Inflation and Interest Rates

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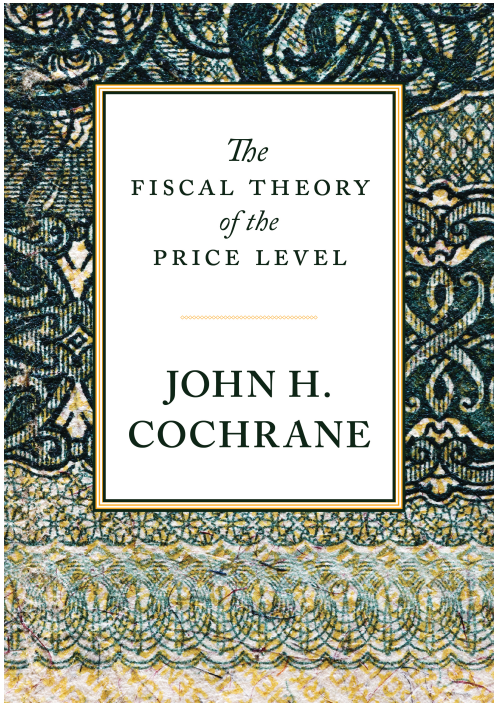
Ads

- *The Fiscal Theory of the Price Level*
- “Expectations and the Neutrality of Interest Rates"
- “Fiscal Histories"
- https://www.johnhcochrane.com/
- “Interest rates and inflation” *Grumpy Economist*

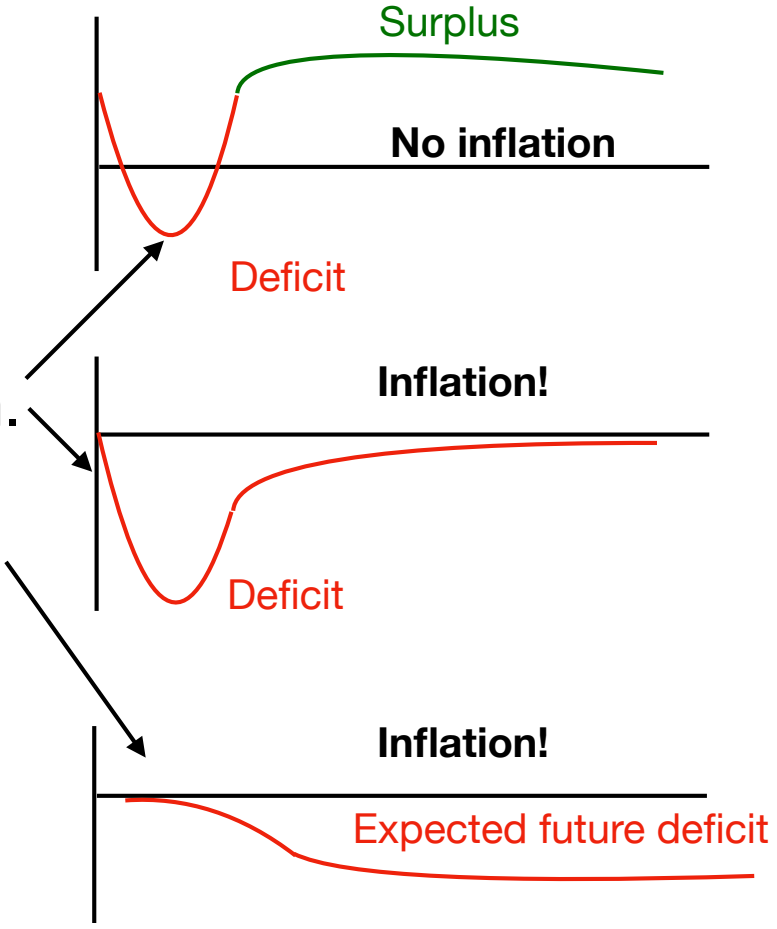


Fiscal theory of the price level

$$\frac{\text{Nominal government debt}}{\text{price level}} = \text{Present value of primary government surpluses}$$

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

- Debt vs. *long run* ability/will to repay. Like stocks & bonds.
- Not necessarily *today's* deficits or debt. "Stock" vs. Keynesian "flow."
- Lots of debt/deficit possible with no inflation. That's typical or good policy.
- Inflation can surprise, with no current deficit.
- Higher discount rate / interest costs = more inflation. Empirically important.
- "Nominal anchor;" foundation for more complex dynamics. Sticky prices, DSGE.



Fiscal theory of monetary policy
FTPL + Interest rate target

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

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

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

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

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

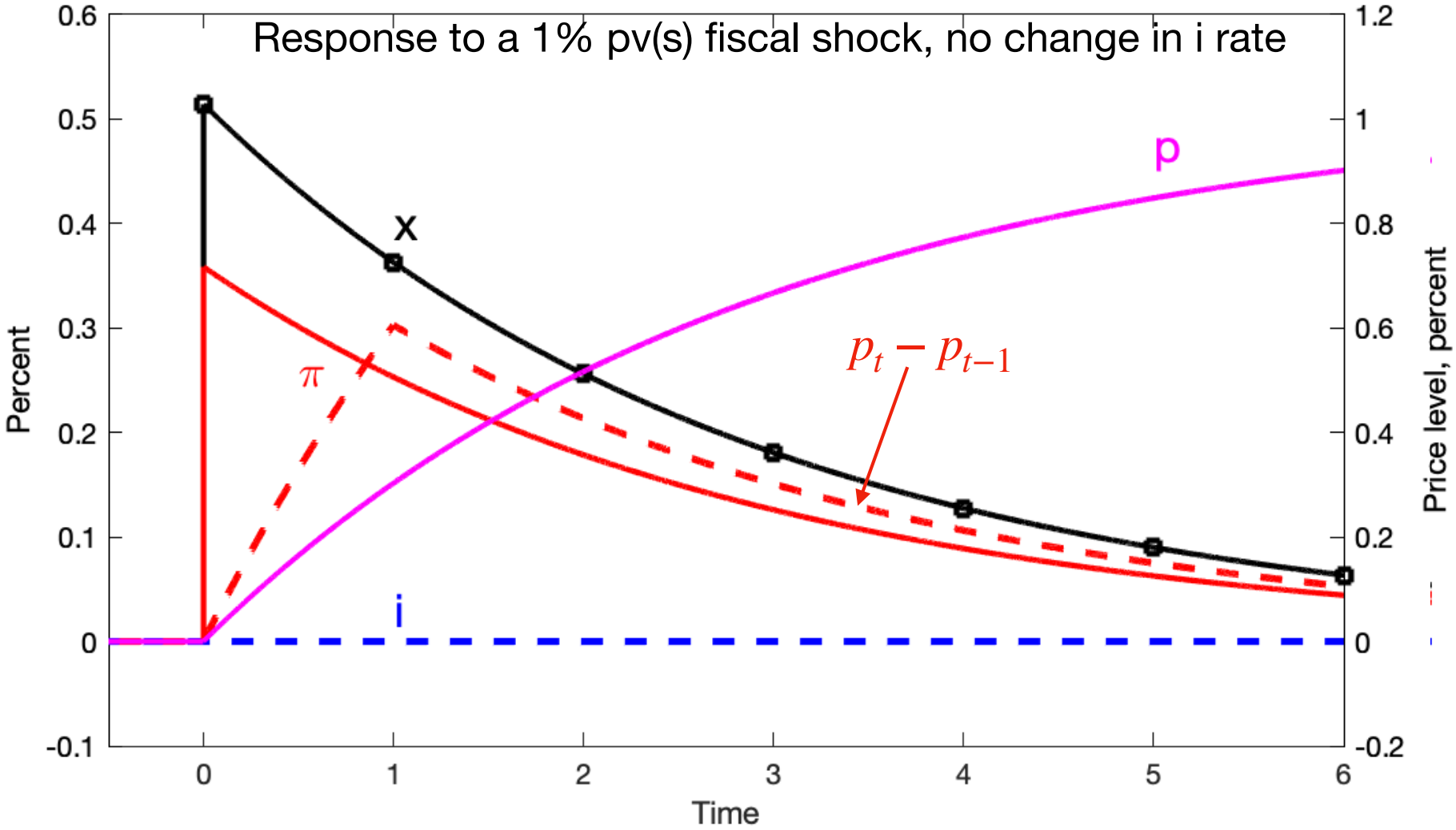
$$\left(\Delta E_{t+1} \equiv E_{t+1} - E_t;\quad \tilde{s}_t \equiv \frac{s_t}{B/P}\right)$$

- Central Bank sets expected inflation; fiscal policy determines unexpected inflation.
- Central Bank remains powerful! But can't stop all inflation.
- A (and the only) full, economic, theory of inflation under interest rate targets, consistent with current institutions (interest rate targets, no "equilibrium selection policy).
- Makes long run sense. Short run dynamics? Sticky prices…

Fiscal theory with sticky prices, fiscal shock

$$x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - \tilde{s}_{t+1}$$
$$0 = \lim_{T \to \infty} E_t \rho^T v_T$$

- No price level jump. Slowly inflate away debt. ($\pi > i$.)
- Inflation eventually goes away even with no i response.
- Very simple case! Much more generality is possible, including i rules, endogenous s, complex NK/DSGE etc.
- Recipe for writing papers.



