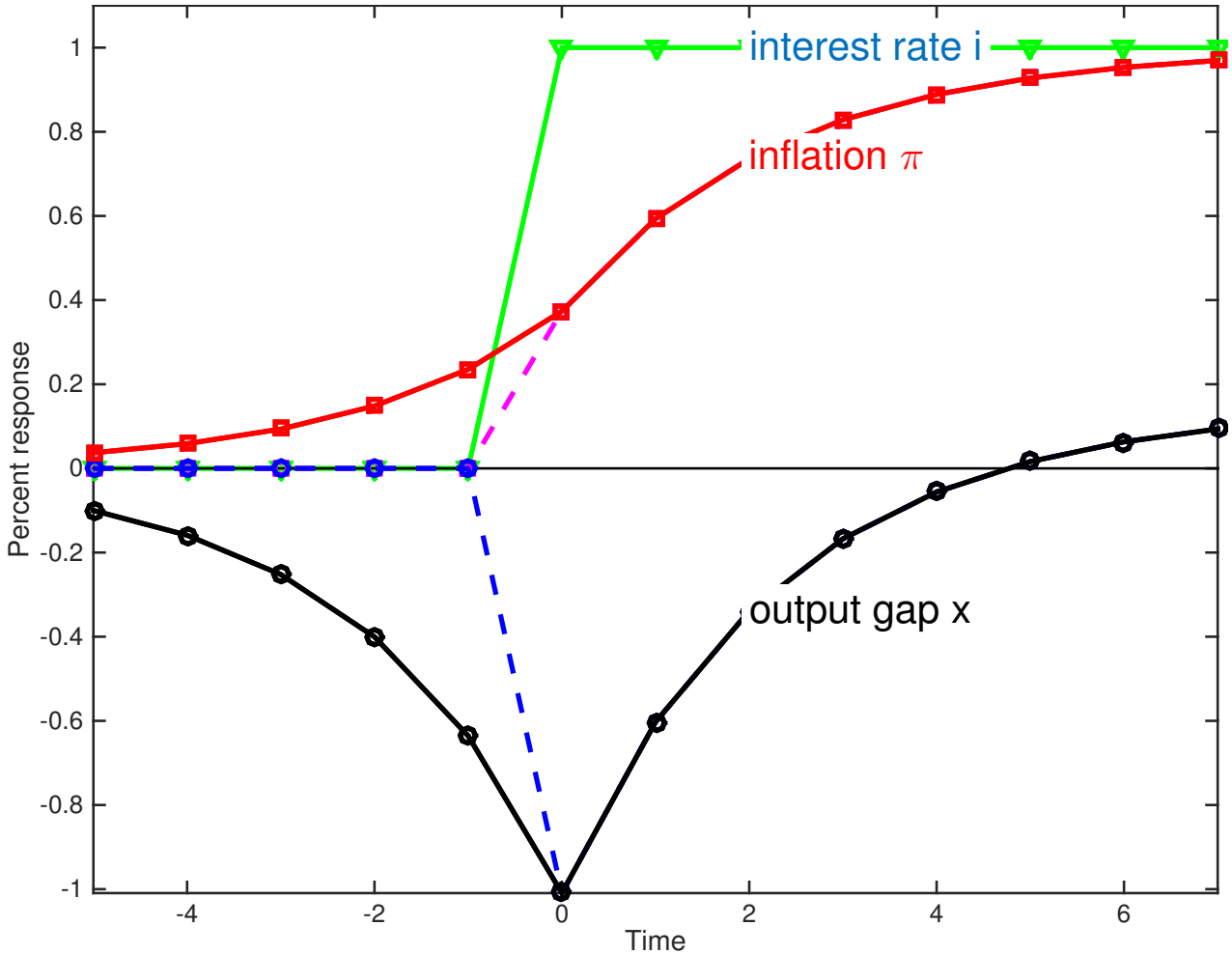
$$i_t = r + E_t \pi_{t+1},$$

$$\pi_{t+1} - E_t \pi_{t+1} = (E_{t+1} - E_t) \sum \beta^j s_{t+j} \; / (B/P)$$

- "Monetary policy" changes i with no change in fiscal $\{s\}$.
- Higher i raises π, immediately.

