The Liquidity Trap and Negative Natural Interest Rate

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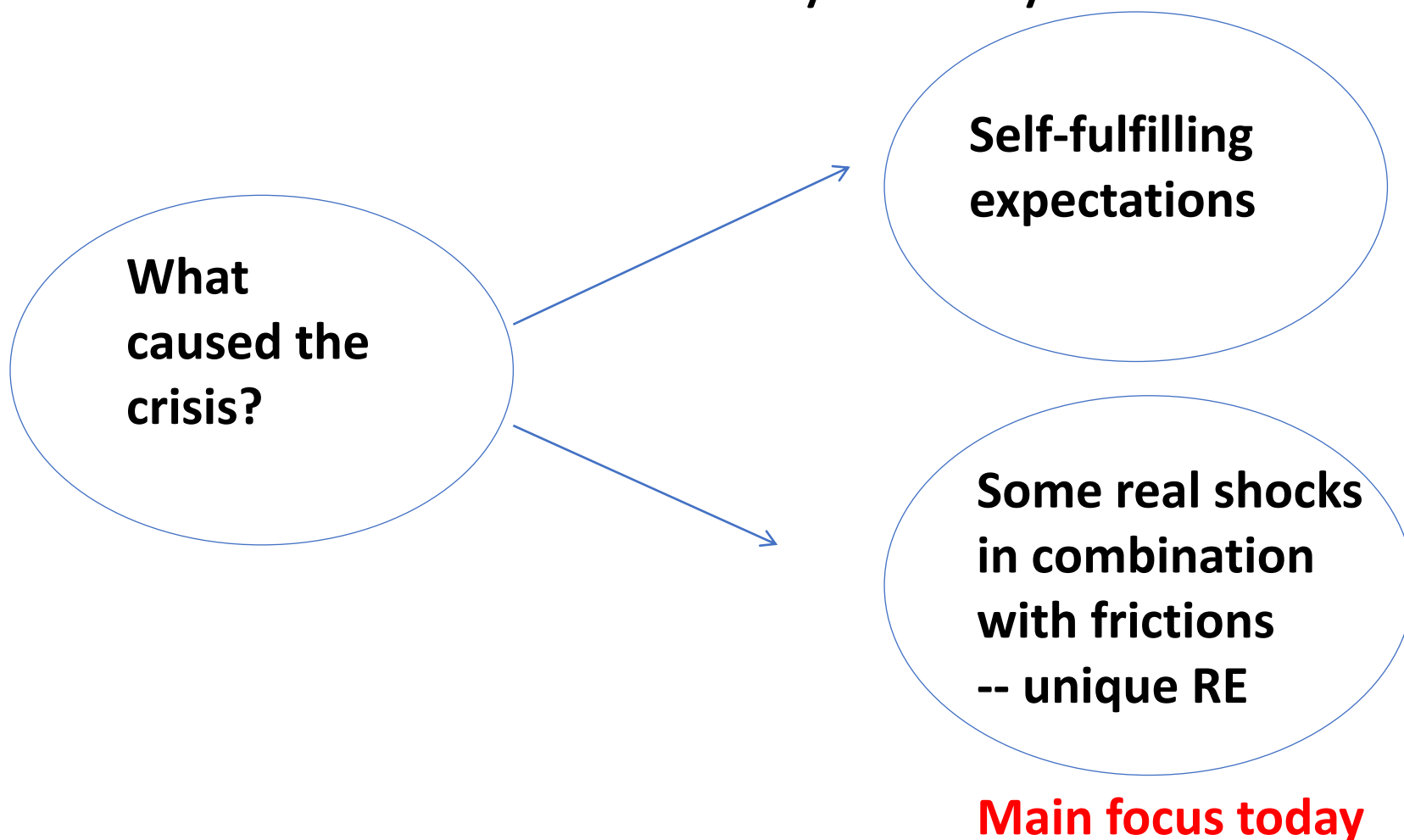
The crisis:
What did we know and when did we know it?

- Common perception that the economic profession was caught flat-footed in 2008

- Want to argue: Key aspects of the crisis was understood prior to 2008 due to work on Japan and the Great Depression.

- Events led to important revision, but perhaps more of extension and refinement than revolutionizing the framework.

- It it true, however, that some conclusion were not widely accepted, and still disputed.

- Will review the amended framework, what was known, what is debated and speculate on what needs to be done.

A particular perspective: Fork in the road I took very early on

What caused the crisis?

Self-fulfilling expectations

Some real shocks in combination with frictions -- unique RE

Main focus today

Outlined

1. Baseline parable: Elements of a synthesis
   - Negative natural interest rates
   - Nominal frictions

2. Dynamics of a crisis in a fixed policy regime
   - Missing deflation?
   - Tax and spending multipliers
   - Paradoxes

3. Policy Expectations and Regime Changes

4. Conclusions

I. The Origin of the Crisis

in a stripped down model

-- and discussion of basic QE, Irrelevance Results

What caused the crisis?

Ingredients:

Natural rate of interest negative:
- Debt deleveraging shock
- Banking crisis
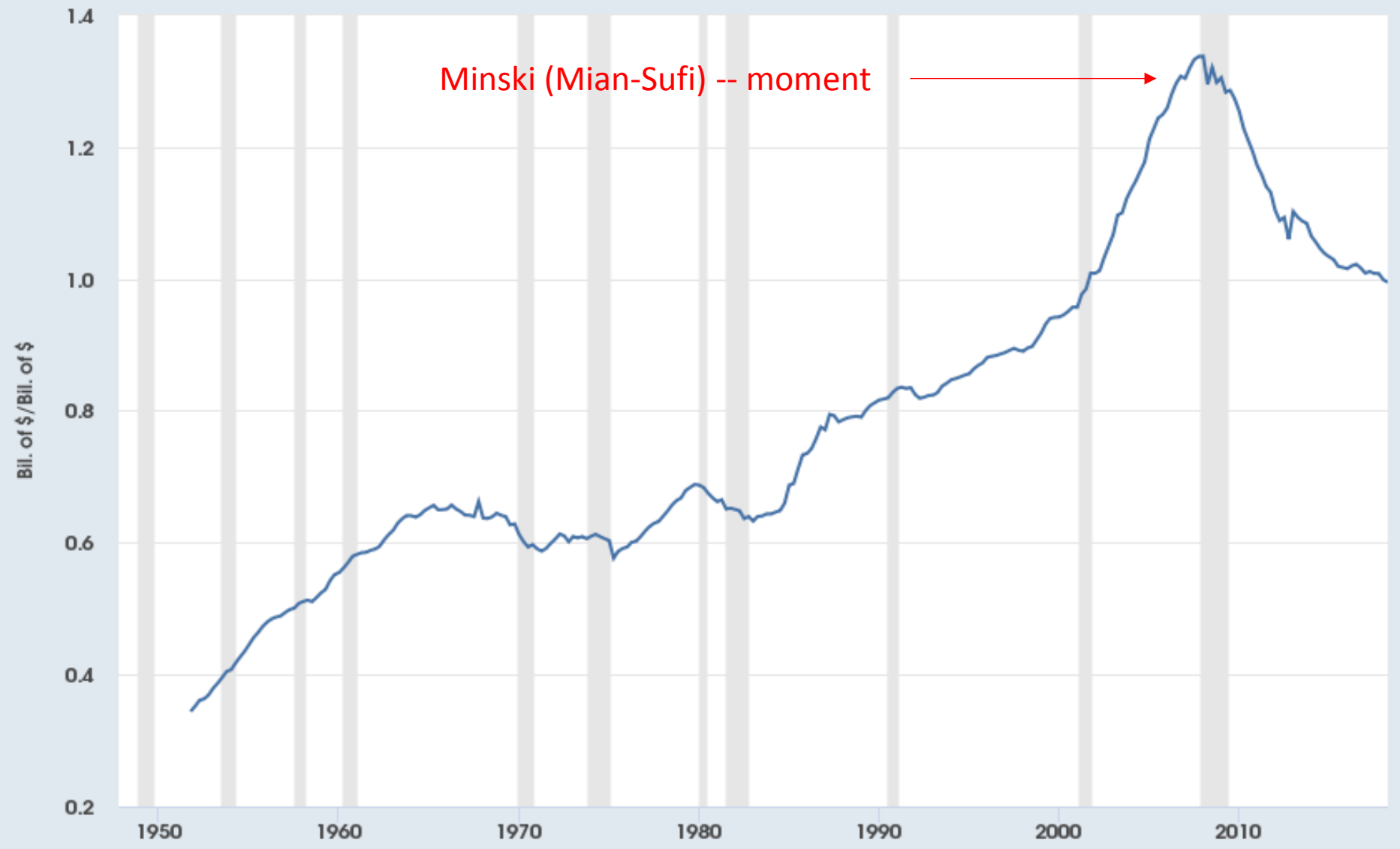- Slow moving forces like demographics, income inequality

Trigger

$$r_t^n < 0$$

Propagation

$$r_t^n < r_t = i_t - E_t \pi_{t+1}$$

ZLB

Price and wage frictions

FRED — Households and Nonprofit Organizations; Credit Market Instruments; Liability, Level/Disposable Personal Income

Minski (Mian-Sufi) -- moment

Bil. of $/Bil. of $

Shaded areas indicate U.S. recessions

Sources: BEA, Board of Governors

myf.red/g/IMd4

$$E_0 \sum_{t=0}^{\infty} \beta(i)^t \log C_t(i) \text{ with } i = s \text{ or } b$$

$$D_t(i) = (1 + r_{t-1})D_{t-1}(i) - \frac{1}{2}Y + C_t(i)$$

$$(1 + r_t)D_t(i) \le D^{high} > 0 \qquad \beta(s) = \beta$$

steady state

$$C^b = \frac{1}{2}Y - \frac{r}{1+r}D^{\boxed{low}} \qquad C^s = \frac{1}{2}Y + \frac{r}{1+r}D^{\boxed{low}} \qquad r = \frac{1-\beta}{\beta}$$

$$D^{high} \longrightarrow D^{low} \qquad S \text{ and } L \qquad 1 + r_S = \frac{\frac{1}{2}Y + D^{low}}{\beta\frac{1}{2}Y + \beta D^{high}} \qquad \longleftarrow \text{ Can be negative!}$$

$$\frac{1}{C_t^s} = (1+i_t)bE_t \frac{1}{C_{t+1}^s} \frac{P_t}{P_{t+1}} \qquad \frac{M_t}{P_t} \geq \chi Y_t$$

