# 2017 Federico Caffè Lectures

# Monetary Policy in Times of Low Inflation

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Lecture 1:
(a) Empirical evidence on recoveries from deep recessions with liquidity traps: they are jobless, inflation is below target, rates are stuck at zero, real wages hold up well although TFP growth is weak.
(b) One explanation, in fact the most widely embraced one, is that such dynamics are the consequence of a long string of negative natural rate surprises.

Lecture 2:
(a) Another explanation, less widely embraced, is that such dynamics are the consequence of an un-anchoring of long-run inflation expectations.
(b) Raising nominal interest rates as a strategy to lift an economy out of a liquidity trap — the neo-Fisher effect.
(c) Empirical evidence on the neo-Fisher effect.

**(a) Explaining jobless recoveries from deep recessions with liquidity traps as a consequence of a negative confidence shock:**

1. Monetary Policy follows a Taylor Rule.

2. The Zero Lower Bound On Nominal Interest Rates.

3. Downward Nominal Wage Rigidity.

4. A Downward Revision in Inflation Expectations.

# Firms

Production function:

$$Y_t = X_t F(h_t),$$

where

- $Y_t =$ output
- $X_t =$ TFP
- $h_t =$ hours
- $X_t/X_{t-1} = \mu > 1$, gross growth rate of TFP

Labor demand:

$$\frac{W_t}{P_t} = X_t F'(h_t)$$

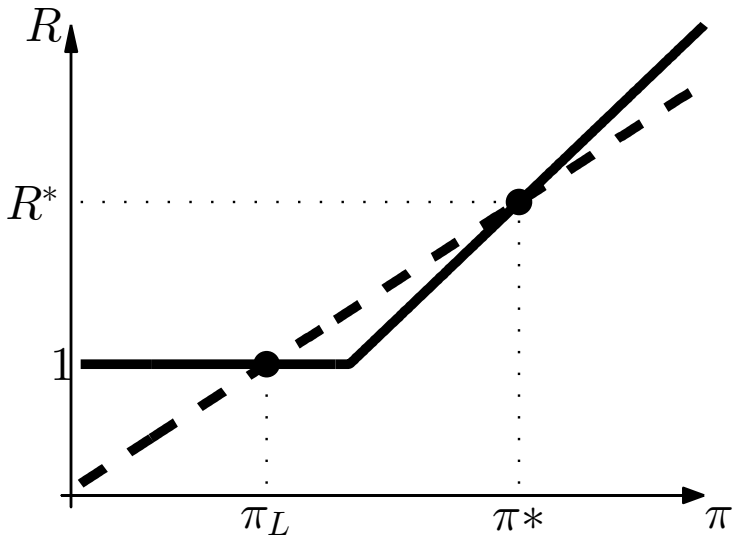
# The Euler Equation and the Taylor Rule

$$U'(C_t/X_t) = \tilde{\beta} R_t E_t \frac{U'(C_{t+1}/X_{t+1})}{\pi_{t+1}}$$

$$R_t = \max\{1, R^* + \alpha_\pi (\pi_t - \pi^*)\}; \quad \alpha_\pi > 1$$

In a steady state they become, respectively,

$$R = \frac{\pi}{\tilde{\beta}} \text{ and } R = \max\{1, R^* + \alpha_\pi (\pi - \pi^*)\}$$




Solid Line: $R = \max\{1, R^* + \alpha_\pi (\pi - \pi^*)\}$

Broken Line: $R = \tilde{\beta}^{-1}\pi$

$\Rightarrow$ Two steady-state equilibria: $\pi^*$ and $\pi_L$

# Downward Nominal Wage Rigidity

$$W_t \geq \gamma(u_t) W_{t-1},$$

where

- $W_t =$ nominal wage rate
- $u_t =$ unemployment rate

Assumption: $\gamma'(u_t) < 0$, nominal wages become more downwardly flexible as unemployment increases.