Monetary shock. No fiscal change. Long term debt

$$x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$

$$\rho v_{t+1} = v_t + r^n_{t+1} - \pi_{t+1} - \tilde{s}_{t+1}$$

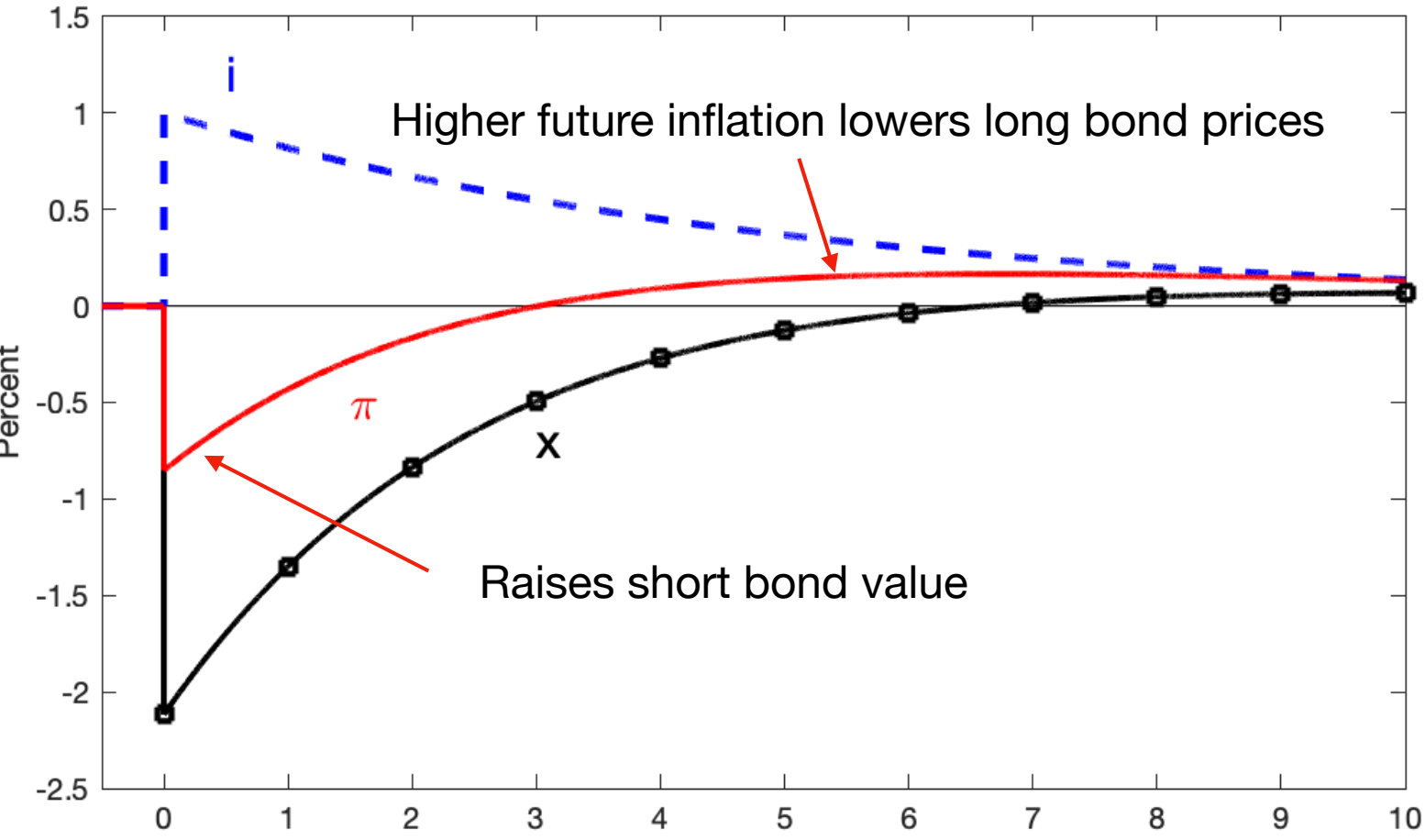
$$E_t r^n_{t+1} = i_t \quad \text{(new)}$$

$$r^n_{t+1} = \omega q_{t+1} - q_t$$

$$0 = \lim_{T \to \infty} E_t \rho^T v_T$$

- $(\sum_j Q_t^{(j)} B_{t-1}^{(j)})/P_t = E_t \sum_j \beta^j s_{t+j}$

  Higher i, future π = lower Q. Same s. P_t falls.
- Fed can only lower current by raising future inflation. ``Unpleasant interest rate arithmetic."
- Easy to miss the future inflation. ``stepping on a rake"
- *Not* standard intuition (higher rates lower demand, Phillips curve). Works (better) with flexible prices!

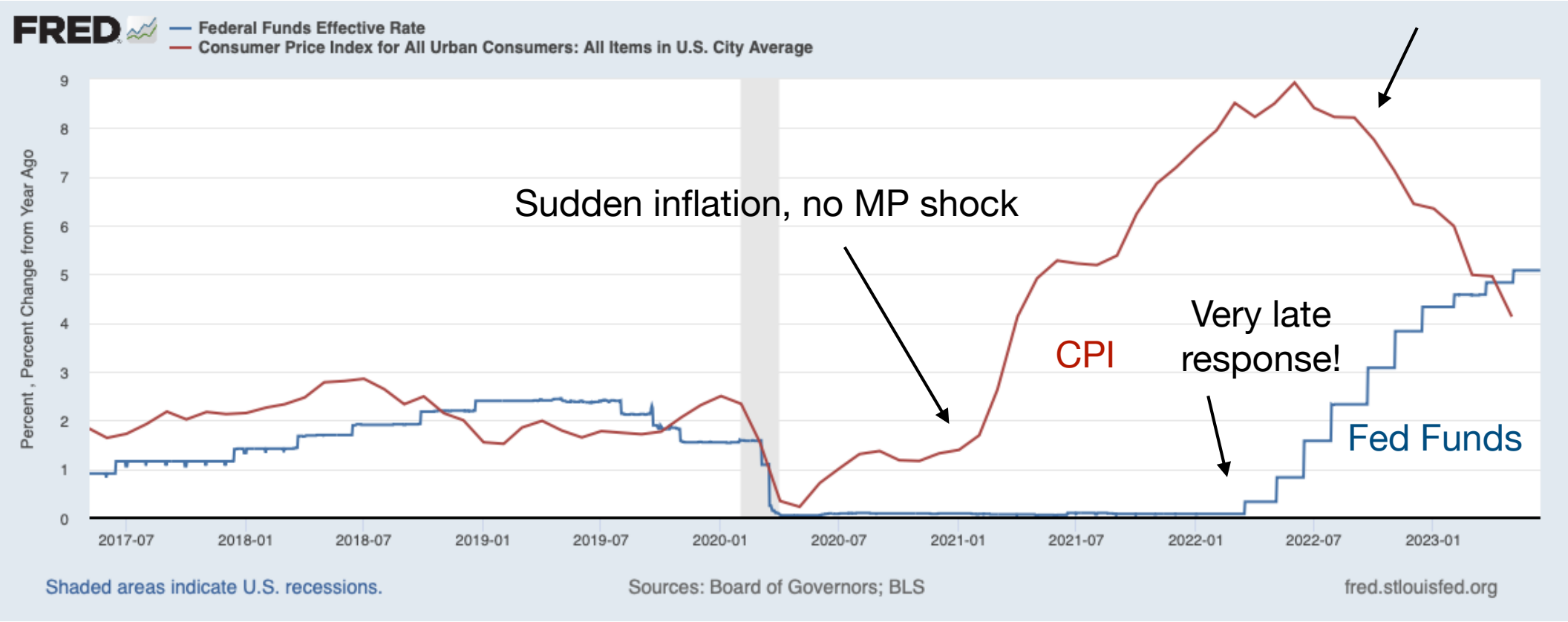


- Central banks can and should do this in response to a fiscal shock. Smoother inflation has less output effect.
- Taylor rule adds such a response automatically.