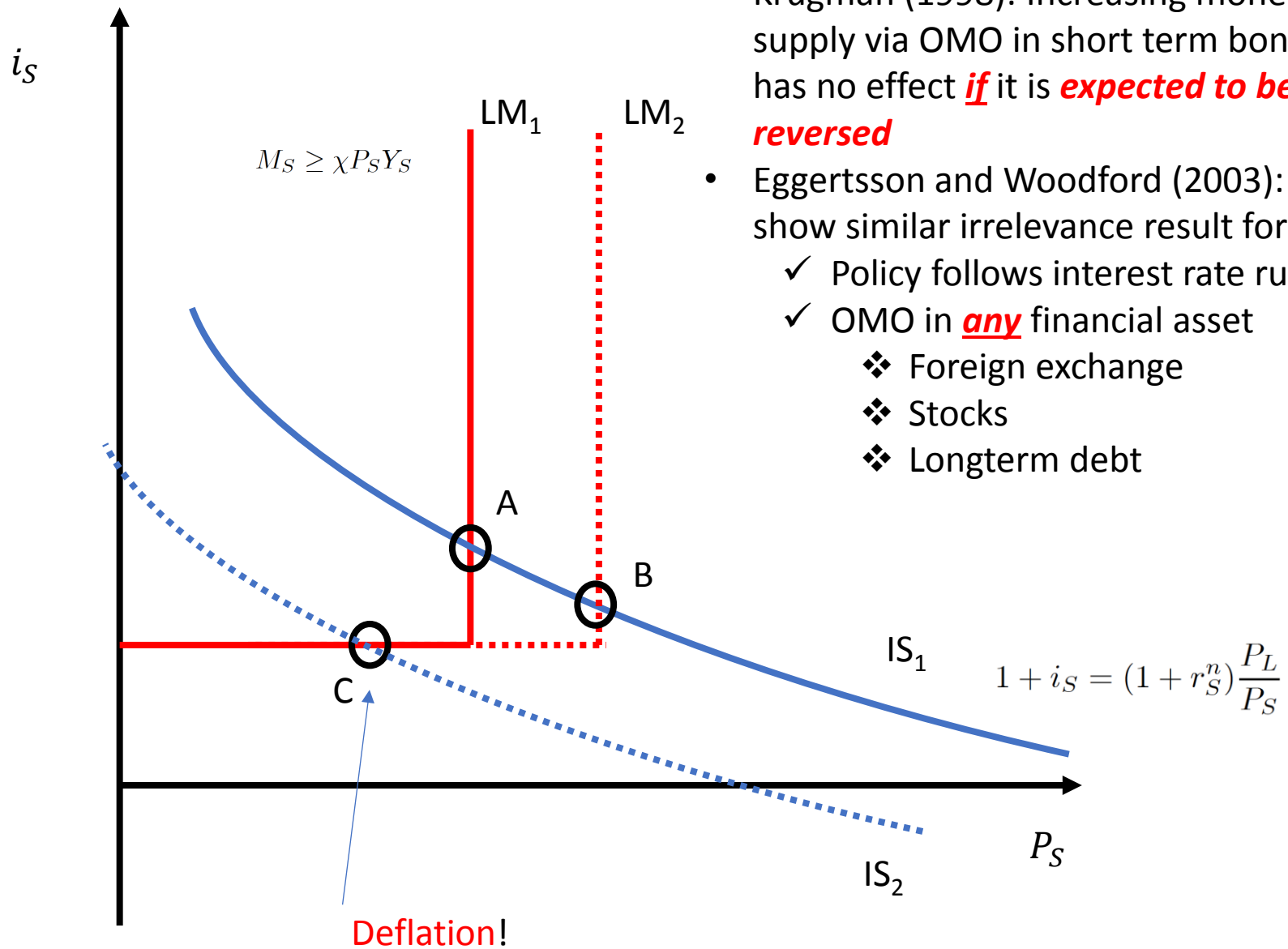**long run**

$$M_L = M^*$$
$$P_L = P^*$$
$$Y_L = Y^*$$

$$1 + i_S = (1 + r_S^n)\frac{P_L}{P_S} \qquad \text{IS}$$

$$M_S \geq \chi P_S Y_S \qquad \text{LM}$$

i_S

$M_S \geq \chi P_S Y_S$

LM_1 LM_2

A

B

IS_1

$1 + i_S = (1 + r_S^n)\frac{P_L}{P_S}$

C

P_S

IS_2

Deflation!

Irrelevance Result:
- Krugman (1998): Increasing money supply via OMO in short term bonds has no effect **_if_** it is **_expected to be reversed_**
- Eggertsson and Woodford (2003): show similar irrelevance result for
   - ✓ Policy follows interest rate rule
   - ✓ OMO in **_any_** financial asset
      - ❖ Foreign exchange
      - ❖ Stocks
      - ❖ Longterm debt
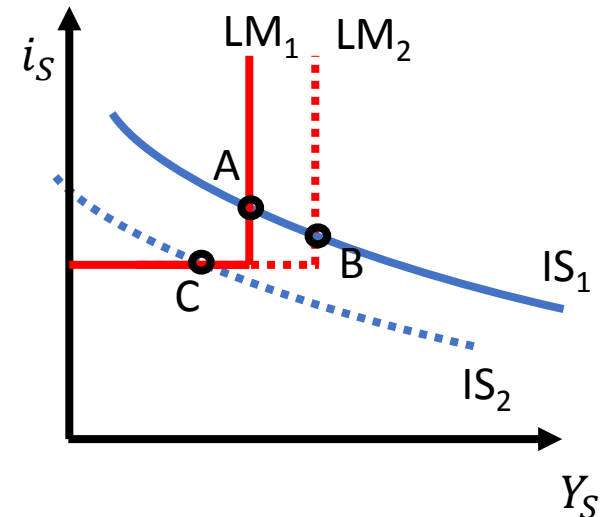
Simple theory of slump

Suppose firm produce using L_t^{α}

Suppose $\quad\quad P_S = fixed$

Rationing equilibrium like Barro-Grossman

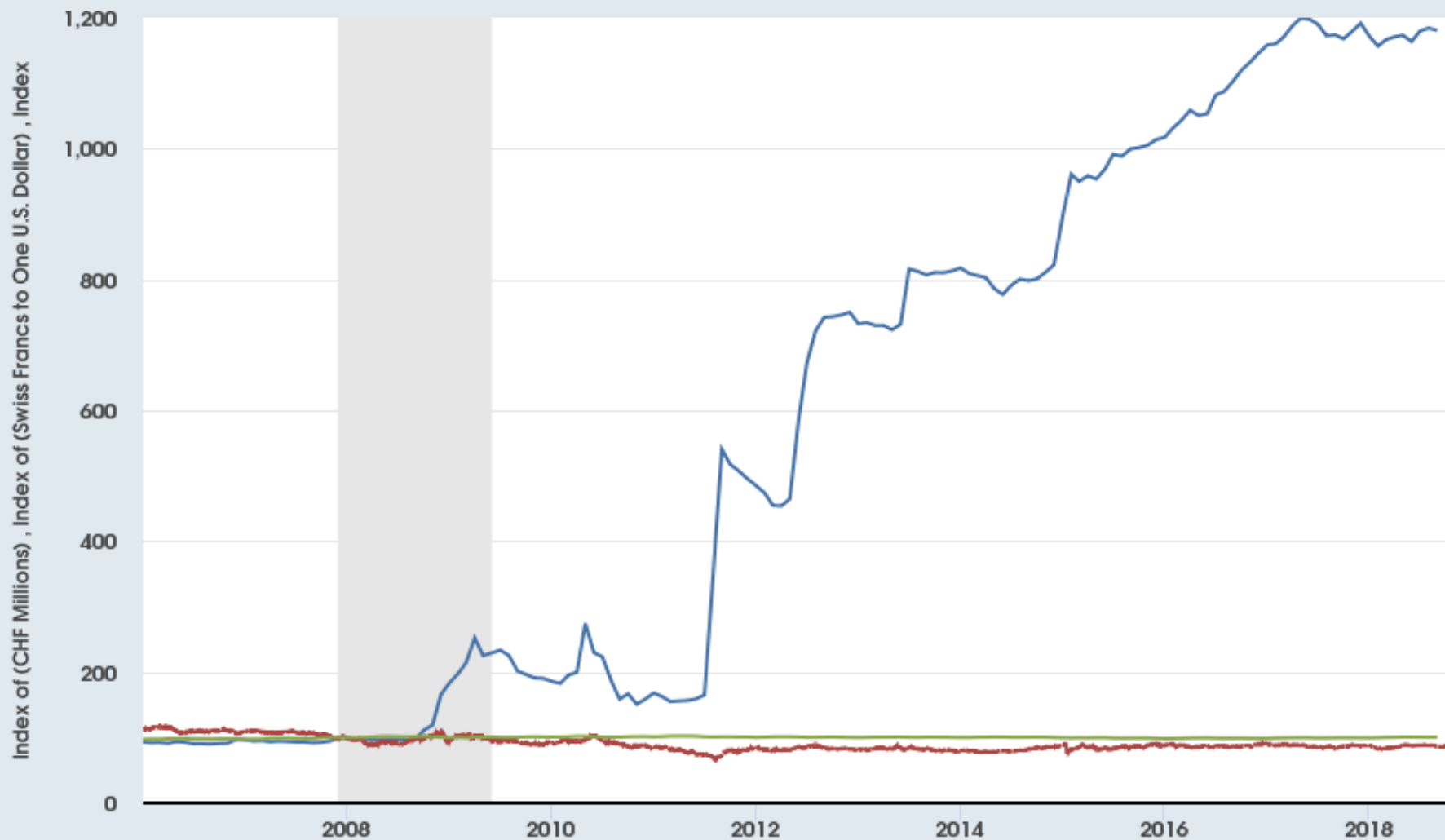$$1 + i_S = \frac{\frac{P_L}{P_S}(1 + r_S^n)}{1 + \frac{1 + r_S^n}{2D^{low}}(Y_S - Y^n)}$$