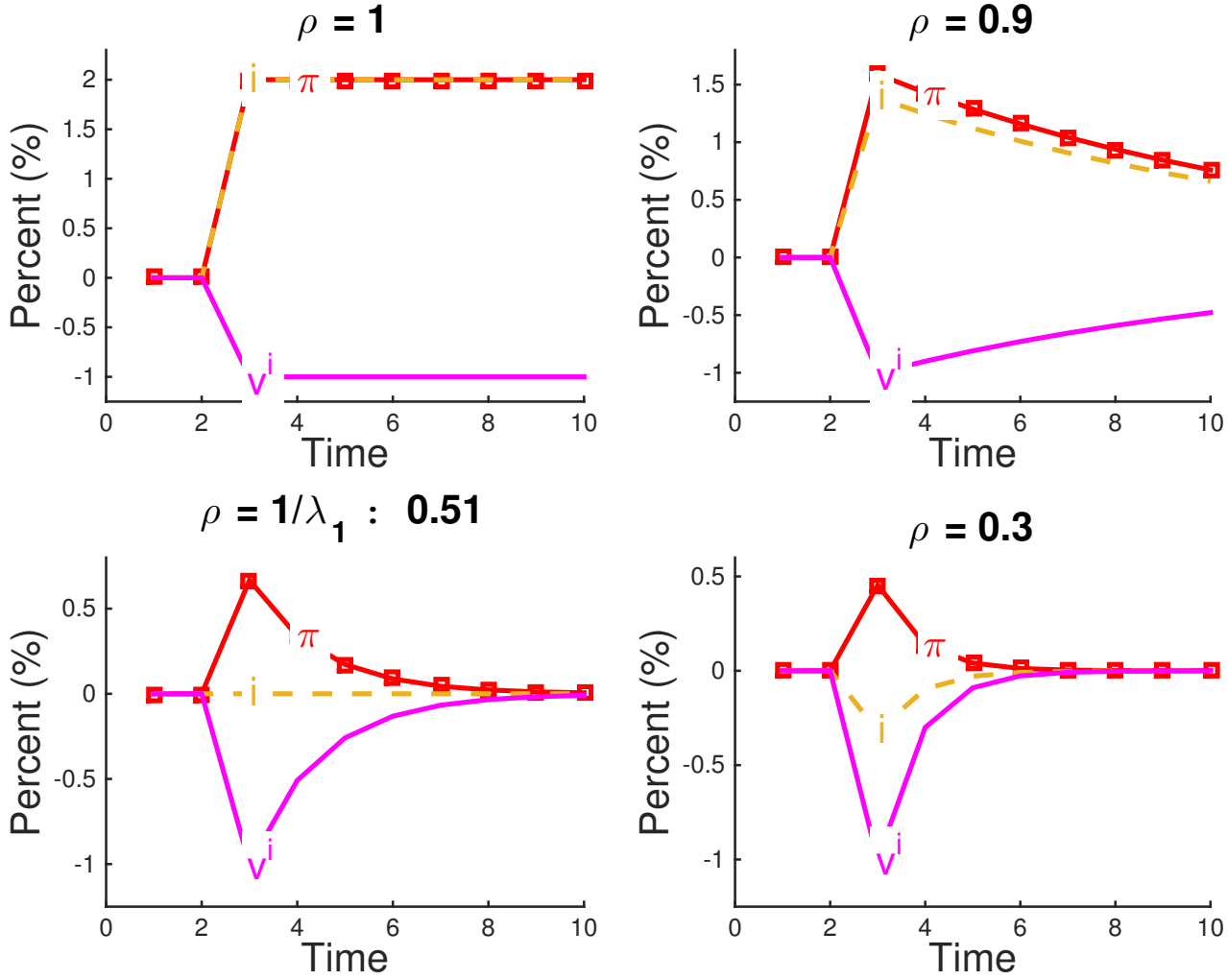
Pricing frictions give a temporary negative π? ...

Effects of rate rise – Standard NK model with $\phi = 0$



- $x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$; $\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$.
- Pricing frictions *do not* produce π decline.