Act II: Current events

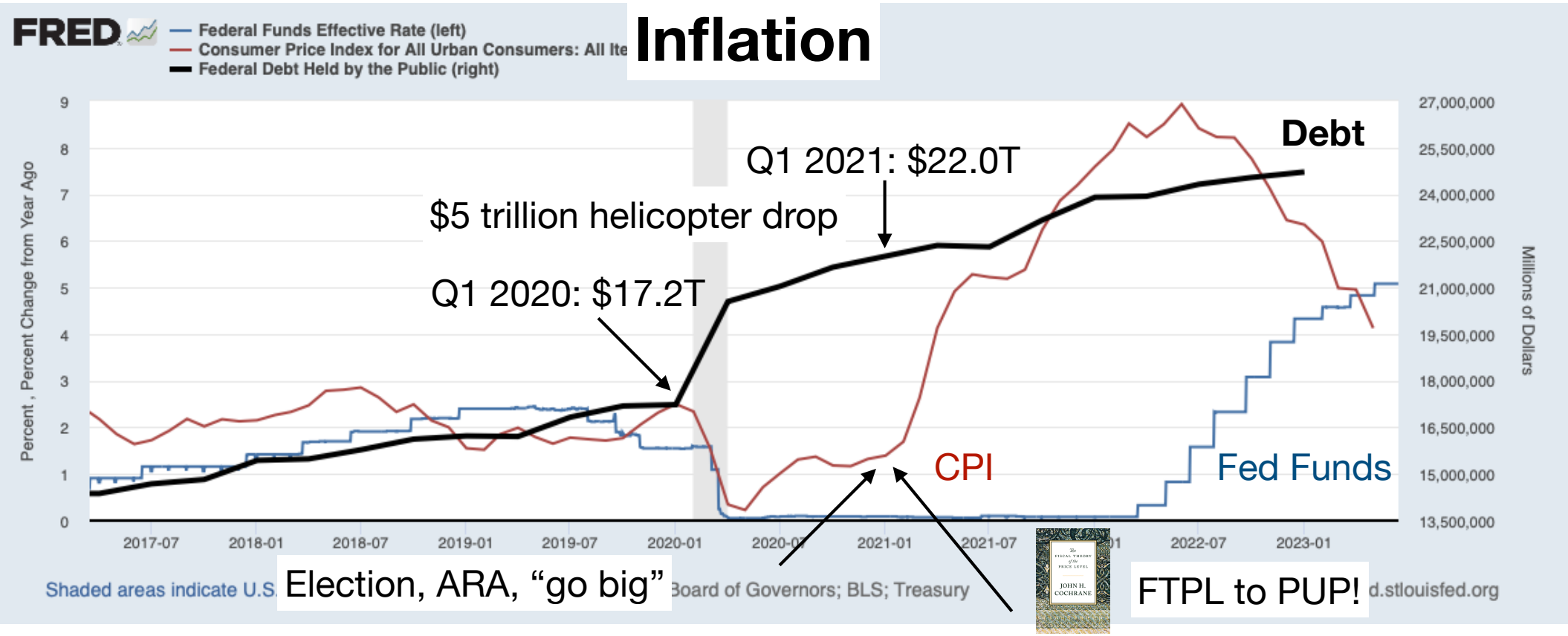
Inflation

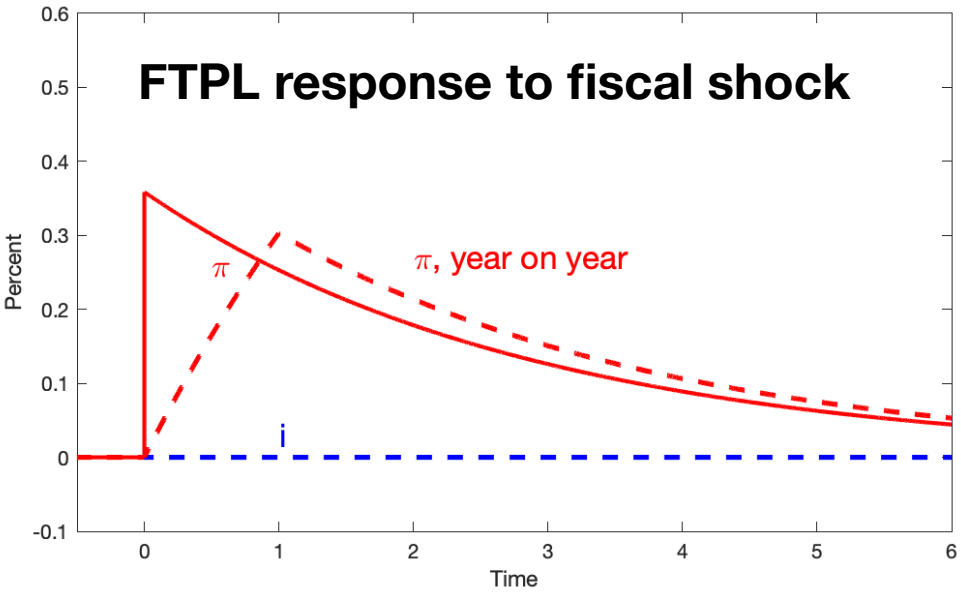
Inflation eases, no 1980s $i > \pi$



- Why did inflation start?
- "Greed," "supply shocks," "monopoly" are *relative* prices.
- Why does inflation plateau and ease, not spiral, with $i < \pi$?

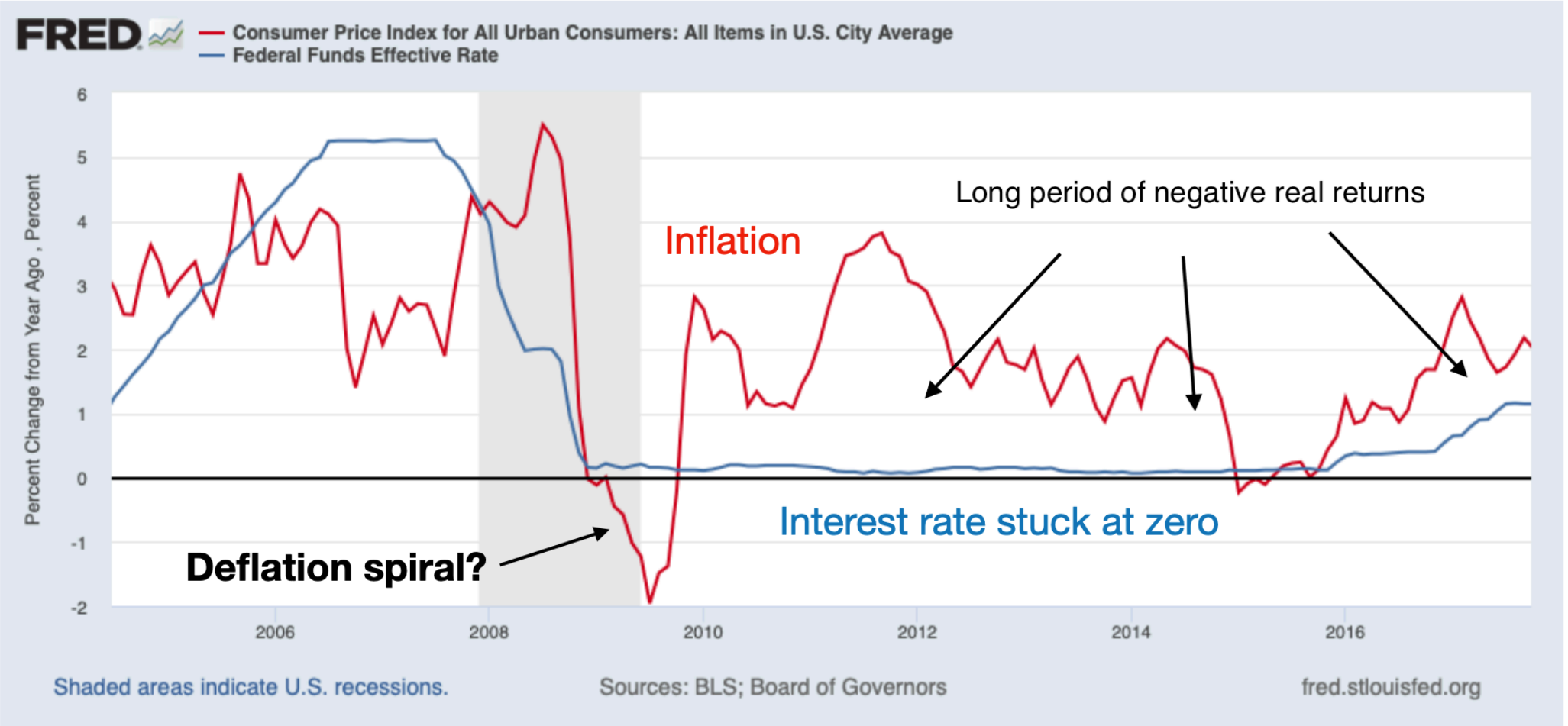
Inflation





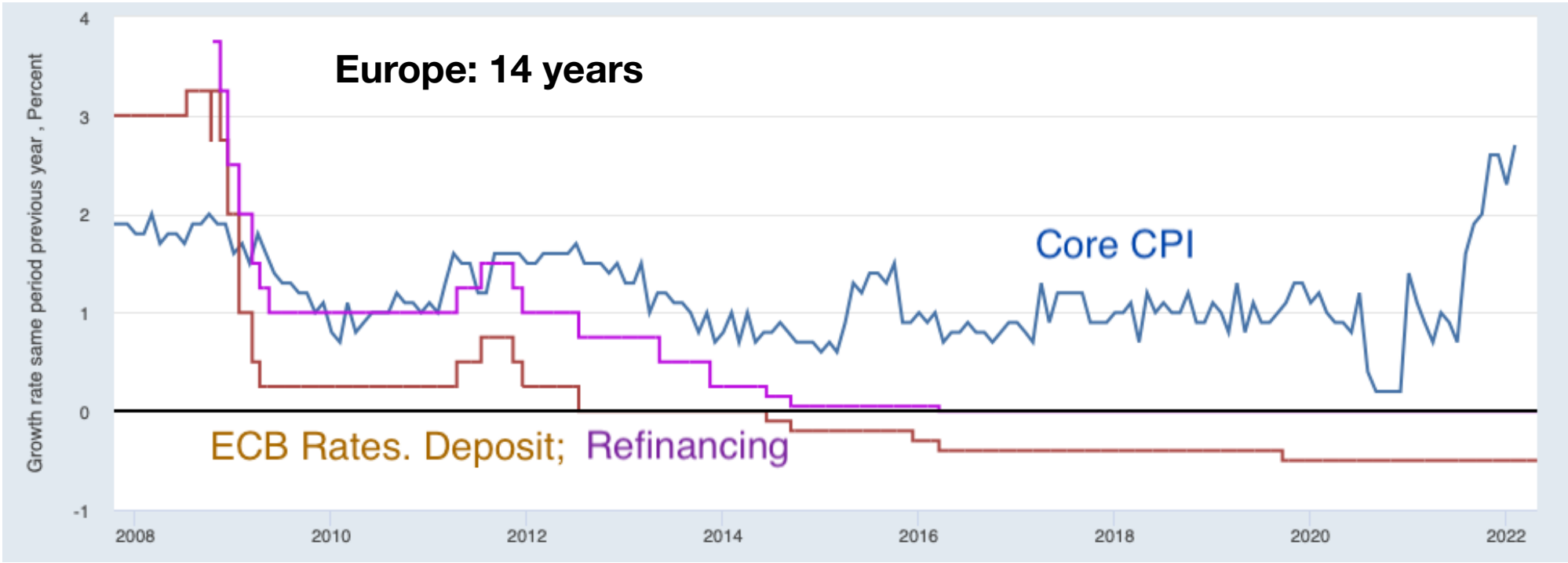
- +$5T debt. ($3T reserves). Checks to people, businesses.
- No "deficit now, repayment later." No lower real rates.
- M? Same QE did not produce π.
- Evidently, people did not save reserves/debt as a good investment.
- Easing just as rates start to rise, as in model. Persistent inflation?