$$M_S \geq \chi P_S Y_S$$

Irrelevance of increase in money on output

FRED 〰

- (Swiss Monetary Base Aggregate), Dec 2007=100
- (Switzerland / U.S. Foreign Exchange Rate), 2007-12-01=100
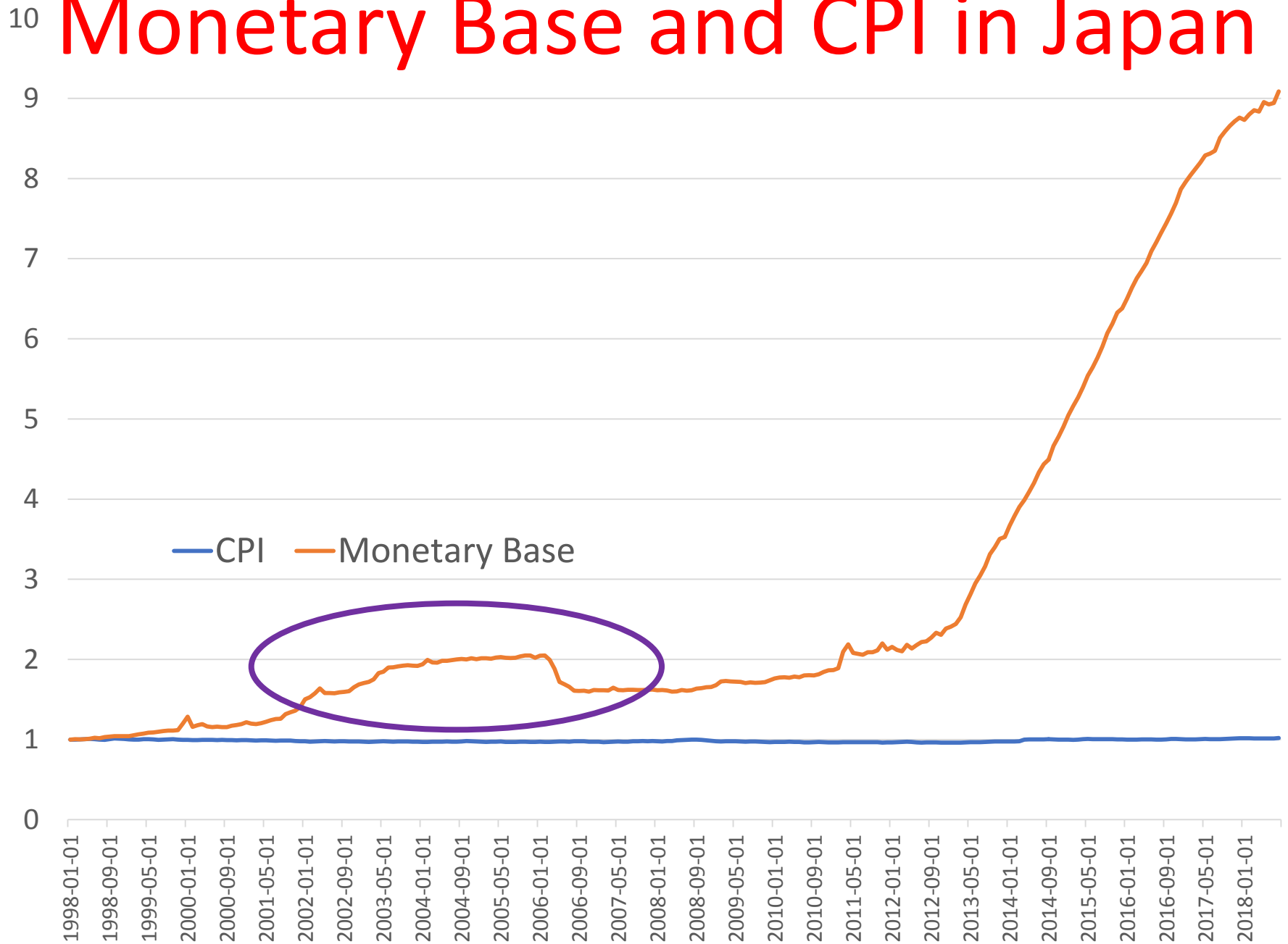- Consumer Price Index: All Items for Switzerland, Dec 2007=100

Index of (CHF Millions) , Index of (Swiss Francs to One U.S. Dollar) , Index

Shaded areas indicate U.S. recessions

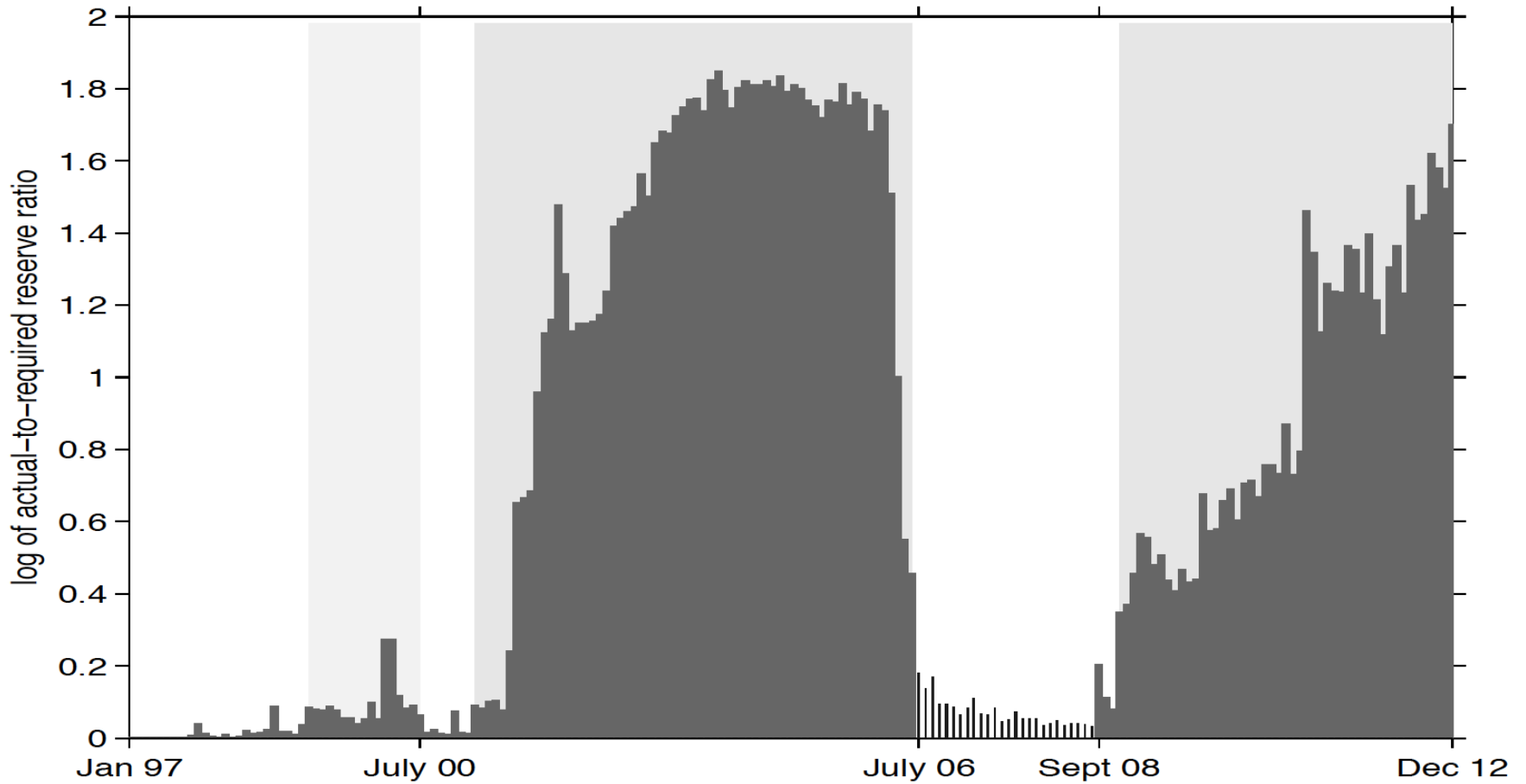Sources: Board of Governors, OECD, Swiss National Bank

myf.red/g/IMTI

Monetary Base and CPI in Japan

Japan

Figure 2a: Excess Reserve Rate, 1997 - 2012

Note: The shades indicate the three spells of the zero-rate period.

Shirakawa in fall of 2003 at BOJ:

I really like your irrelevance result about QE -- Eggertsson Woodford (2003).
I have been saying the same for years.
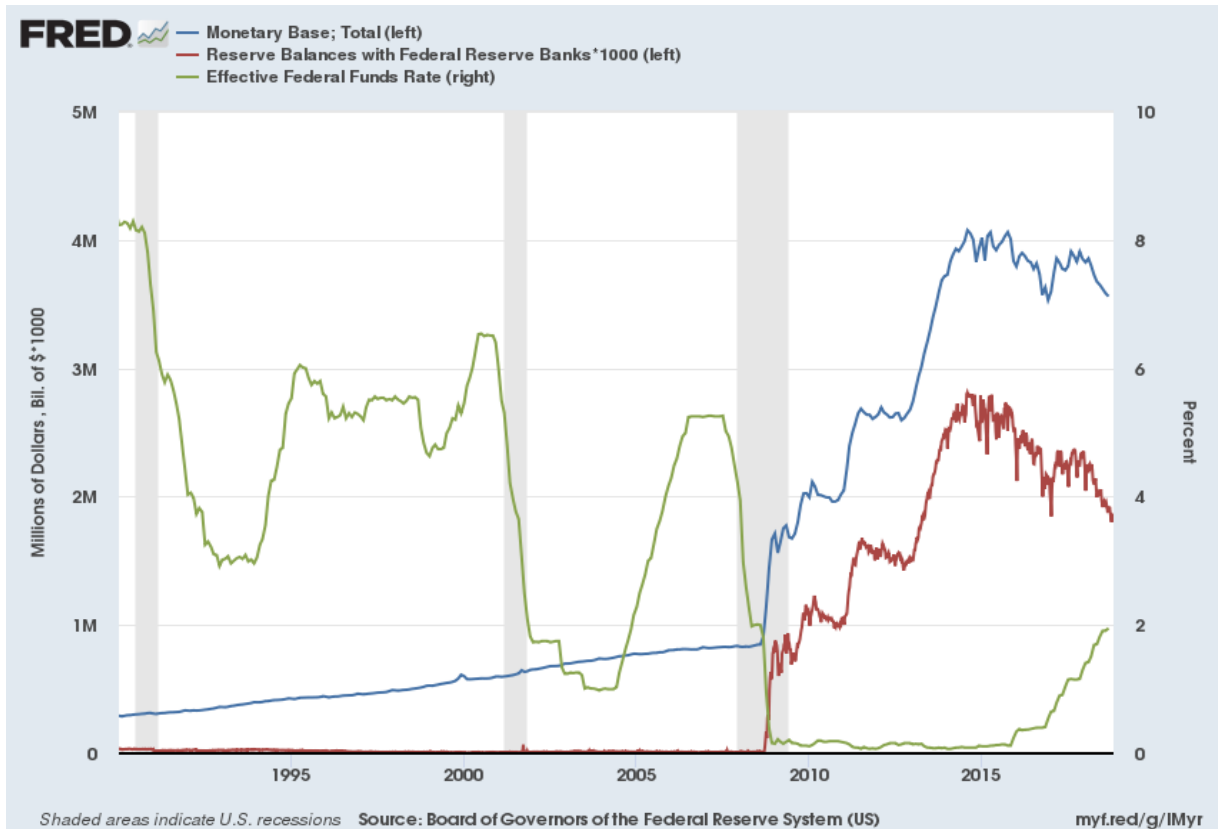**QE is irrelevant.**
And that is why we do it.