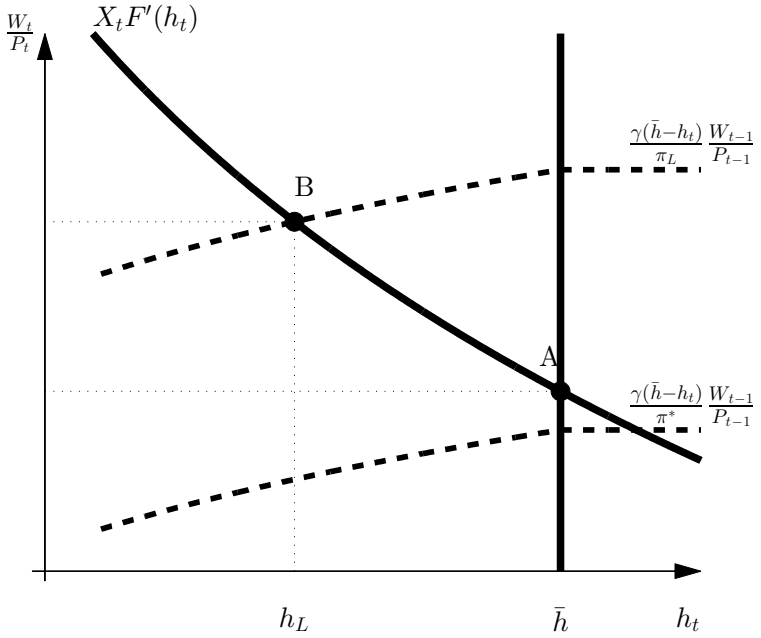
# The Labor Market

Labor Demand: $\boxed{\frac{W_t}{P_t} = X_t F'(h_t)}$

Inelastic Labor Supply: $\boxed{h_t \leq \bar{h}}$

Unemployment: $u_t = \bar{h} - h_t$

Downward Wage Rigidity: $W_t \geq \gamma(u_t) W_{t-1} \Rightarrow \boxed{\frac{W_t}{P_t} \geq \frac{\gamma(\bar{h}-h_t)}{\pi_t} \frac{W_{t-1}}{P_{t-1}}}$




If $\pi_t = \pi^*$, then the equilibrium is at point $A$.

If $\pi_t = \pi_L < \pi^*$, then the equilibrium is at point $B$.