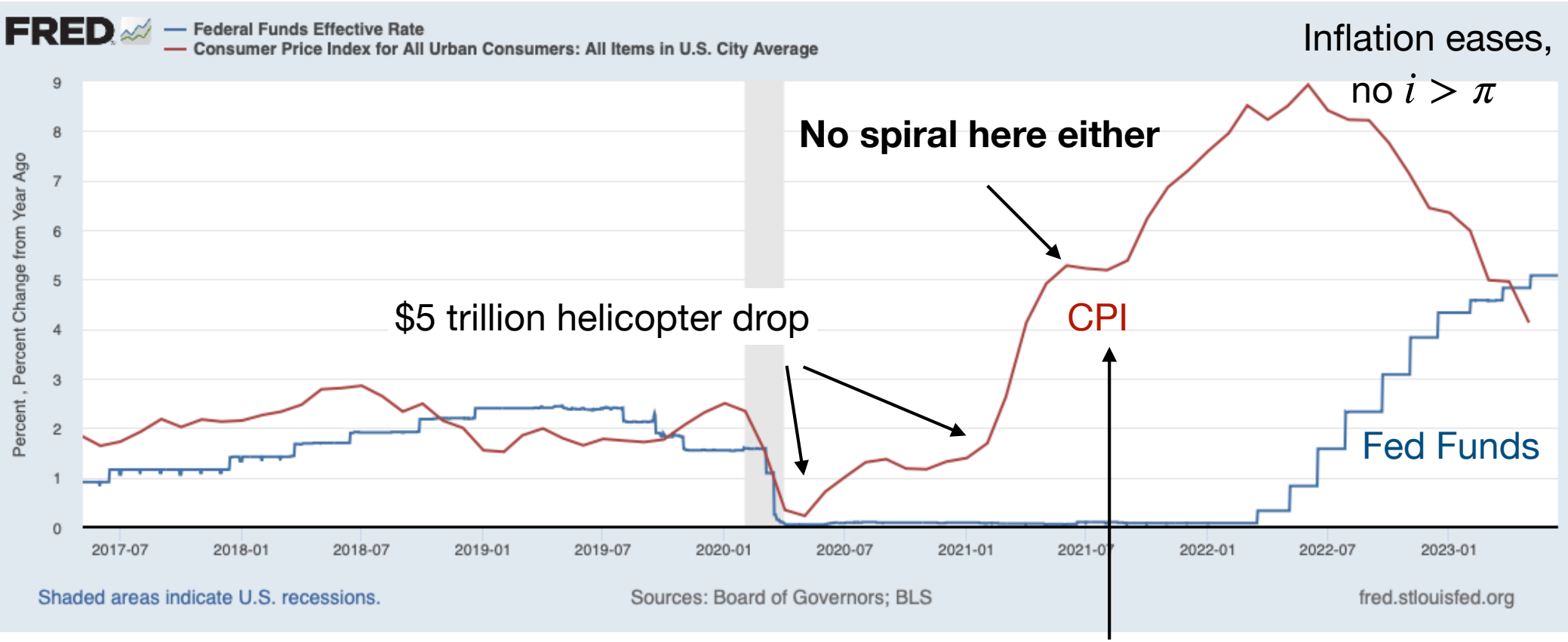
A test of theories: 2008 and zero bound

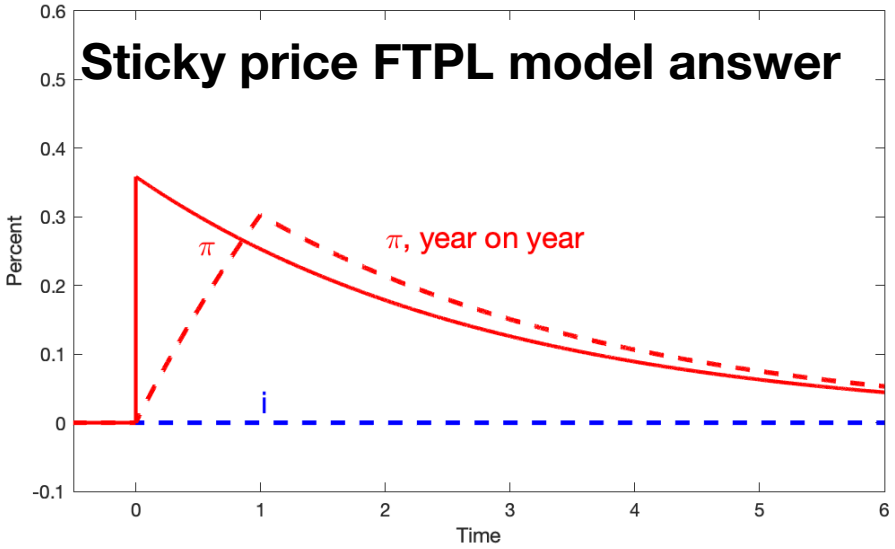


- 2008/2009: No big deflation, though widely predicted. Debt/price = EPV(surplus). No deflation because of *fiscal* policy.
- Long zero bound: no spiral, no sunspots, though widely predicted. Only FTPL: inflation *can be* stable, quiet at ZLB.
- Immense QE: No monetary hyperinflation, though widely predicted.
- Fiscal? Not great, but no *news*. Unexpectedly low interest rates/costs.

The long quiet stable zero bound







- Adaptive: Inflation will spiral up until $i > \pi$.
- NK model: Central bank can completely control inflation. $i_t = \phi(\pi_t - \pi_t^*)$, $\phi > 1$. There cannot be a fiscal shock, as "passive" fiscal policy always changes s_{t+j} so that $B_{t-1}/P_t = EPV(s)$ after CB chooses P_t .
- →Inflation broke out because the Fed did not announce an equilibrium-selection policy and threaten hyperinflation should inflation exceed its target. ??

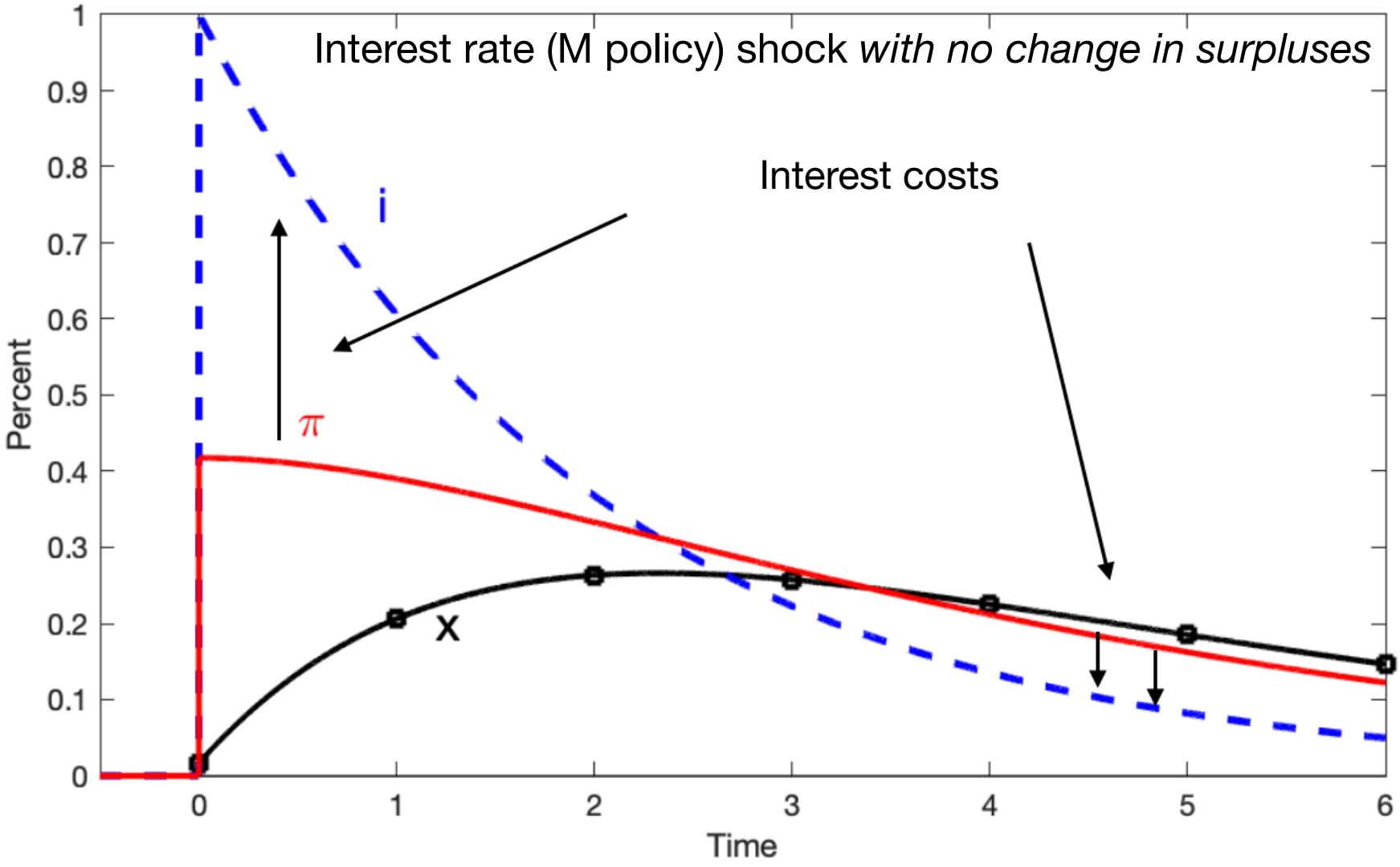
Act III. The future.
Fiscal - monetary interaction

- Higher interest rates?
  - Higher interest costs on debt. 100% D/Y; 1% rate = 1% of GDP deficits
  - Disinflation: bondholder windfall.
  - Recession: bailout, stimulus, etc.
- Conventional models include joint fiscal / monetary tightening.
- What happens if fiscal policy cannot / does not go along? *Inflation does not fall. This is true in conventional new and old Keynesian models too.*
- Containing inflation requires joint fiscal monetary (and usually growth-oriented microeconomic) policy.