Views in late 90's early 2000s on the liquidity trap

"No one should seriously believe that the BOJ would face any significant technical problems in inflating if it puts it mind to the matter, liquidity trap or not. For example, one can feel quite confident that if the BOJ were to issue *__a 25 percent increase in the current supply and use it to buy back 4 percent of government nominal debt__*, inflationary expectations would rise."
Ken Rogoff, in 1998 discussion of Krugman (1998) analysis of Japan.
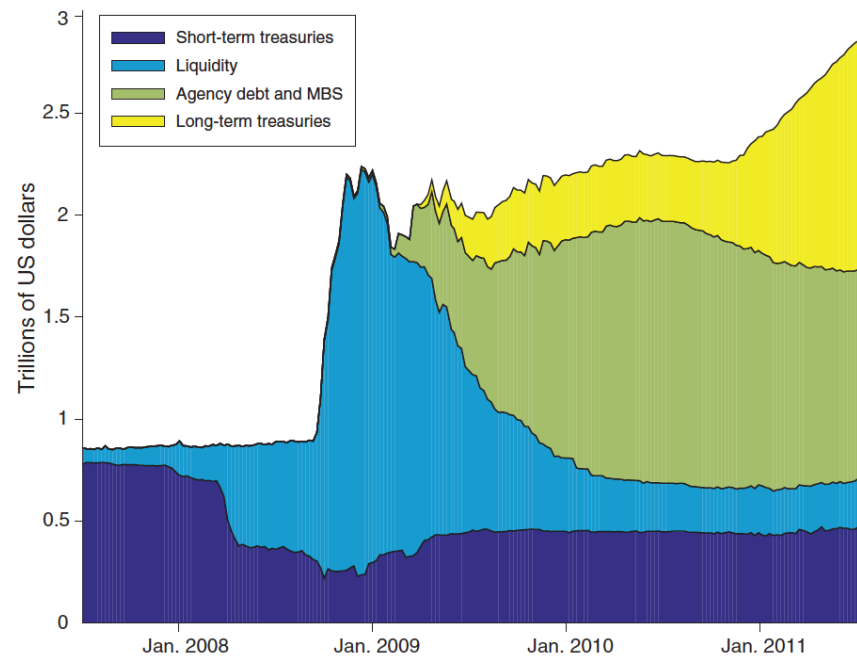
Meanwhile in the US....

Consesus:

Monetary base is Irrelevant!!

.... started paying interest on reserves

Missing

- Theory of why QE mattered

- QE: Theories of assets different in degree of liquidity

- Example: series of paper by Kiyotaki-Moore
  - Post Crisis: Del Negro, Eggertsson, Kiotaki and Ferrero (AER, 2017): The Great Escape?
  - Prevented a Second Great Depression?

- Still missing: Theory of QE2 and QE3
  - Silva (2016) – risk channel
  - King (2015) – portfolio balance channel
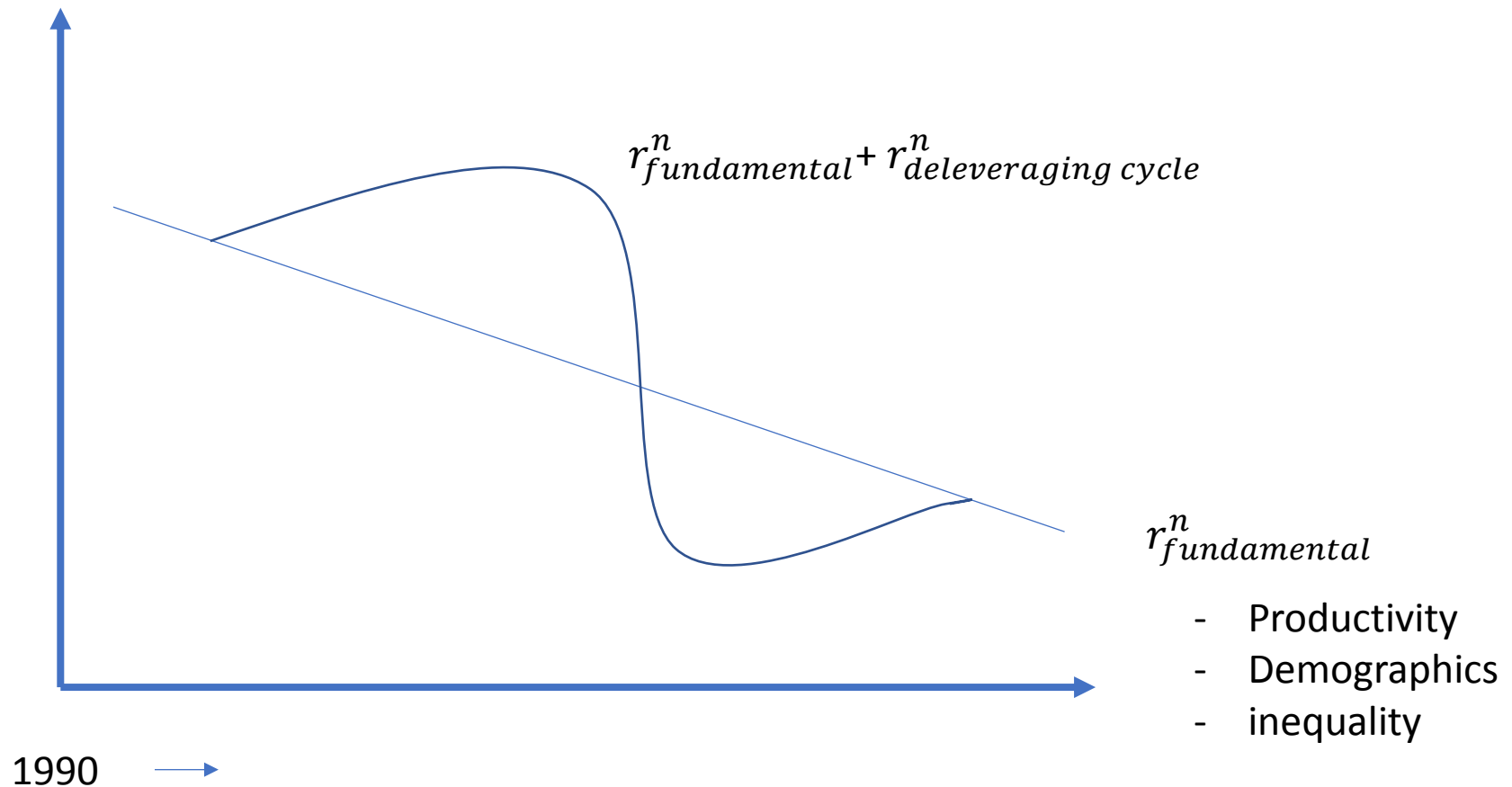 - Bhattarai, Eggertsson and Gafarov (2016) - signalling channel

Missing

- Why long
rates still
so low?
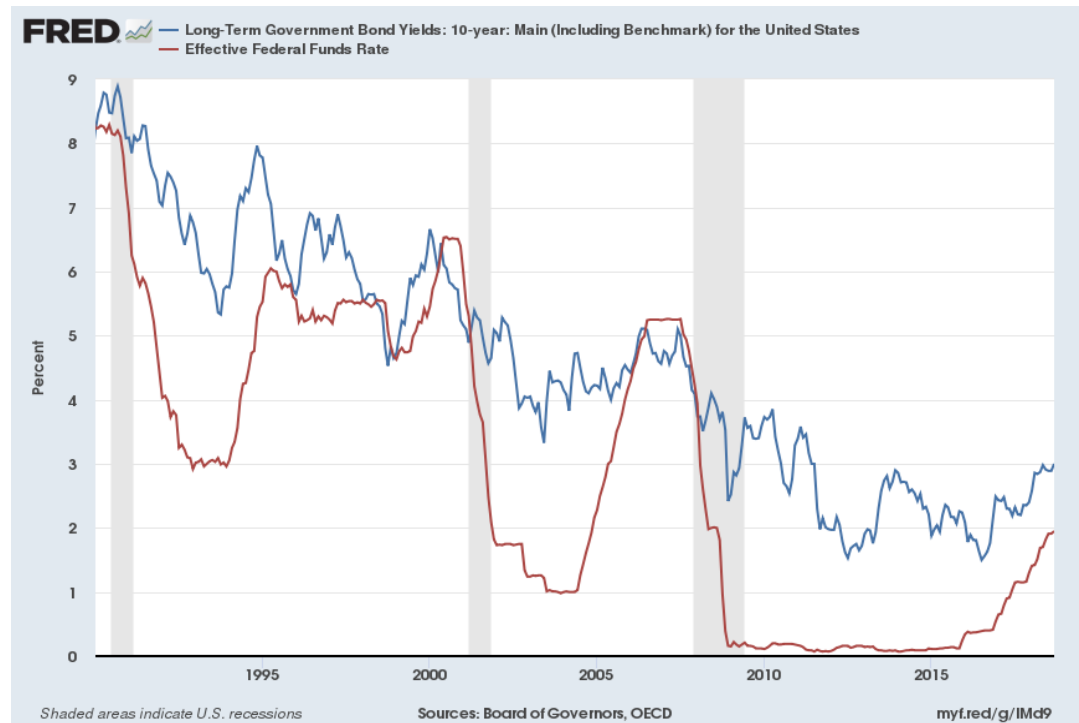
- Post crisis theories have emerged explaining persistent fall in the natural rate
    - Under the rubric "secular stagnation"
    - Hansen (1938), Summers (2014), Eggertsson, Mehrotra and Robbins (2018)
    - Permanently negative natural rates pose challenge to conventional theory of monetary policy.