# A Downward Revision in Expectations.

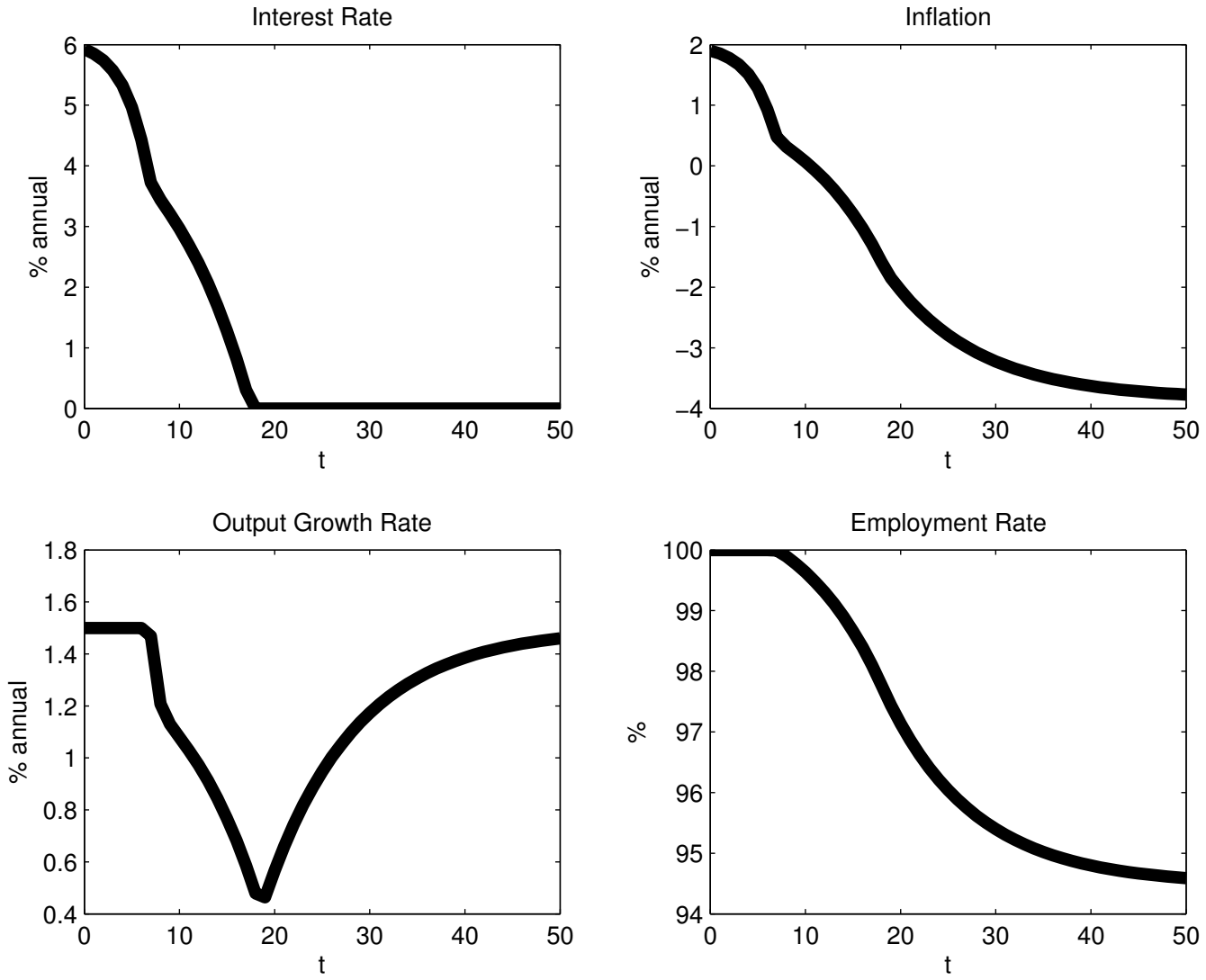
In period 0, expectations change from

$$\lim_{t\to\infty} E_0\pi_t = \pi^*$$

To

$$\lim_{t\to\infty} E_0\pi_t = \pi_L < \pi^*$$

# Dynamics Triggered by a Downward Revision in Expectations




Source: Schmitt-Grohé and Uribe, 2017.