Fiscal theory with price stickiness, short debt

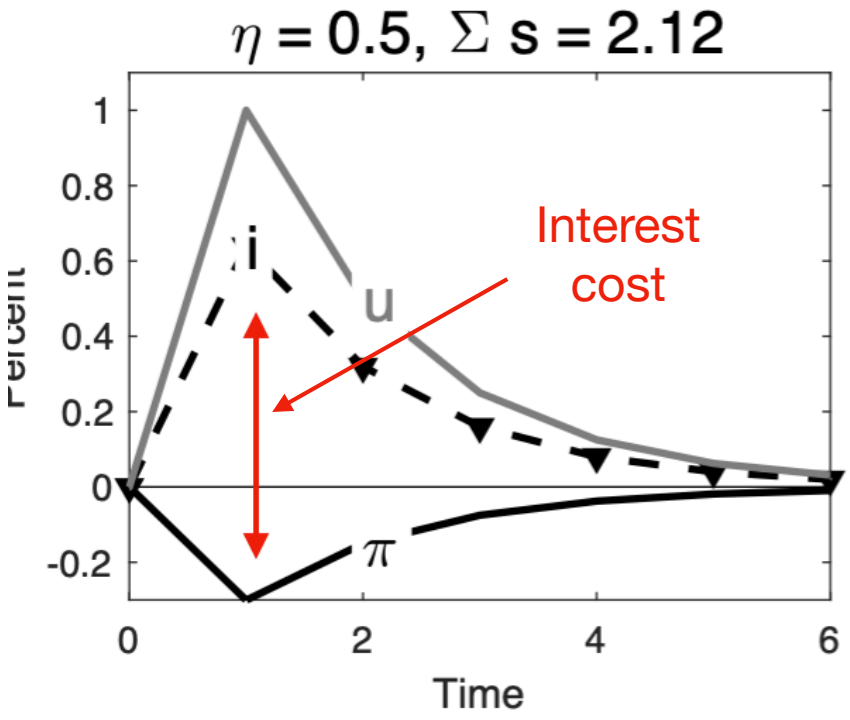
$$x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - \tilde{s}_{t+1}$$
$$0 = \lim_{T \to \infty} E_t \rho^T v_T$$

- Definition of "monetary policy" shock: Interest rate change *with no change in surpluses*.
- Inflation still *rises* despite sticky prices.
- Pv(interest costs) = Pv(surpluses) = 0.

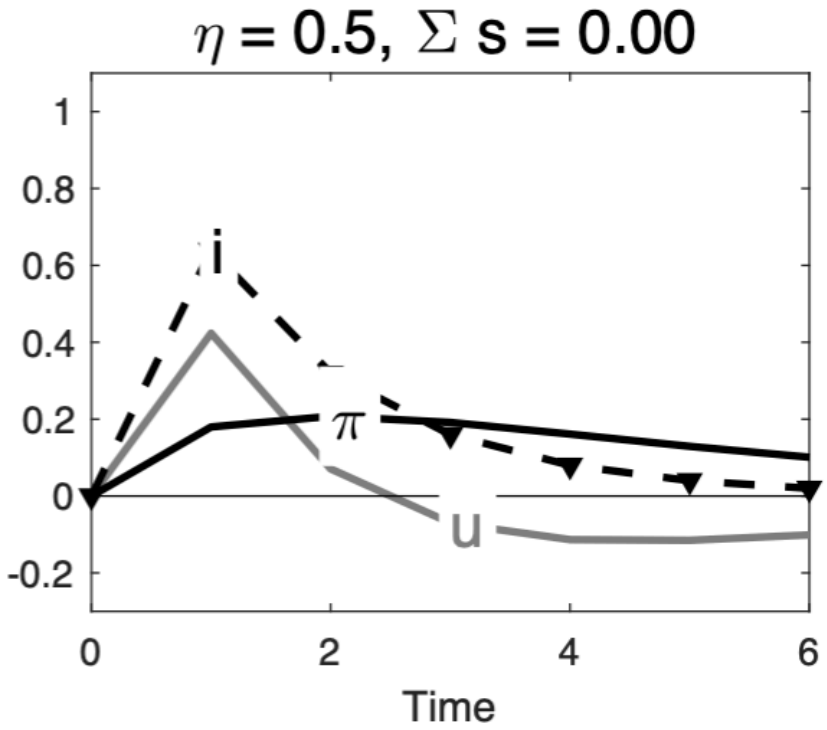


Standard new-Keynesian model

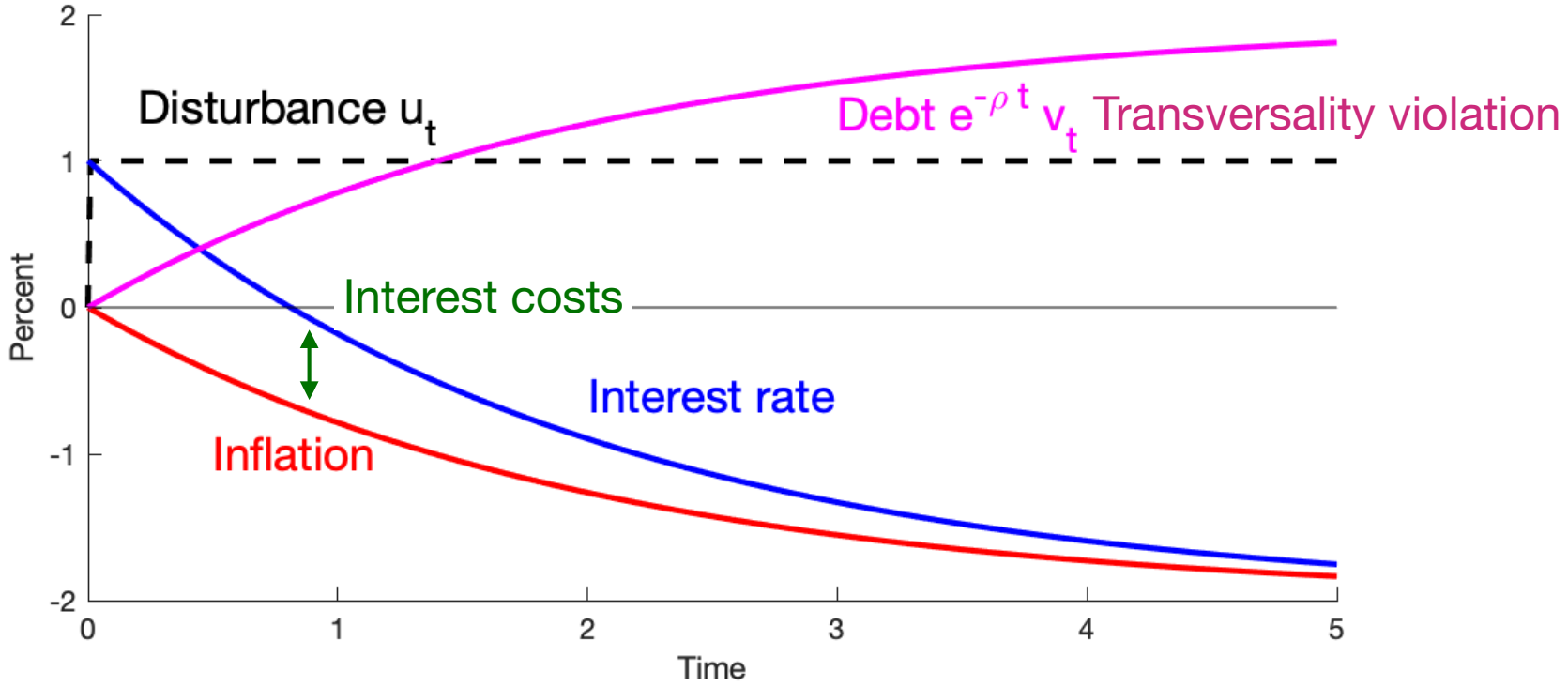
$$x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$
$$i_t = \phi \pi_t + u_t;\ \phi > 1$$
$$u_{t+1} = \eta u_t + \varepsilon_{t+1}$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - \tilde{s}_{t+1}$$ "Passive"



- NK model with a transitory AR(1) shock lowers inflation.
- But "passive" fiscal raises taxes to pay interest cost & bondholder windfall.
- Choose $\{u_t\}$(not AR(1)) to give the *same* i path, no fiscal change: *Inflation rises*! (Roughly, $i_t - \pi_{t+1}$ averages zero).
- NK inflation reduction comes from equilibrium selection, with "passive" fiscal tightening! *Despite* higher rates, not *because* of higher rates.
- Without fiscal shock, *higher rates do not lower inflation in the standard NK model!*