Towards a more general theory

$$r^n_{fundamental} + r^n_{deleveraging\ cycle}$$

$$r^n_{fundamental}$$

- Productivity
- Demographics
- inequality

1990

II. Dynamics and Basic Policy Responses

in absence of a monetary policy regime changes

-- missing deflation?

Summarizing the model

shock

AD $\quad \hat{Y}_t = \delta E_t \hat{Y}_{t+1} - \sigma\delta\left(i_t - E_t\pi_{t+1} - r_t^e\right)$

People determine "demand", i.e. overall spending

AS $\quad \pi_t - \pi^* = \kappa\hat{Y}_t + \beta\alpha E_t(\pi_{t+1} - \pi^*)$

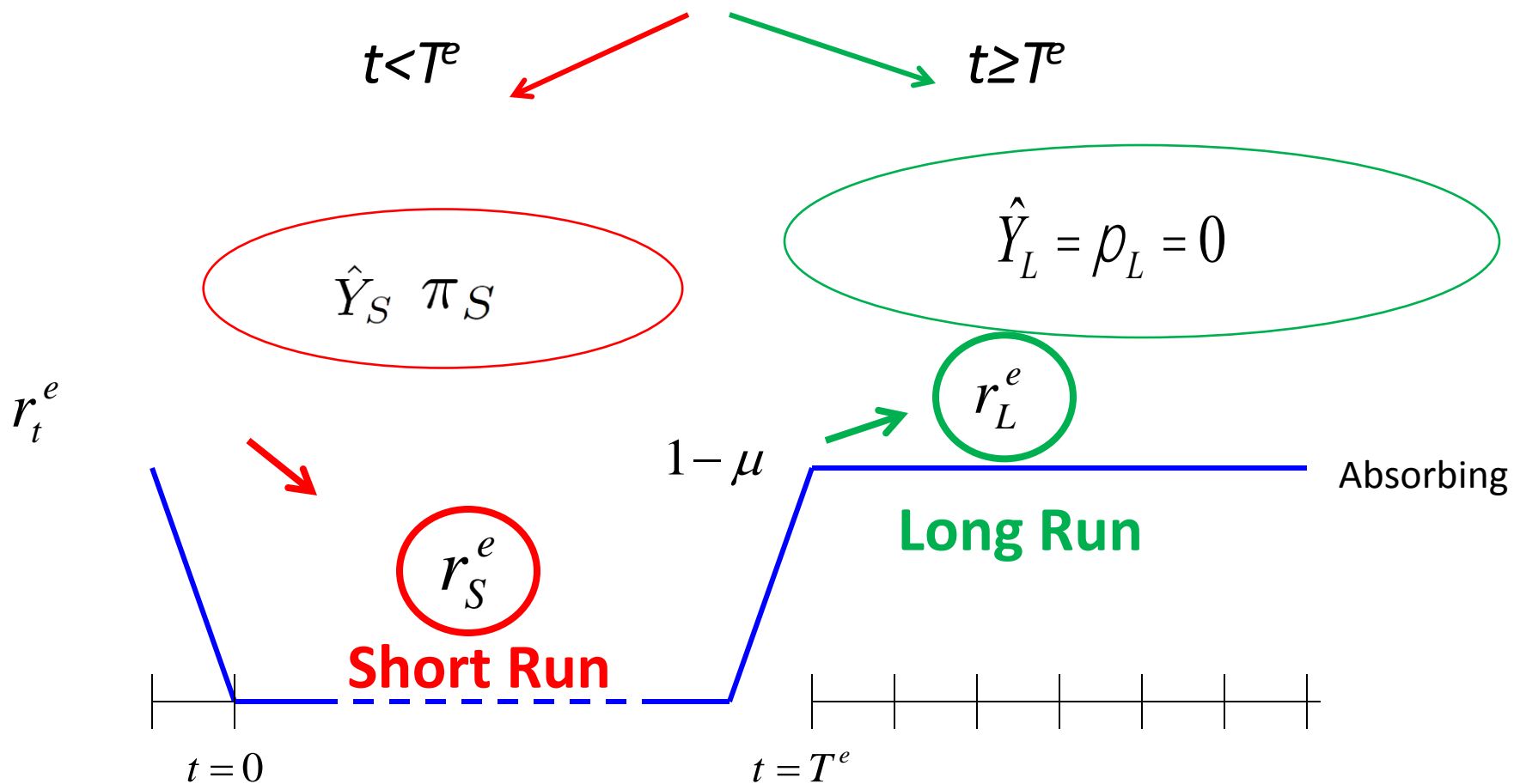Firms supply whatever is demanded but demand has effect on their pricing

ZB $\quad i_t \geq 0$

$r_t^e \equiv \log\beta^{-1} + \hat{\hat{\xi}}_t - E_t\hat{\hat{\xi}}_{t+1}$

Two states:
short run and long run
transition prob 1-μ.

$t < T^e$

$t \geq T^e$

$\hat{Y}_S \quad \pi_S$

$\hat{Y}_L = \rho_L = 0$

r_t^e

r_L^e

$1 - \mu$

Absorbing

Long Run

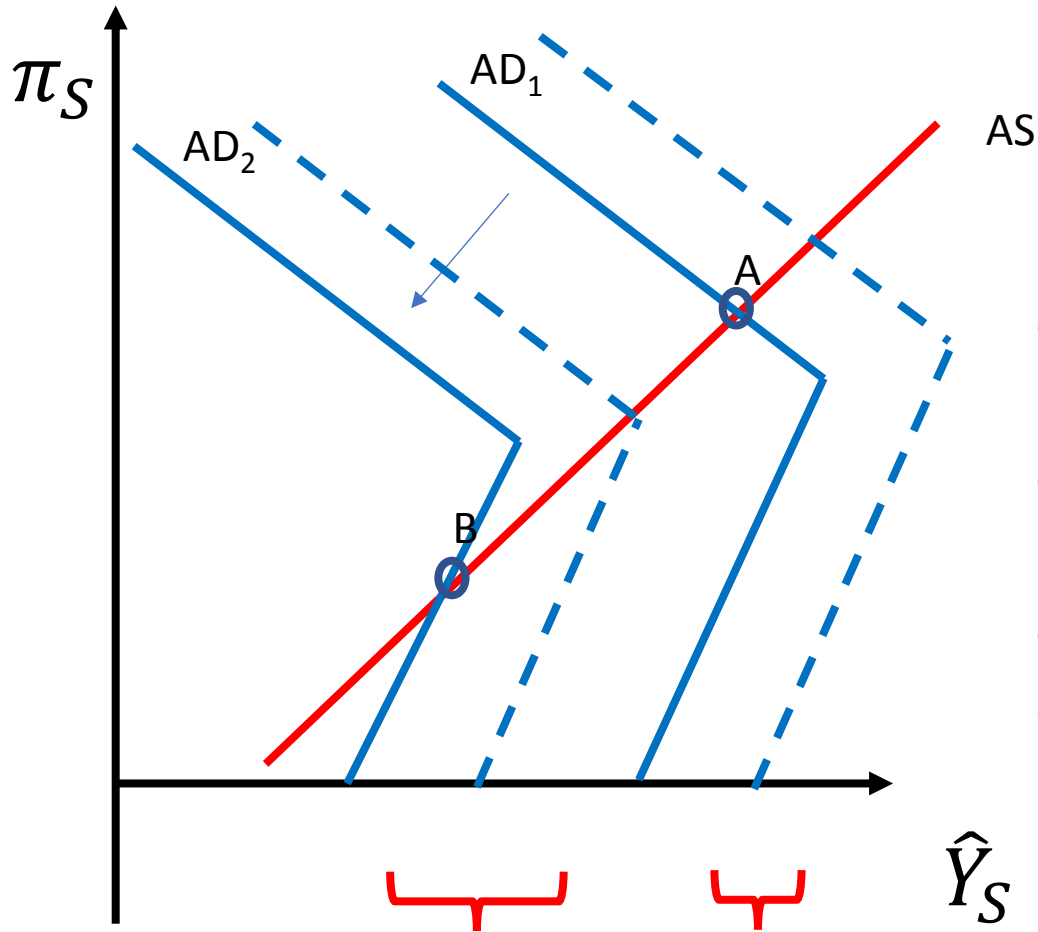r_S^e

Short Run

$t = 0$

$t = T^e$

Baseline policy

$$i_t = \max\{0, r_t^e + \pi^* + \phi_\pi(\pi_t - \pi^*) + \phi_y \hat{Y}_t\}$$

$$\hat{G}_t = 0 \text{ and } \hat{\tau}_t^{\ s} = \hat{\tau}_t^{\ w} = \hat{\tau}_t^{\ p} = \hat{\tau}_t^{\ A} = 0$$

Emphasis here:
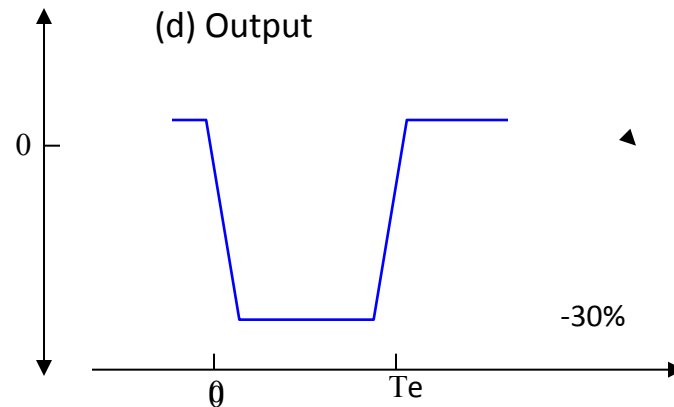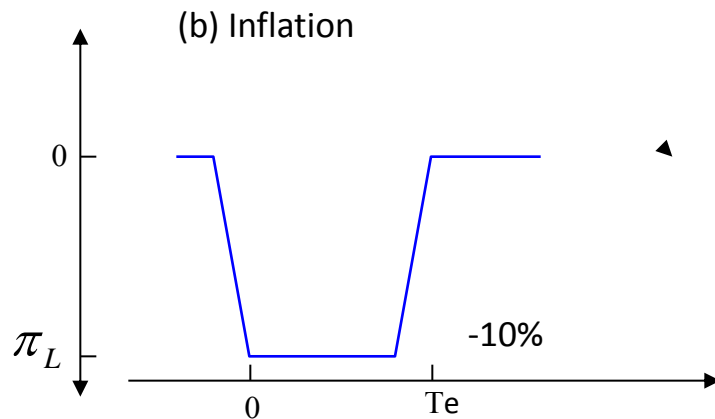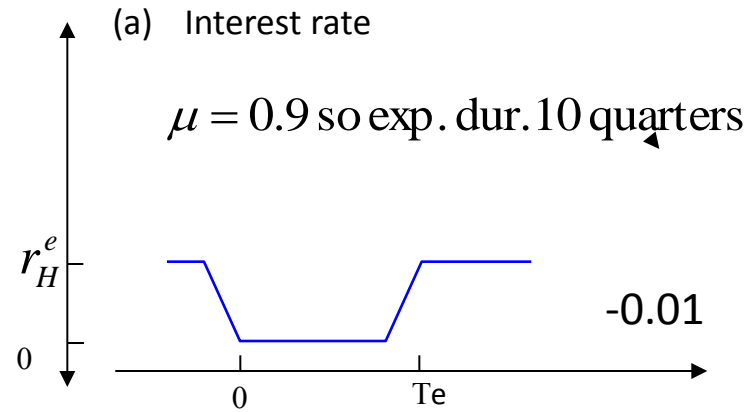Policy on the *margin,* i.e. "multipliers"