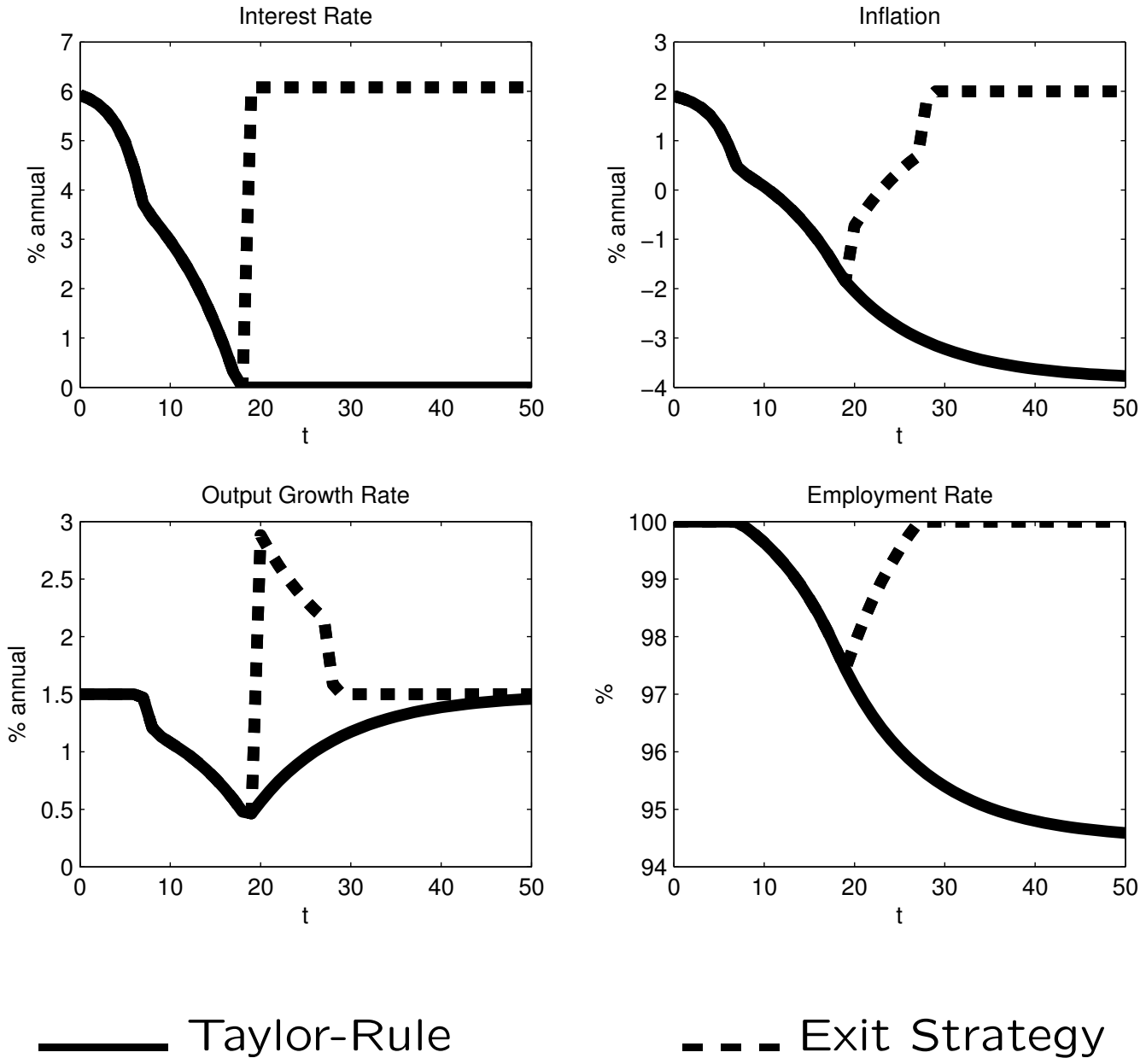
# (b) How to lift the economy out of a confidence shock induced liquidity trap

Consider the interest rate policy:

$$R_t = \begin{cases} \max\left\{1, \frac{\pi^*}{\tilde{\beta}} + \alpha_\pi \left(\pi_t - \pi^*\right)\right\} & \text{if } s_t = 0 \\ R^* & \text{if } s_t = 1 \end{cases}.$$

$$s_t = \begin{cases} 1 & \text{if } R_j = 1 \text{ for any } 0 \leq j < t \\ 0 & \text{otherwise} \end{cases}.$$

# Exiting the Slump: Tightening is Easing



- Model predicts that when economy suffers a confidence shock then the economy falls into a liquidity trap and experiences a jobless growth recovery.

- In an environment with falling inflation expectations, an increase in nominal rates can contribute to re-anchoring expectations around the intended target and lifting the economy out of a slump **(the neo Fisher effect)**.

- Possible objection to the proposed exit strategy: Tightening in the midst of a liquidity trap will only further exacerbate the slump.

## (c) Empirical Evidene on the neo-Fisher Effect

What does the data say? Uribe (2017) estimates the neo-Fisher effect in the United States and Japan. His estimated model produces dynamics consistent with the neo-Fisherian prediction that a credible and gradual increase of nominal interest rates to normal levels can generate a quick reflation of the economy with low real interest rates and no output loss.

The Fisher effect vs the neo-Fisher effect.