Fiscal foundations of adaptive expectations /old Keynesian

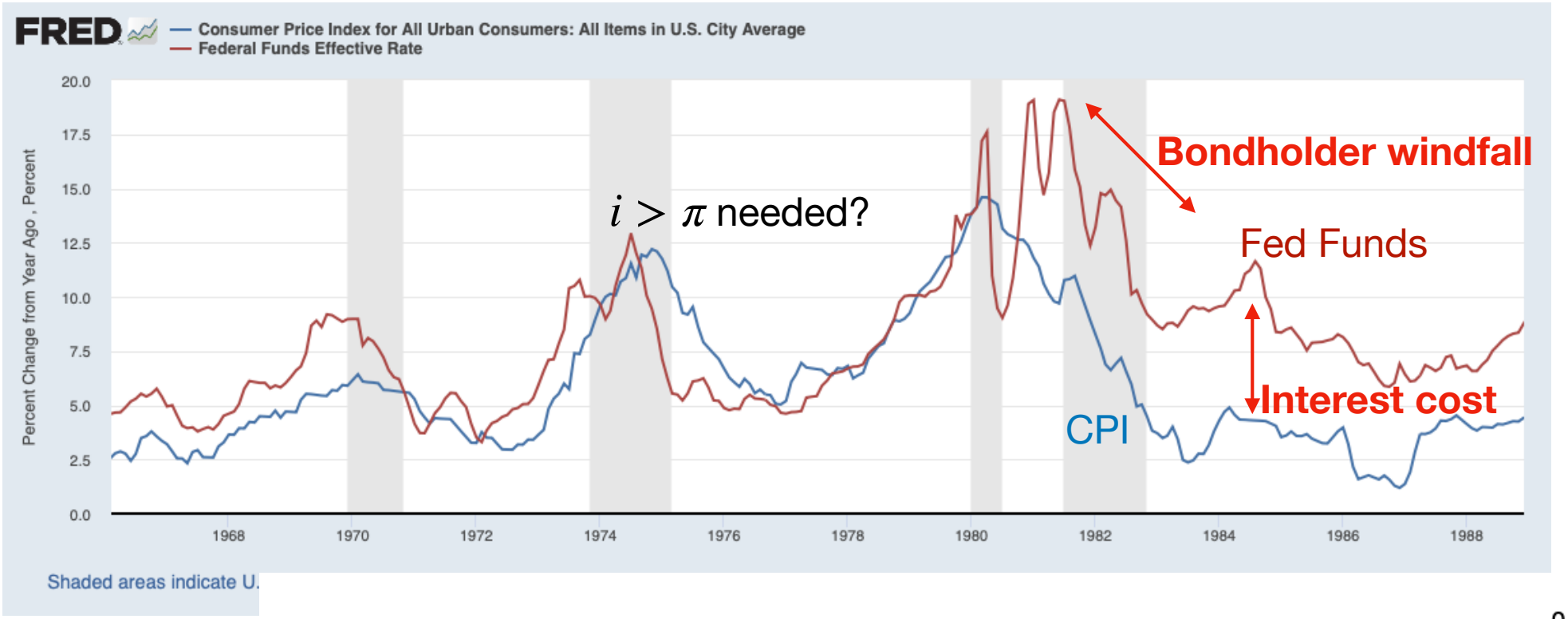


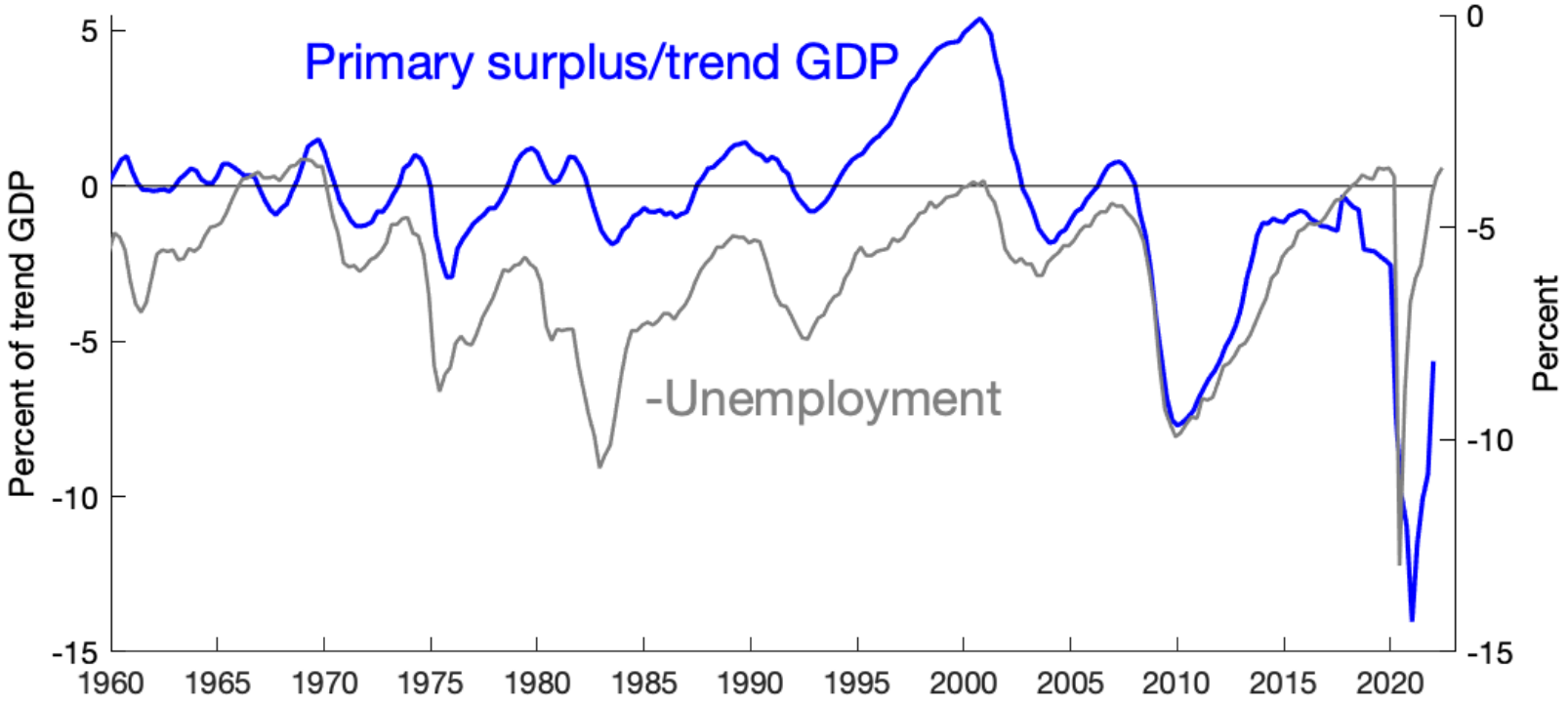
- Disinflation requires fiscal tightening to pay interest costs on debt.
- Paper: Interest rates with no change in fiscal policy *cannot* change long-run inflation. Adaptive expectations doesn't work either!
- Intuition: pv of real interest cost on debt = 0 → average real interest to move inflation = 0.
- $0 = \int_0^\infty e^{-rj} r_j dj;\ \pi_\infty = -\sigma\kappa \int_0^\infty r_j dj\,.$

$$x_t = -\sigma(i_t - \pi_{t-1})$$
$$\pi_t = \pi_{t-1} + \kappa x_t$$
$$\rho v_{t+1} = v_t + i_t - \pi_{t+1}$$
$$i_t = \phi\pi_t + u_t$$
$$\sigma\kappa = 1;\ \phi = 1.5;$$
$$\rho = 0.99$$

(Continuous time)

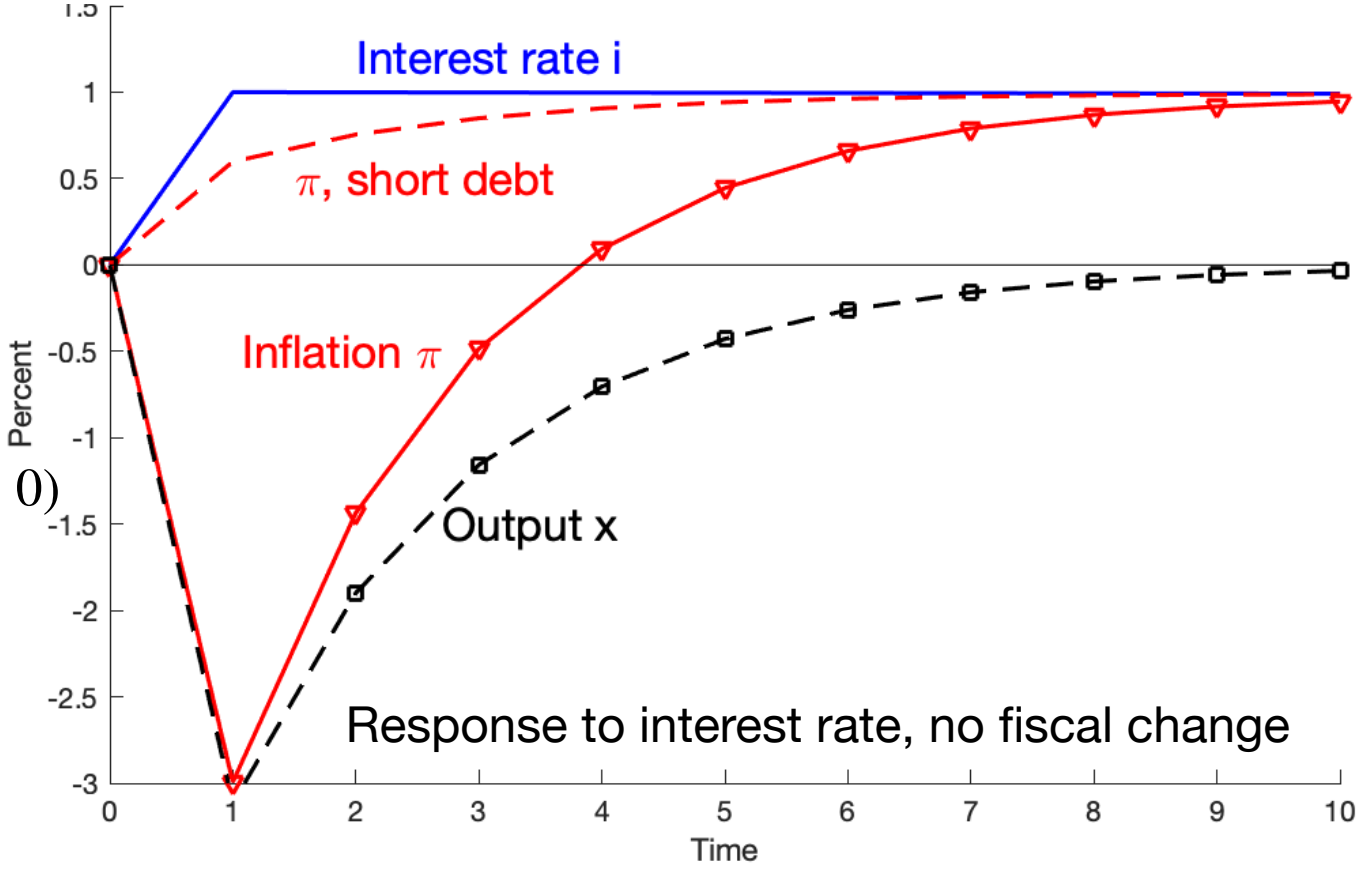
1980s were a joint monetary, fiscal, and microeconomic disinflation





The imperfect best we have so far (without fiscal help)