Standard NK model with $\phi > 1$ (Woodford)



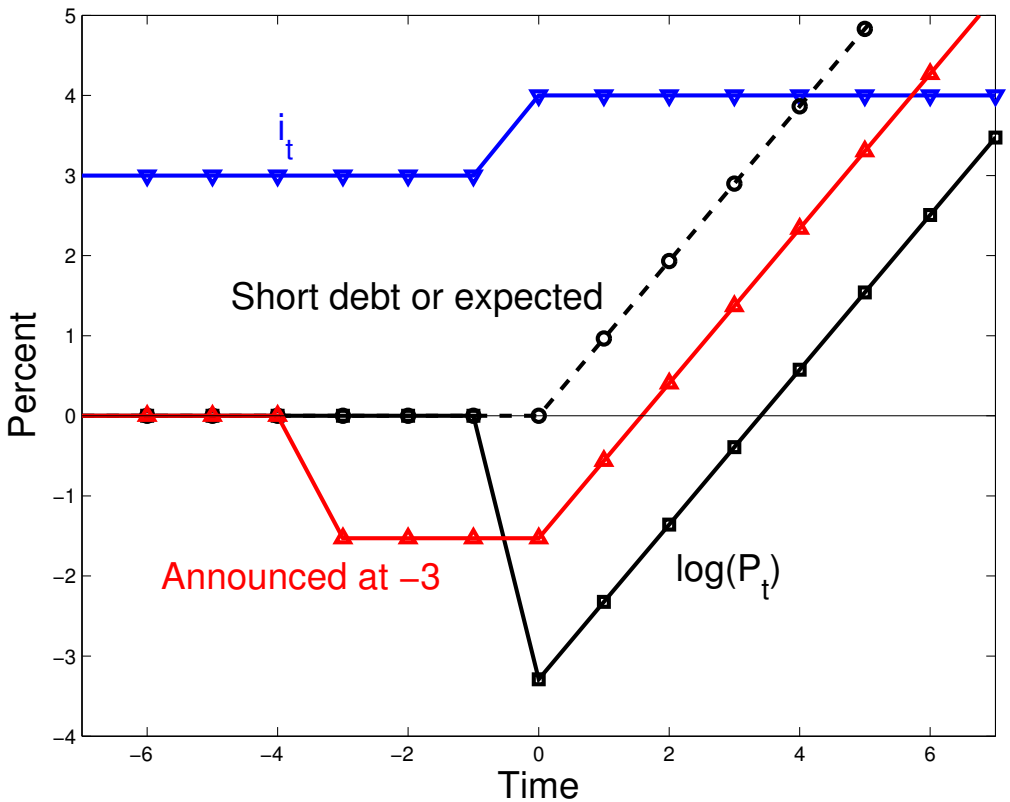
$$i_t = \phi\pi_t + v_t^i; \quad v_t^i = \rho v_{t-1}^i + \varepsilon_t^i; \ \phi = 1.5$$

- Standard $\phi > 1$ model is even more Fisherian!

FTPL + long term debt works

Simple frictionless example.

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



- Higher (future) $i \rightarrow$ lower Q. P *level* falls.
- Just like a fiscal shock.
- Then $i = r + E\pi$ *inflation* rises.
- Forward guidance.
- Needs long debt and some unexpected.

The fiscal theory of monetary policy

- "Monetary policy:" Change quantity and maturity structure of debt $\{B_t^{(j)}\}$ with no change in fiscals surpluses $\{s_t\}$.

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

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

- Change B with fixed s changes i. (Open market)
- Set i, how much B will sell. (i target)
- Monetary policy can set the nominal interest rate, in a completely frictionless (money, finance) economy.
- It can thereby control expected inflation.
- This actually resembles current institutions.

The fiscal theory of monetary policy II

QE:

- Example: Debt $B_0^{(j)}$, paid by surpluses s_j, no rollover.