Implications:

- Government spending multipliers higher at ZLB
- Spending can be self-financing
- Paradox of thrift and toil
- **Evidence?**

$$\hat{Y}_S = \begin{cases} \frac{\sigma\delta(\phi_\pi-\mu)}{1-\delta\mu-\sigma\delta\phi_y}(\pi_S - \pi^*) & v \\ \\ \frac{\sigma\delta\mu}{1-\delta\mu}\pi_S + \frac{\sigma\delta\mu}{1-\delta\mu}r_S^e & v \end{cases}$$

$$\pi_t - \pi^* = \frac{\kappa}{1-\mu\alpha\beta}\hat{Y}_S$$

Output collapse

(a)   Interest rate

$\mu = 0.9$ so exp. dur. 10 quarters

r_H^e

0

Te

-0.01

(b) Inflation

0

π_L

0   Te

-10%

(d) Output

0

0   Te

-30%

Why output collapse?

$$\hat{Y}_t = E_t \hat{Y}_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r_t^e)$$

Expectations of future
deflation → EY(t+1) very
negative → vicious cycle→
Output collapse

Real interest rates were in
double digits in 29-33 due
to deflation

Missing deflation?

Personal Consumption Expenditures Excluding Food and Energy (Chain-Type Price Index)

Shaded areas indicate U.S. recessions   Source: U.S. Bureau of Economic Analysis   myf.red/g/IMBy
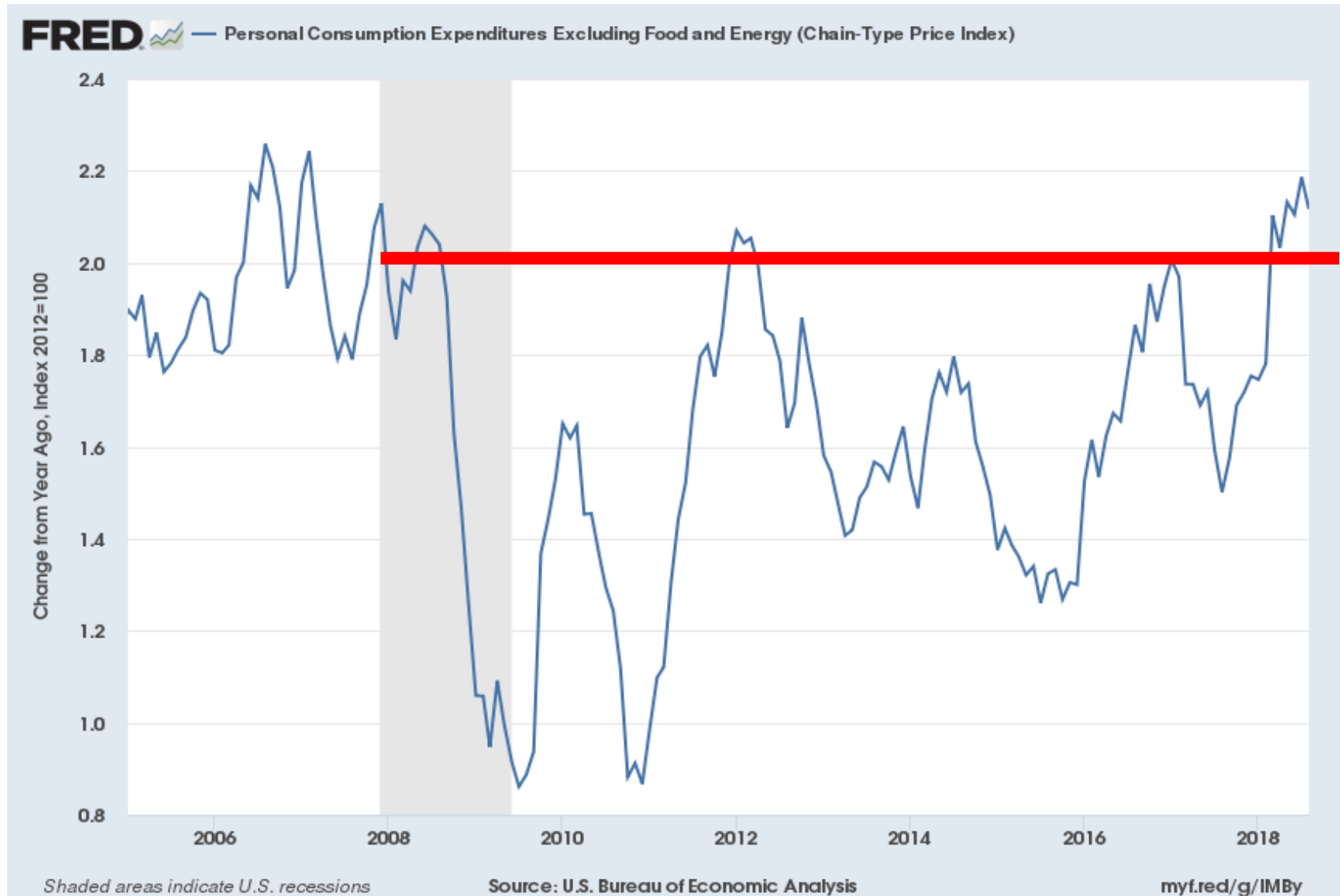
Missing deflation?

$$\pi_t - \pi_{t-1} = \kappa \hat{Y}_t$$ Only a puzzle for "Old" Keynesians

Del Negro, Giannoni and Schorfeide: "Inflation in the Great Recession and New Keynesian Models" American Economic Journal: Macroeconomics

$$\pi_t - \pi^* = \kappa \hat{Y}_t + \beta \alpha E_t(\pi_{t+1} - \pi^*)$$

Theories of price setting still very incomplete.
But Great Recession posed no more challenge to those theories than already existed

Problem: NK model "too" forward looking

- Cannot study long lasting slumps (model explodes)

- Forward guidance puzzle.

- Solution:

$$\hat{Y}_t = \delta E_t \hat{Y}_{t+1} - \sigma\delta(i_t - E_t\pi_{t+1} - r_t^e)$$

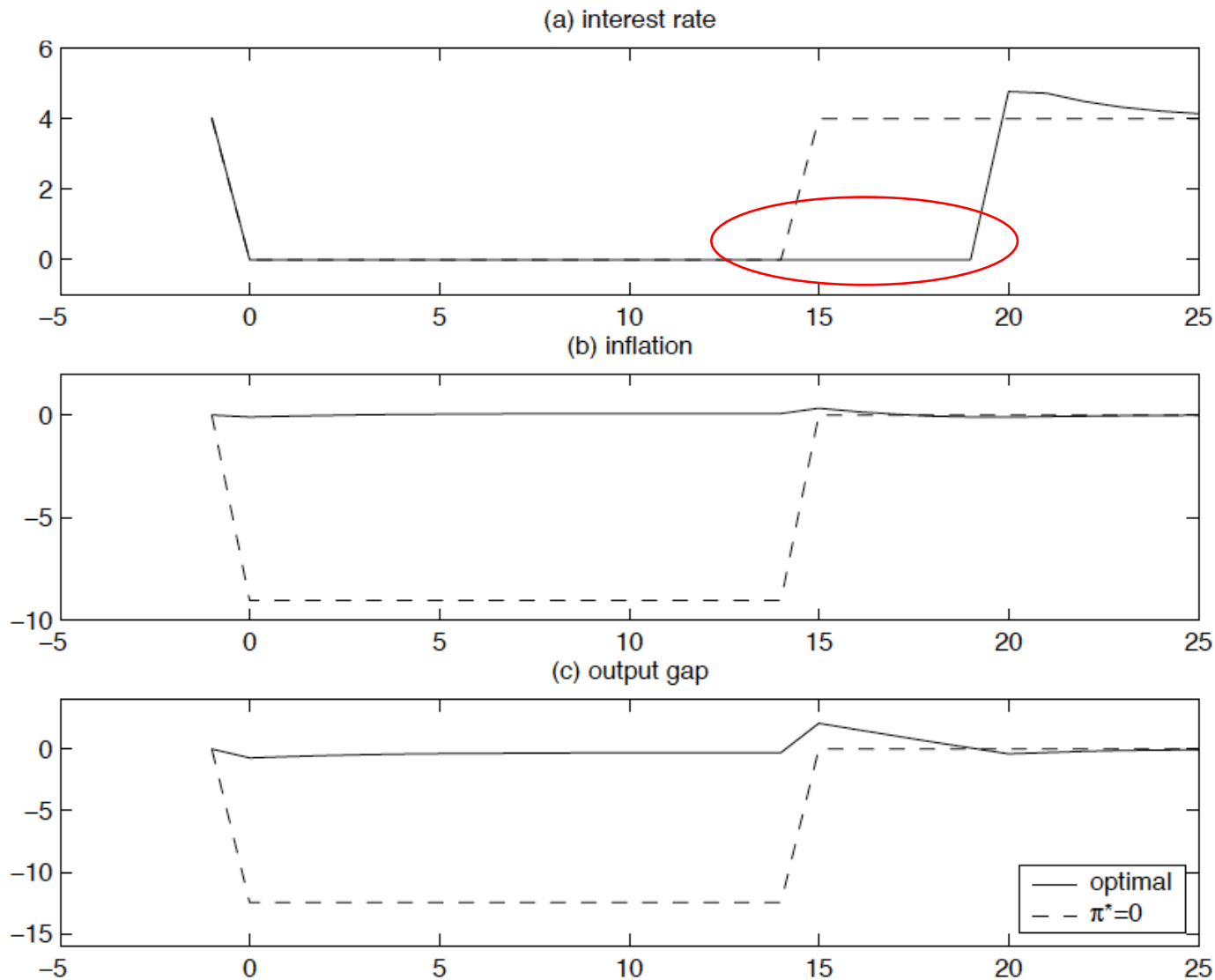OLG, incomplete asset markets, non-RE expectations

III. Regime changes

-- does forward guidance work?