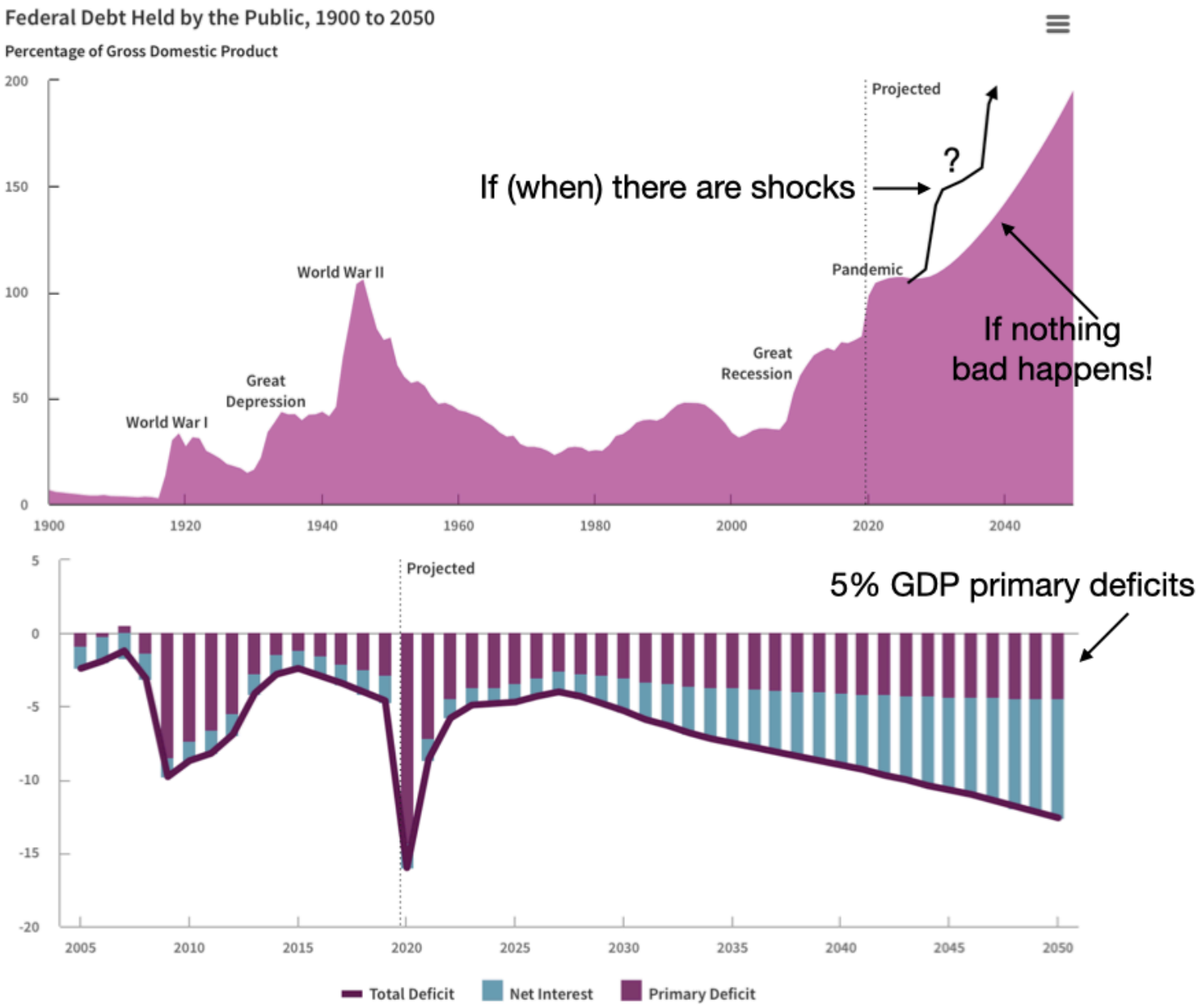
$$x_t = E_t x_{t+1} - 0.5(i_t - E_t \pi_{t+1})$$
$$\pi_t = E_t \pi_{t+1} + 0.5 x_t$$
$$i_t = i_{t-1} + \varepsilon_{i,t}$$
$$\rho v_{t+1} = v_t + r^n_{t+1} - \pi_{t+1} - (\tilde{s}_{t+1} = 0)$$
$$E_t r^n_{t+1} = i_t$$
$$r^n_{t+1} = 0.9 q_{t+1} - q_t .$$



- Only ``unpleasant arithmetic,'' move inflation around; Only unexpected rate rises; Only with long term debt, weaker for short debt. More for longer-lasting rate rises, weaker for transitory rises. *Less* for more sticky prices.
- Works by reallocating wealth among bond holders. Not Sticky prices, raise real rates, lower AD, Phillips curve. On central bank websites / speeches?
- A better model? Empirical work for how rates without fiscal help affect inflation? Or, maybe this is it!

The fiscal future

- CBO: Projection, not expectation. Evidently, people don't think this will happen.
- Danger 1: People lose faith that it will get fixed.
- Danger 2: Next big shock?
- Note: inflation / default will not solve the main problem, future spending!



Inflation's important lessons

Conventional wisdoms now wrong:

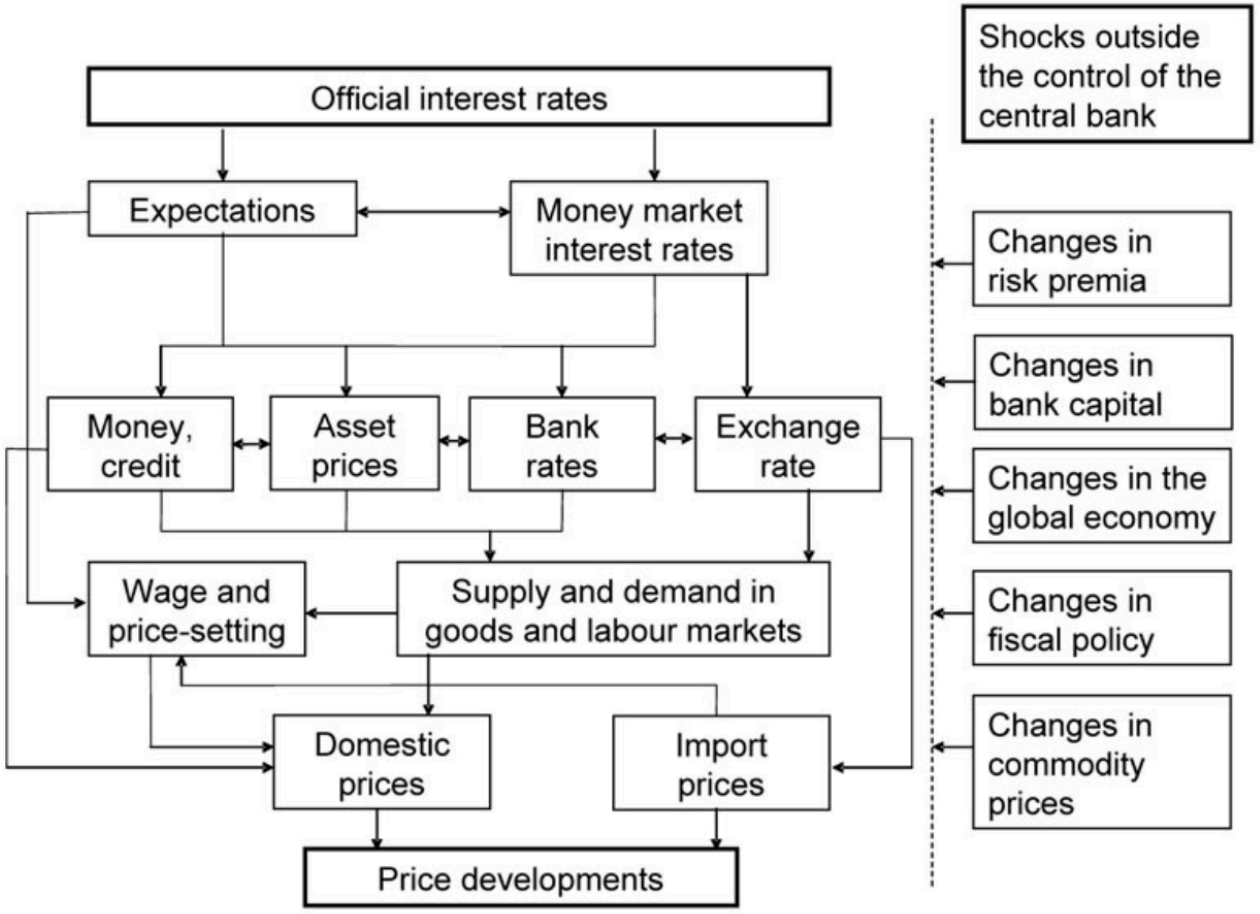
- It's supply; growth now, not demand.
- Secular stagnation, fiscal stimulus.
- MMT, r<g, "go big," debt need not be repaid.
- Endless appetite for debt.
- Endless low real rates, interest costs.
- "Jobs" are now a cost, not a benefit.

The End

(Extra slides for questions)

What we definitely do not know, courtesy ECB

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



Source: https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

Requests for generality

$$
\begin{aligned}
x_t &= E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1}) \\
\pi_t &= \beta E_t \pi_{t+1} + \kappa x_t \\
i_t &= \theta_{i\pi} \pi_t + \theta_{ix} x_t + u_{i,t} \\
\tilde{s}_{t+1} &= \theta_{s\pi} \pi_{t+1} + \theta_{sx} x_{t+1} + \alpha v_t^* + u_{s,t+1} \\
\rho v_{t+1}^* &= v_t^* + r_{t+1}^n - \pi_{t+1}^* - \tilde{s}_{t+1} \\
\rho v_{t+1} &= v_t + r_{t+1}^n - \pi_{t+1} - \tilde{s}_{t+1} \\
E_t \pi_{t+1}^* &= E_t \pi_{t+1} \\
\Delta E_{t+1} \pi_{t+1}^* &= -\beta_s \varepsilon_{s,t+1} - \beta_i \varepsilon_{i,t+1} \\
E_t r_{t+1}^n &= i_t \\
r_{t+1}^n &= \omega q_{t+1} - q_t \\
u_{i,t+1} &= \eta_i u_{i,t} + \varepsilon_{i,t+1} \\
u_{s,t+1} &= \eta_s u_{s,t} + \varepsilon_{s,t+1} \, .
\end{aligned}
$$

Fiscal and monetary rules;
Endogenous surpluses

Surpluses rise to pay
off debts, but still
active fiscal policy

(What about money?)

Theory

- Cash and reserves are government debt.
- Yes, $5 trillion from helicopters = inflation…
- What if you get $5 trillion but give up $5 trillion Treasury bonds? QE did not cause inflation!
- Composition vs. overall quantity of debt. “Wealth” vs. “portfolio” effect. Backing vs. liquidity demand + limited supply.