$$\frac{B_0^{(j)}}{P_j} = \frac{B_{j-1}^{(j)}}{P_j} = s_j$$

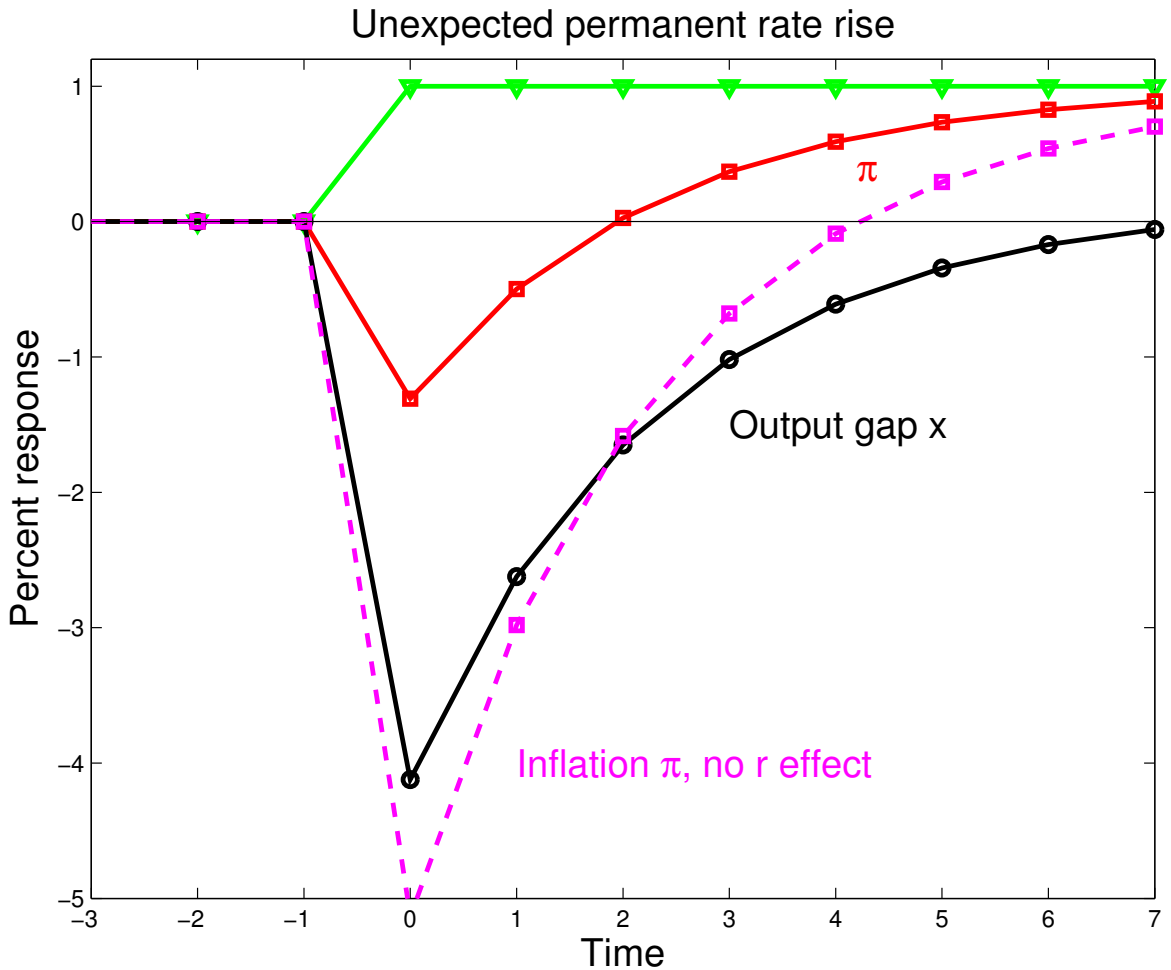
- Buy (reduce) $B_0^{(j)}$, lowers P_j, lowers long-term rate. QE!
- Also raises P_0, QE "stimulates."

Summary:

- A unified theory of open market operations, interest rate targets, forward guidance, and QE.
- Needs *no* frictions. May add pricing, monetary, financial, or other frictions for realistic dynamics, but not needed for basic story, price level determination.

Long term debt + fiscal theory + sticky prices

$$\frac{\sum_{j=0}^{\infty} Q_t^{(j)} B_{t-1}^{(j)}}{P_t} \approx E_t \sum_{j=0}^{\infty} \left(\prod_{k=1}^{j} \frac{1}{1+r_{t+k}} \right) s_{t+j}; \quad r_t = i_t - E_t \pi_{t+1}$$



- Only effect is equilibrium selection. Not shape of ir.
- More sticky → r rises, → PV declines → *less* effect.

The Answer for negative sign?

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

Points in favor:

- $\rightarrow$ QE (twist), forward guidance, and i policy are the same thing.
- Works in totally frictionless model (money, prices).

Warnings:

- Only works for unexpected changes. Hard to justify systematic policy, "fine tuning."
- Positive in long run. Produces 1970 failed stabilizations, not standard 1980s story. (Without a fiscal change too.)
- AD is FTPL, not IS. *Nothing* like any story told to undergraduates, FOMC.
- $\rightarrow$ The answer is yes, but not for every question.

Other approaches?....

(Long) Paper: What about..