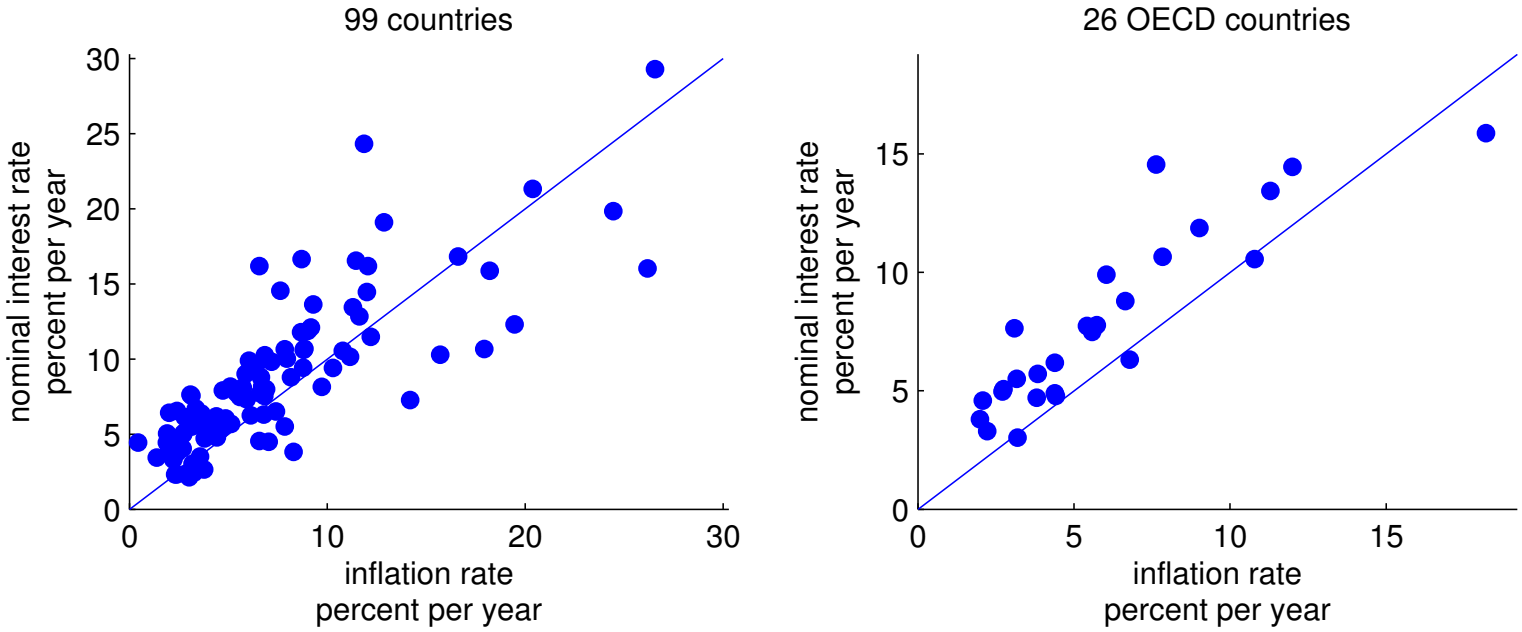
The Fisher effect (a long-run concept)

$$R = r + \pi$$

• The following two figures provide cross-sectional evidence consistent with the validity of the Fisher hypothesis in the long run.

# Long-Run Average Inflation and Nominal Interest Rates: Cross-Country Evidence of the Fisher Effect

$$R = r + \pi$$




Source: Uribe, 2017. Each dot represents one country. The solid line is the 45-degree line. Average sample is 1989 to 2012.

# The neo-Fisher Effect

What is the effect of a shock to the nominal rate on inflation?

Theory suggests that the answer depends on whether the change in the interest rate is expected to be transitory or permanent.

Effect of an Increase in the
Nominal Interest Rate on Inflation

| | **Long** Run Effect | **Short** Run Effect |
|---|---|---|
| Transitory interest rate shock | 0 | $\downarrow$ |
| Permanent interest rate shock | $\uparrow$ | $\boxed{\uparrow}$ |

Entry (2,1): The Fisher effect.
Entry (2,2) : **The neo-Fisher effect.**

# Uribe's Empirical Model

• The empirical model aims to capture the dynamics of three macroeconom indicators:

• $y_t$, denoting the logarithm of real output per capita.

• $\pi_t$, denoting the inflation rate, expressed in percent per year.

and

• $i_t$, denoting the nominal interest rate, expressed in percent per year.

# Four Shocks

$X_t^m$, denoting a permanent monetary shock.

$z_t^m$, denoting a transitory monetary shock.

$X_t^n$, denoting a permanent nonmonetary shock.

$z_t^n$, denoting a transitory nonmonetary shock.

# Three Observables

• $100 \times \Delta y_t$ growth rate of real output per capita expressed in percent per quarter.