Policy regime changes
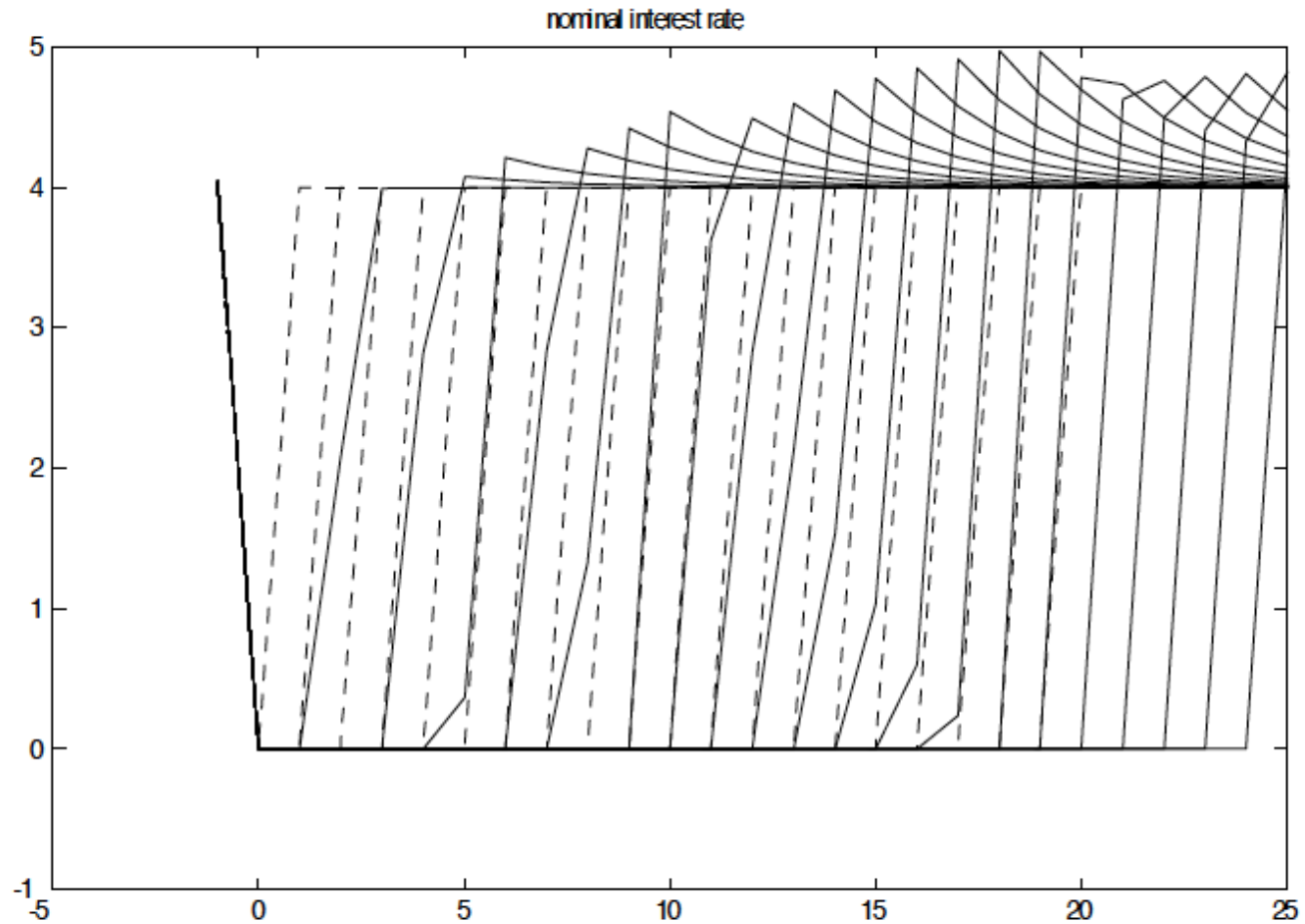
- So far we have only talked about policy options in the absence of being able to change the monetary policy regime (and only change policy instruments in short run).

- What is the best thing monetary policy can do?
  - How can it be implemented?

- Then link this to policy regime change

- What is a policy regime change?
  - Trying to use "forward guidance".
  - Going off gold standard

$$\min E_0 \sum_{t=0}^{\infty} \beta^t \{\pi_t^2 + \lambda(\hat{Y}_t - \hat{Y}_t^n)^2\}$$

Eggertsson and Woodford (2003)

(a) interest rate

(b) inflation

(c) output gap

optimal
$\pi^* = 0$

How can this be implemented?

nominal interest rate

One implementation: Threshold strategy

- Show that above FOCs are satisfied if CB behaves as follows:
  [i] Each period, there is a predetermined price-level *target* p_t^*. CB chooses interest rate i_t so as to achieve the target relation

$$\tilde{p}_t \equiv p_t + (\lambda_x / \kappa) x_t = p_t^*$$

if possible; if this is not possible, even setting $i_t = 0$, then $i_t = 0$.
[ii] The target for next period is determined as

$$p_{t+1}^* = p_t^* + \beta^{-1}(1 + \kappa\sigma)\Delta_t - \beta^{-1}\Delta_{t-1}$$

where Δ_t is the period t *target shortfall*

$$\Delta_t \equiv p_t^* - \tilde{p}_t.$$

Example of Fed Policy Statement at ZLB

- Forward guidance, December 2012

- The Committee expects that a highly accommodative stance of monetary policy will remain appropriate for a considerable time ***after*** the asset purchase program ends and the economic recovery strengthens. In particular, the Committee decided to keep the target range for the federal funds rate at 0 to 1/4 percent and currently anticipates that this exceptionally low range for the federal funds rate will be appropriate ***at least as long*** as the unemployment rate remains above 6-1/2 percent, inflation ***between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal***, and longer-term inflation expectations continue to be well anchored.

Key question

- How effective was forward guidance during the crisis?

- Will it be enough to respond next time?
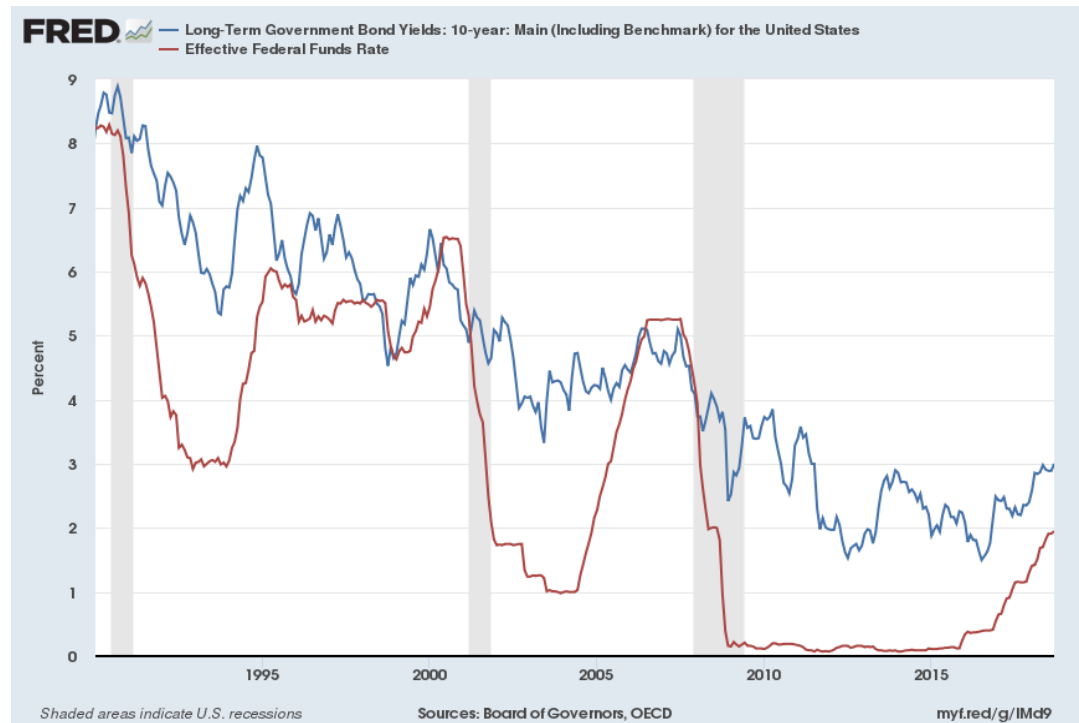
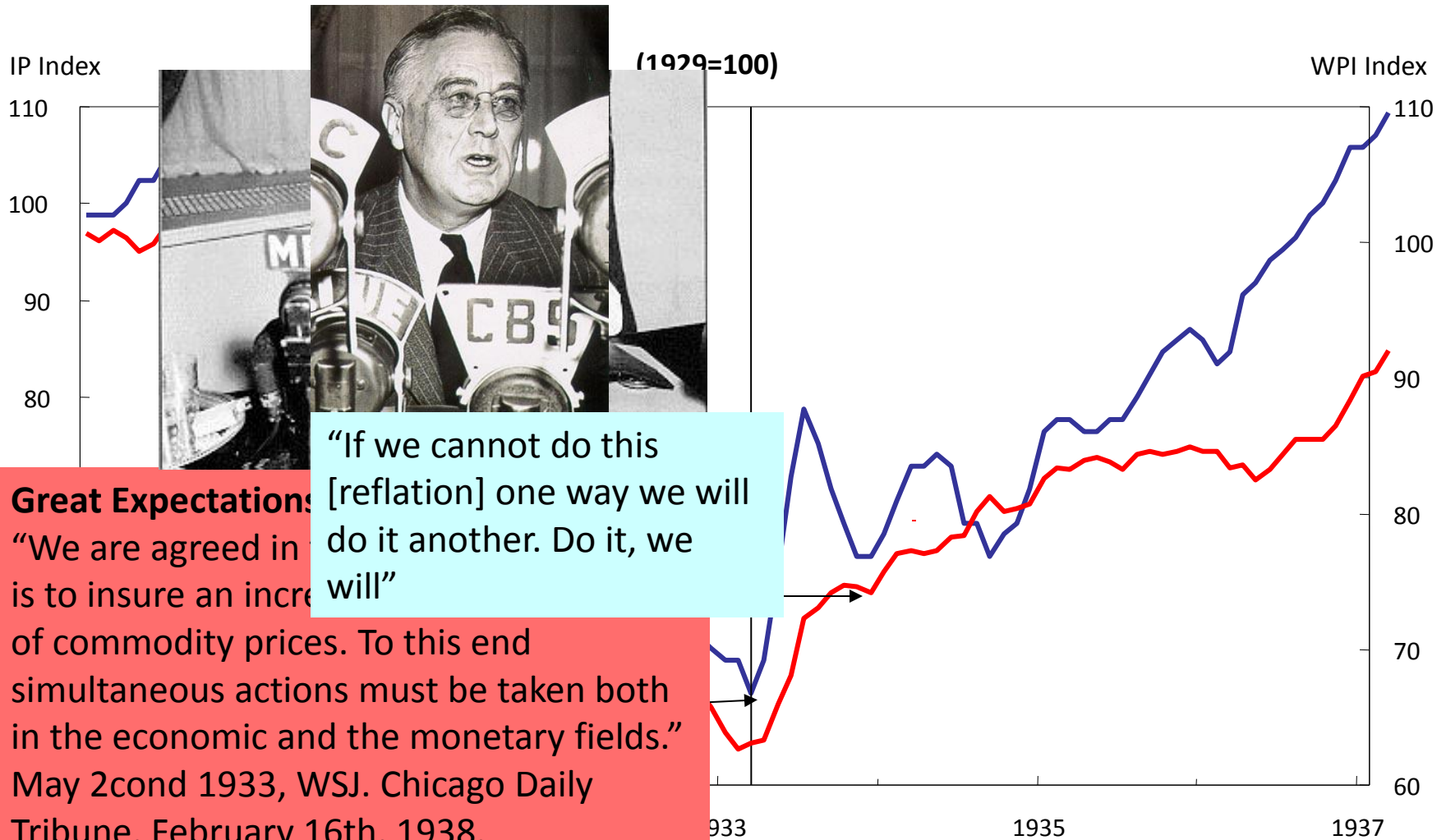Swanson (2018): ZLB was not a problem, QE and FG
Hamilton (2018): much more skeptical.