Variations that don't work:

- Sticky prices
- Money $U(c, M/P)$
  - Only expected Δi works. Won't help VARs. Won't work in IOER. Sign helps, but off by $\times$ 10 in size.
- Temporary rates.
- Backward-looking Phillips, or static IS.
- Multiple equilibria, coincident or "passive" fiscal shocks.
- Standard solution of 3 equation model.

Paper: What about..

- More ingredients?
  - Borrowing or collateral constraints, hand-to-mouth consumers, bounded rationality or irrational behavior, a lending channel; habits, labor/leisure, production, capital, variable capital utilization, adjustment costs, alternative models of price stickiness; informational, payments, monetary, financial, frictions; pricing or timing lags, alternatives to rational expectations ("reflective," "k-step" expectations); non-Walrasian equilibrium, game theory,...
  - A: If so, *necessary* as well as sufficient. The *sign* (and stability?) of M policy depends on soup, not simple economics. There is *no* honest simple story to tell undergrads, FOMC.
  - Yes to frictions etc.! To understand size and dynamics on top of a simple model that gets sign and stability right.

Bottom line:

- There is no other simple, modern (rational expectations) theory, that delivers the traditional view that higher interest rates lower inflation, even temporarily.
- Is it true? VAR evidence is weak, price puzzle, includes fiscal shocks, long term debt effect.

Policy

Summary: Evidence suggests, and NK+FTPL theory digests:

- ZLB is stable, quiet. No deflation spiral, sunspots.
- $\rightarrow$ Peg or passive $\phi < 1$ too.
- Large interest-paying reserves do not cause inflation.
- Contrary classic doctrines were wrong.