Apply to our world

- *Fed sets interest rate, not money supply.*
- There are no reserve requirements, limits on inside money.
- M? $3-4 trillion reserves pay market interest. Money and bonds are nearly perfect substitutes.
- Great theory, but MV=PY does not apply to current institutions. Like gold.
- We need *a theory of inflation under interest rate targets, with no money supply control.*

Expectations and the neutrality of interest rates

- Goal: Better model of how interest rates affect inflation. FTPL + NK/DSGE. Ends up needing back to basics.
- What is our basic theory of inflation under interest rate targets, with no money supply control, ~~MV≡PY~~?
- Which minimal central frictions do we need on top of that?
- Do / how do higher nominal rates lower inflation?
- Essay: Analogy to Lucas 1972 “Expectations and the neutrality of money.”

Theory of inflation under interest rate targets

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

$\pi_t = \pi_t^e + \kappa x_t$

Inflation dynamics $\pi_t = (1 + \sigma\kappa)\pi_t^e - \sigma\kappa i_t$. (> 1, < 0)

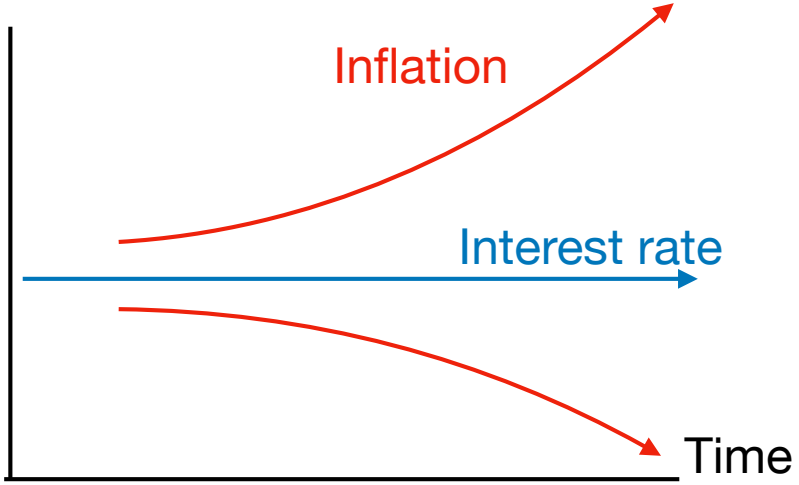
1) Adaptive Expectations $\pi_t^e = \pi_{t-1} \quad \rightarrow \quad \pi_t = (1 + \sigma\kappa)\pi_{t-1} - \sigma\kappa i_t$.

a) Friedman (1968): i peg is *unstable.* Inflation/deflation spirals.

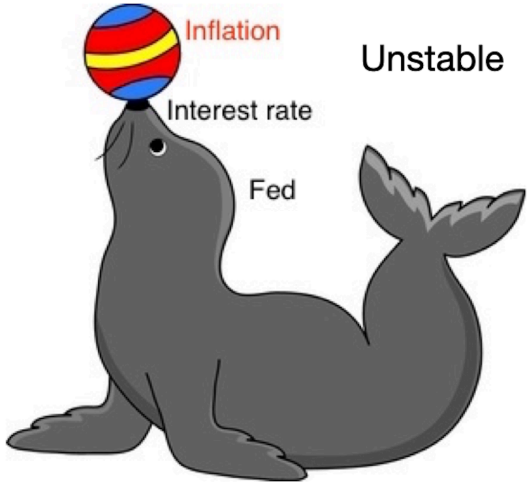
b) Taylor rule + adaptive

$$i_t = \phi\pi_t \quad \rightarrow \quad \pi_t = \frac{1 + \sigma\kappa}{1 + \sigma\kappa\phi}\pi_{t-1} .$$

Fed stabilizes inflation with adaptive E.



c) Higher rates lower (future) inflation. Captures common policy/pundit beliefs.



But… Adaptive expectations always and everywhere, *necessary minimal* component?

Expectations *of* the model ≠ expectations *in* the model?

There *is no* simple, rational theory for the basic sign and operation of monetary policy?

Theory of inflation under interest rate targets

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

$\pi_t = \pi_t^e + \kappa x_t$

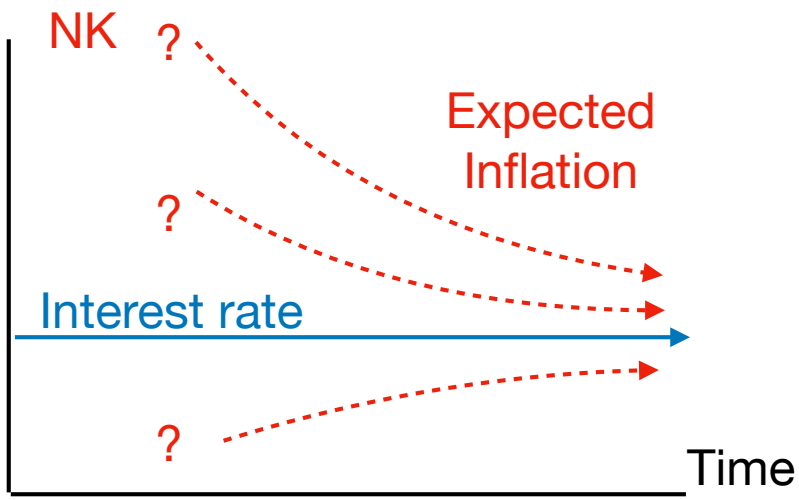
Inflation dynamics $\pi_t = (1 + \sigma\kappa)\pi_t^e - \sigma\kappa i_t\,.$

2) Rational expectations $\pi^e = E_t\pi_{t+1} \quad \rightarrow \quad E_t\pi_{t+1} = \dfrac{1}{1+\sigma\kappa}\pi_t + \dfrac{\sigma\kappa}{1+\sigma\kappa} i_t$ ($1 < 1$, $\sigma\kappa > 0$)

a) Sargent-Wallace (1975): Inflation is *stable*, but *indeterminate* under a peg.

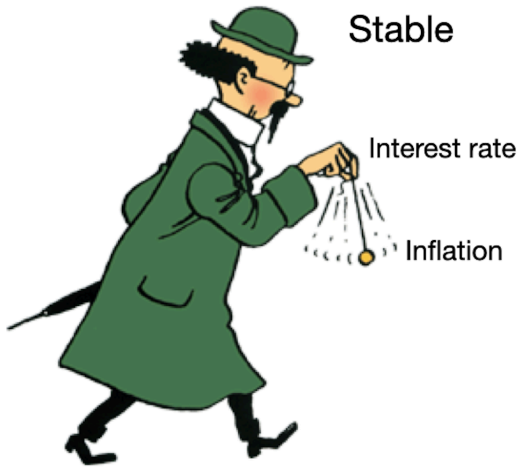
b) New-Keynesian.

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



- Central bank *destabilizes* inflation to select equilibria. Opposite of adaptive model.
- Central banks don't do that.

c) Higher interest rates *raise* inflation unless there is a jump to a different equilibrium. Lower inflation comes from equilibrium selection.



New-Keynesian equilibrium selection

Flex price model for really simple algebra:

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

Equilibrium:

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

$i_t = i_t^*;\ \pi_t = \pi_t^*$ is the unique non-explosive (locally bounded) equilibrium.

- Central bank picks inflation target $\{\pi_t^*\}$. Implement with an *interest rate policy* $i_t^* = E_t \pi_{t+1}^*$ (observed) that sets expected inflation, and a separate *equilibrium selection policy* (unobserved off-equilibrium threats) destabilizing the economy for all but one unexpected inflation.
- The central bank *fully* determines inflation.
- *Central banks don't do this.* Like MV=PY, gold, another beautiful theory that does not apply to current institutions.
- Whether interest raise or lower inflation depends entirely on equilibrium selection.
- "Open mouth" operation. Iid $\{\pi_t^*\}$, i_t is constant, π_t is any desired iid process!

Theory of inflation under interest rate targets

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

$\pi_t = \pi_t^e + \kappa x_t$

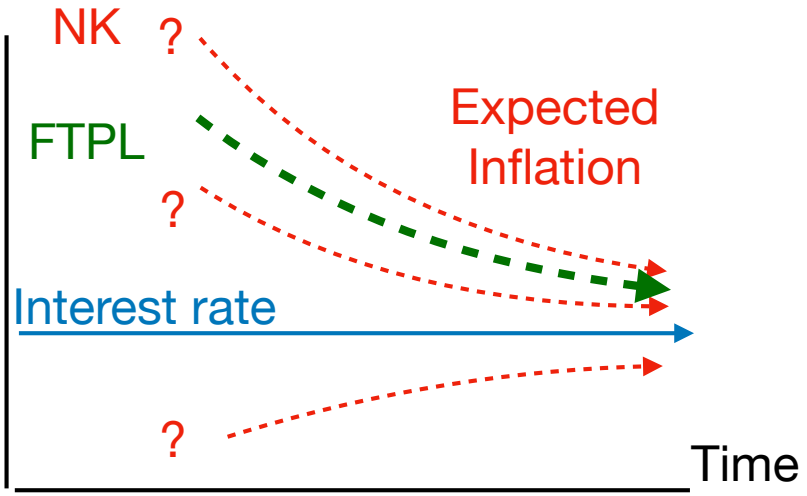
Inflation dynamics $\pi_t = (1 + \sigma\kappa)\pi_t^e - \sigma\kappa i_t\,.$

2) Rational expectations $\pi^e = E_t\pi_{t+1} \quad \rightarrow \quad E_t\pi_{t+1} = \dfrac{1}{1+\sigma\kappa}\pi_t + \dfrac{\sigma\kappa}{1+\sigma\kappa} i_t$ ($1 < 1$, $\sigma\kappa > 0$)

c) Fiscal theory of the price level

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

- **Inflation is *stable* and *determinate* (at last); obeys *long-run neutrality*.**
- **A complete theory of inflation under an interest rate target, like MV=PY, but consistent with today's institutions.**
- **The only such theory we have! "Test?"**



d) Issues:

- *Is* inflation stable/determinate under a peg?
- Do higher interest rates raise/lower inflation?