What if people expect rates to stay low for a very long time?

Could more radical forward guidance/regime change be effective?
- Evidence from the Great Depression
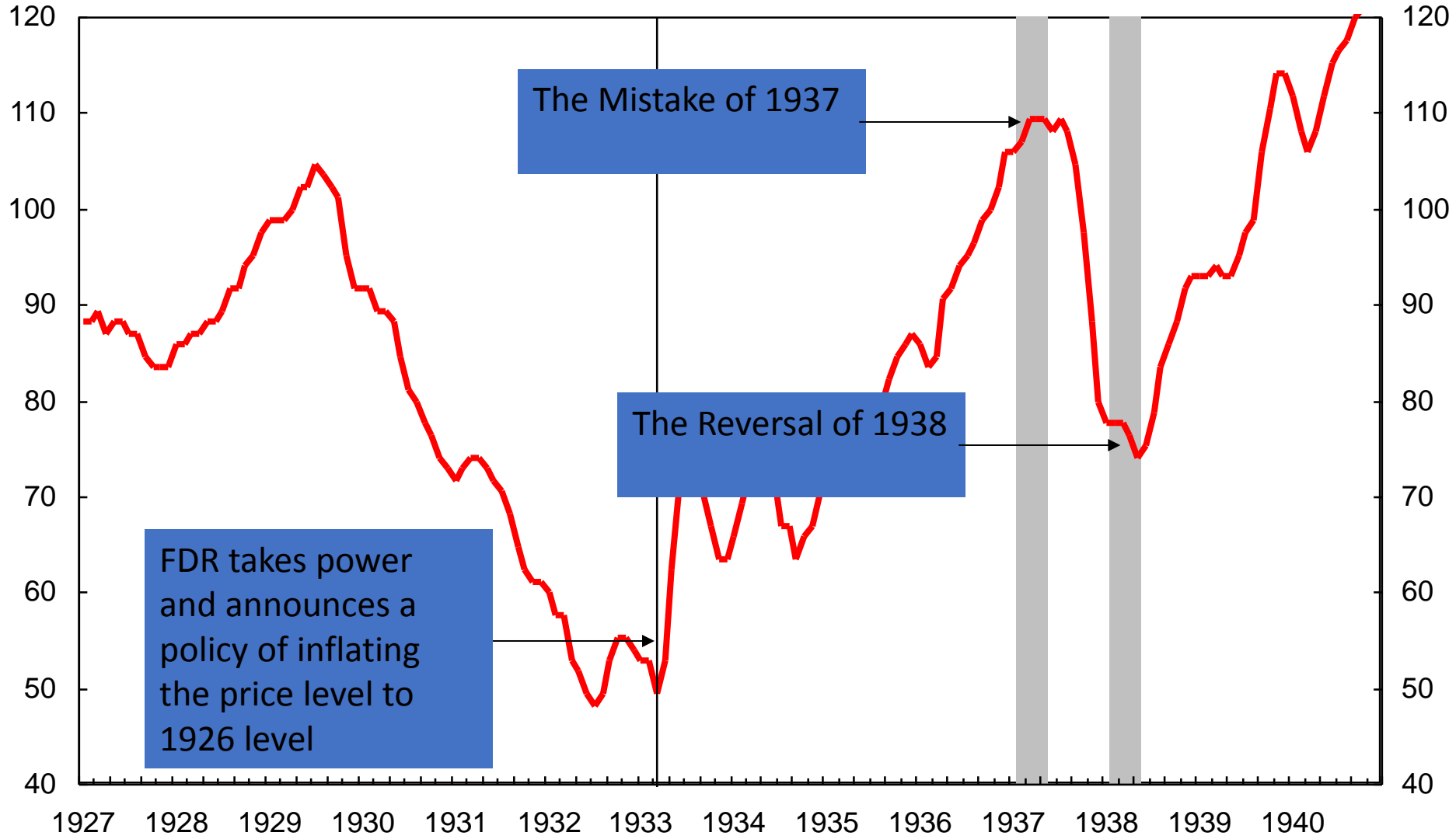
FDR Policy Regime: Reflation

IP Index   **(1929=100)**   WPI Index

"If we cannot do this [reflation] one way we will do it another. Do it, we will"

Great Expectations "We are agreed in [...] is to insure an incre[...] of commodity prices. To this end simultaneous actions must be taken both in the economic and the monetary fields." May 2cond 1933, WSJ. Chicago Daily Tribune, February 16th, 1938.

Industrial Production
(1929=100)

FDR takes power and announces a policy of inflating the price level to 1926 level

The Mistake of 1937

The Reversal of 1938

Source: Federal Reserve Board
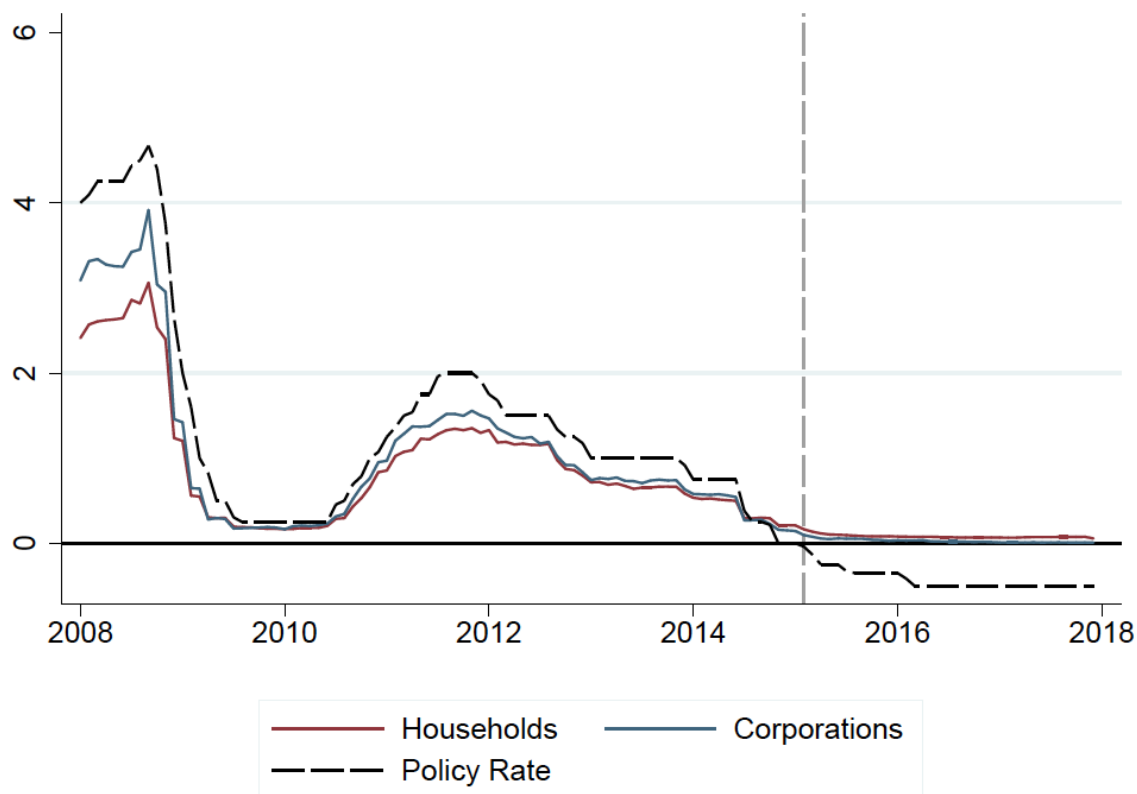
Other Tools

- Negative interest rates (not clear they work when deposit rates are binding).

Conclusions

- DSGE model can account for drop in output at the ZLB and have stories about trigger and propagation.

- Banking can be included that clarifies the mechanism.

- Not clear that the paradigm failed in fundamental way – perhaps most important to allow for very persistent fall in natural rates.

- There *is* great deal of uncertainty about estimates of driving forces and of the effect of policies even in the absence of regime changes that are hard to measure.
  - This uncertainty may be a feature of the data, rather than representing some fundamental problems of the paradigm.
  - Not clear we get better understanding without *models*.
  - We understood that base money increases would not increase prices on basis of models – *not data*.