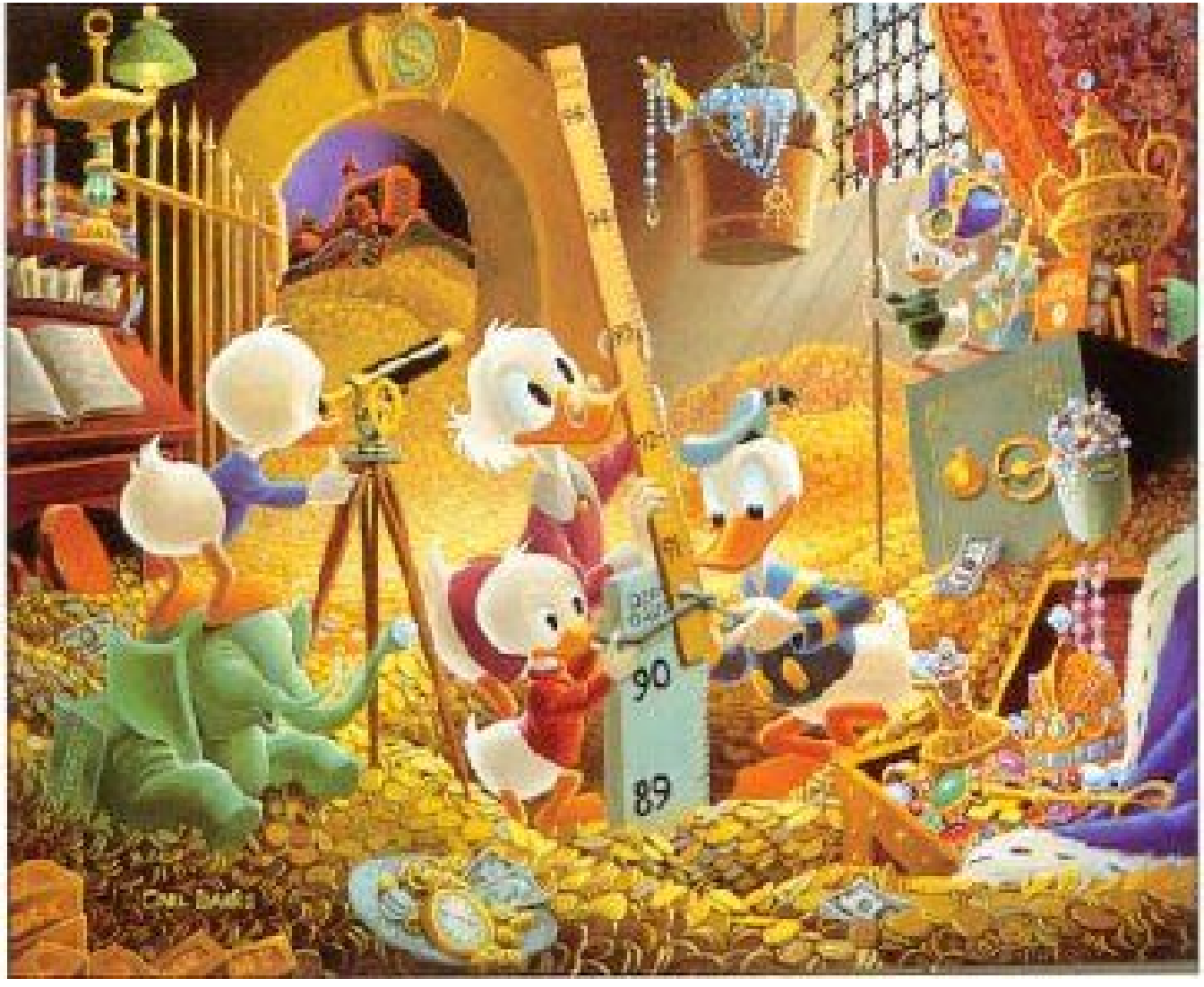
Summary: Implication

- Higher i can lead to higher π in the long run. (Neutrality.)
- Negative short run effect? No simple economic model for standard beliefs. (Only a fiscal / long-term debt channel.)

Policy: (Consequence of stability, quiet)

- Do not fear the ZLB, balance sheet!
- We *can* live the Friedman rule; Huge reserves paying market interest.
- Or, better, the Treasury can issue reserves to the rest of us. No need to keep "bonds" illiquid for price level control.

Optimal quantity of money/Balance sheet



Policy

Policy: (Consequence of stability, quiet)

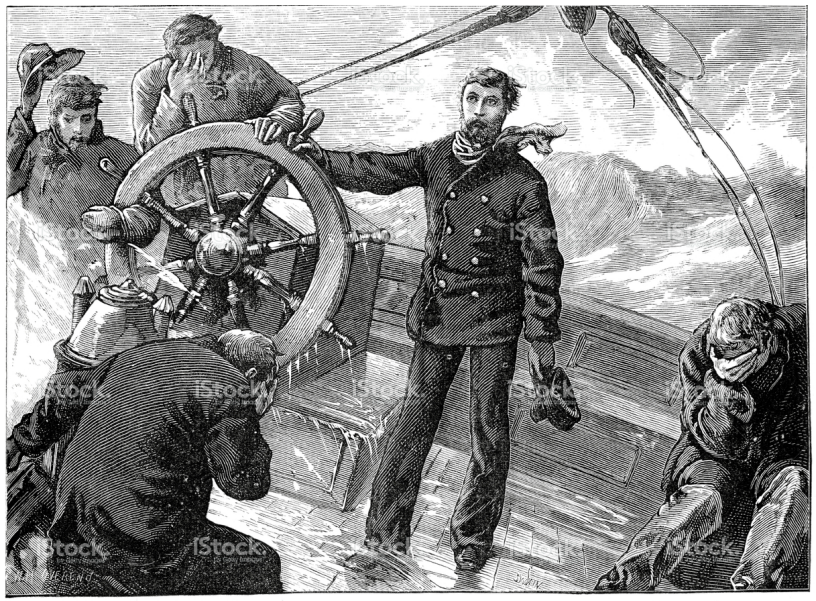
- The Fed *can* keep a low peg. (Inflation then varies as r^* varies.)
- The Fed can vary interest rates to offset shocks, it's idea of $r*$, to produce more stable inflation.
- The Fed *can* target the spread between indexed and non-indexed debt, thus target expected inflation, and let the level of the real rate free to respond to market forces. (Expected CPI standard.)

$$i_t = r_t + E_t\pi_{t+1} \rightarrow E_t\pi_{t+1} = i_t - r_t$$

- The Fed can offset shocks with time-varying rates/spread; fine-tune inflation / output path with negative fiscal effect or complex DSGE.
- Vs. it's stable, leave it alone, like hot/cold shower. Old "fine tuning," "rules vs. discretion," planning debate continues.

Policy

The Fed? Simple rules v. fine-tuning discretion continues.



CAPTAIN LYON AND HIS CREW OFFERING PRAYERS FOR THEIR PRESERVATION.

- Observed policy may not change much – Taylorish responses to output and inflation + temporary responses to shocks.
- Case for leave it alone is a little stronger.
- Foundations / strategy may change a lot. No more $\phi > 1$ equilibrium selection. Fiscal anchoring. Balance sheet. Inflation target.
- Monetary economics is now like regular economics! A simple S&D benchmark, then add frictions to taste.

Warnings

Extrapolation warning:

- NOT "lower rates to lower inflation" (Turkey, Brazil).
- Must be very persistent, credible, and with fiscal backing. (Our flight to quality came first.)

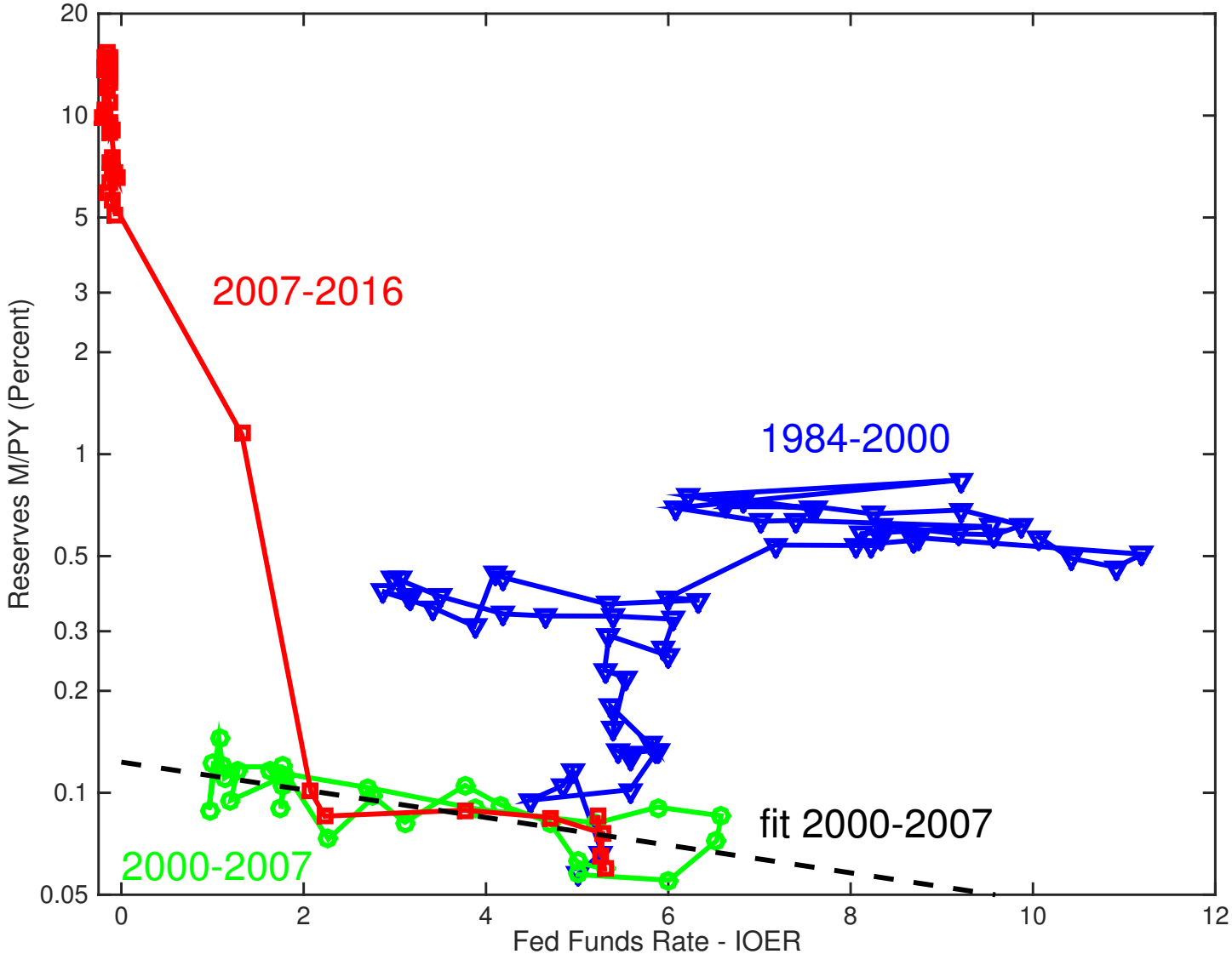
FTPL warning:

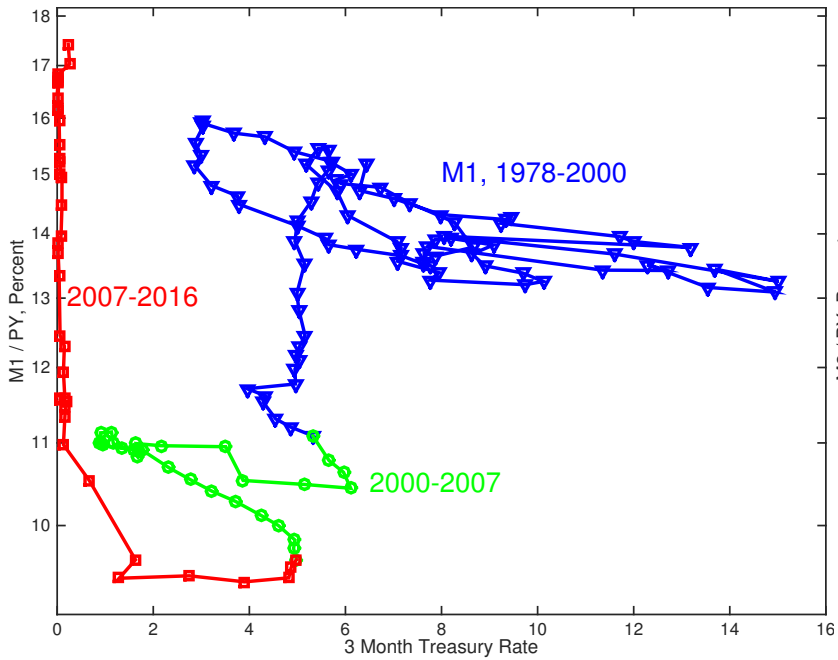
$$\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \frac{1}{R_{t,t+j}} s_{t+j}$$

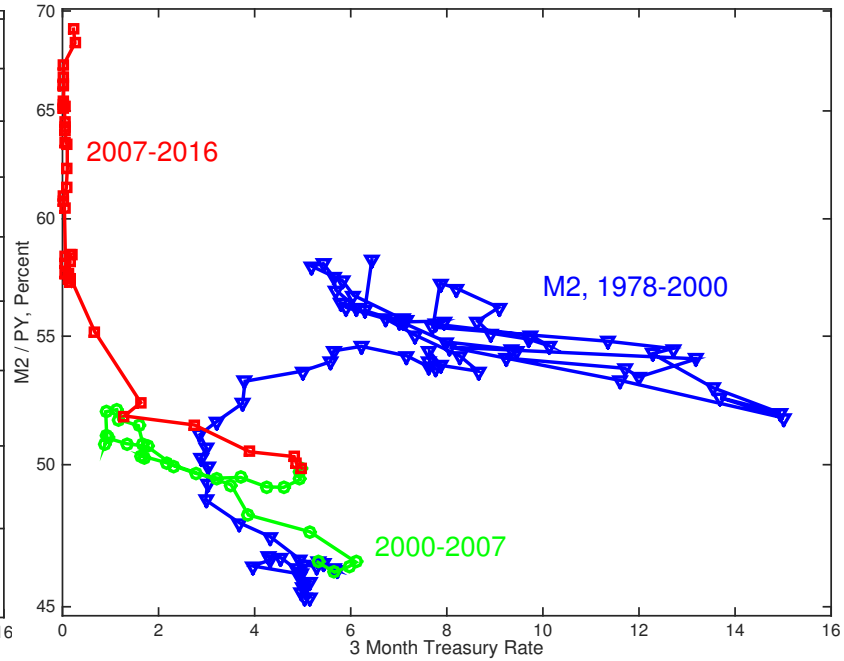
- Fiscal policy "anchoring" comes from expectations of eventual primary surpluses, and low real rates for government debt.
- Low R, flight to quality, $\rightarrow$ low P.
- Discount rates dominate valuation everywhere.
- Low discount rates could evaporate quickly.

The End

Extra Graphs


20
10
5
3
2
1
0.5
0.3
0.2
0.1
0.05
Reserves M/PY (Percent)
0
2
4
6
8
10
12
Fed Funds Rate - IOER
2007-2016
1984-2000
2000-2007
fit 2000-2007


M1, 1978-2000
2007-2016
2000-2007
M1 / PY, Percent
3 Month Treasury Rate


2007-2016
M2, 1978-2000
2000-2007
M2 / PY, Percent
3 Month Treasury Rate