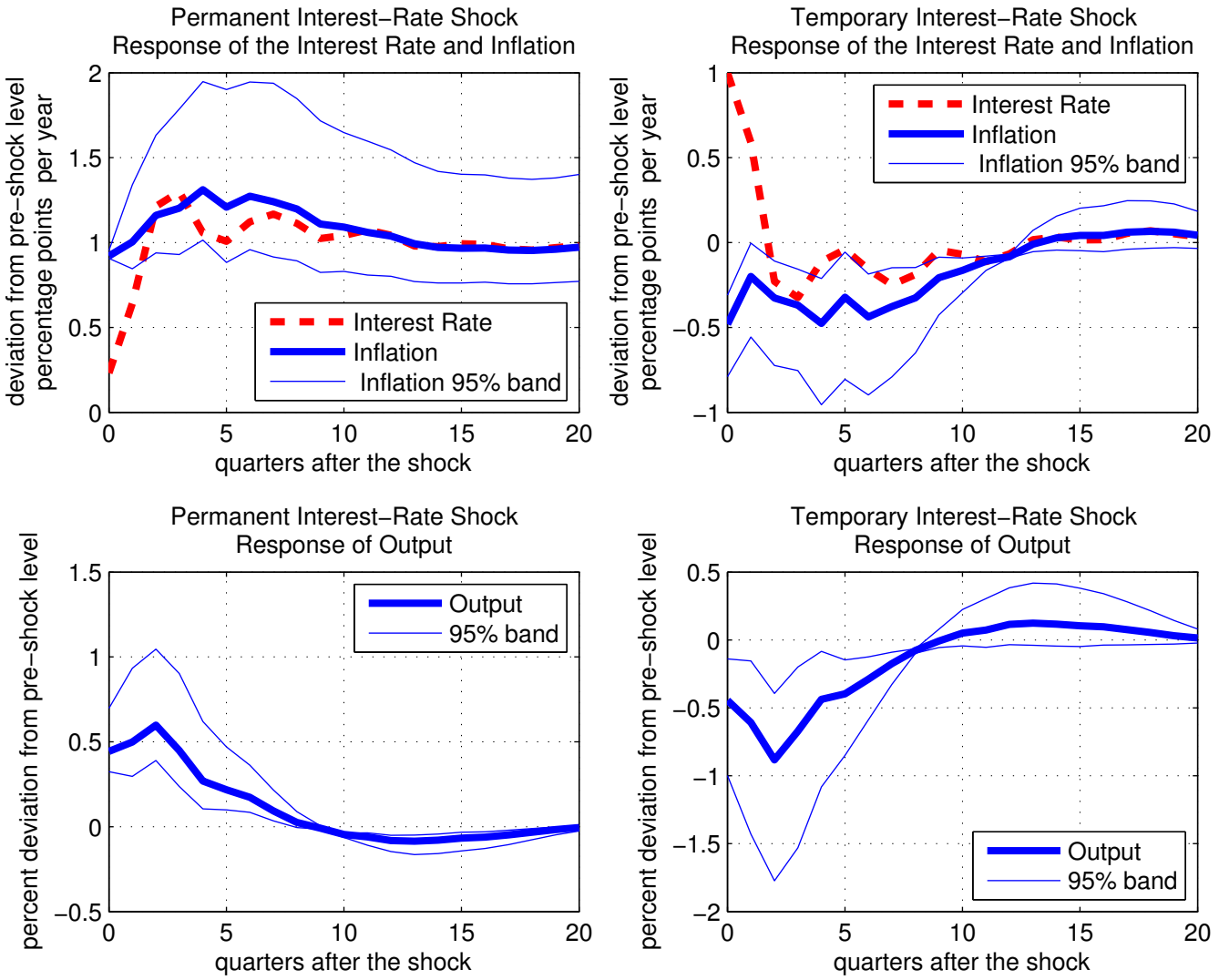
• $r_t \equiv i_t - \pi_t$ interest-rate-inflation differential expressed in percent per year.

• $\Delta i_t \equiv i_t - i_{t-1}$ time difference of the nominal interest rate expressed in percent per year.

The following identities link observables to unobservables:

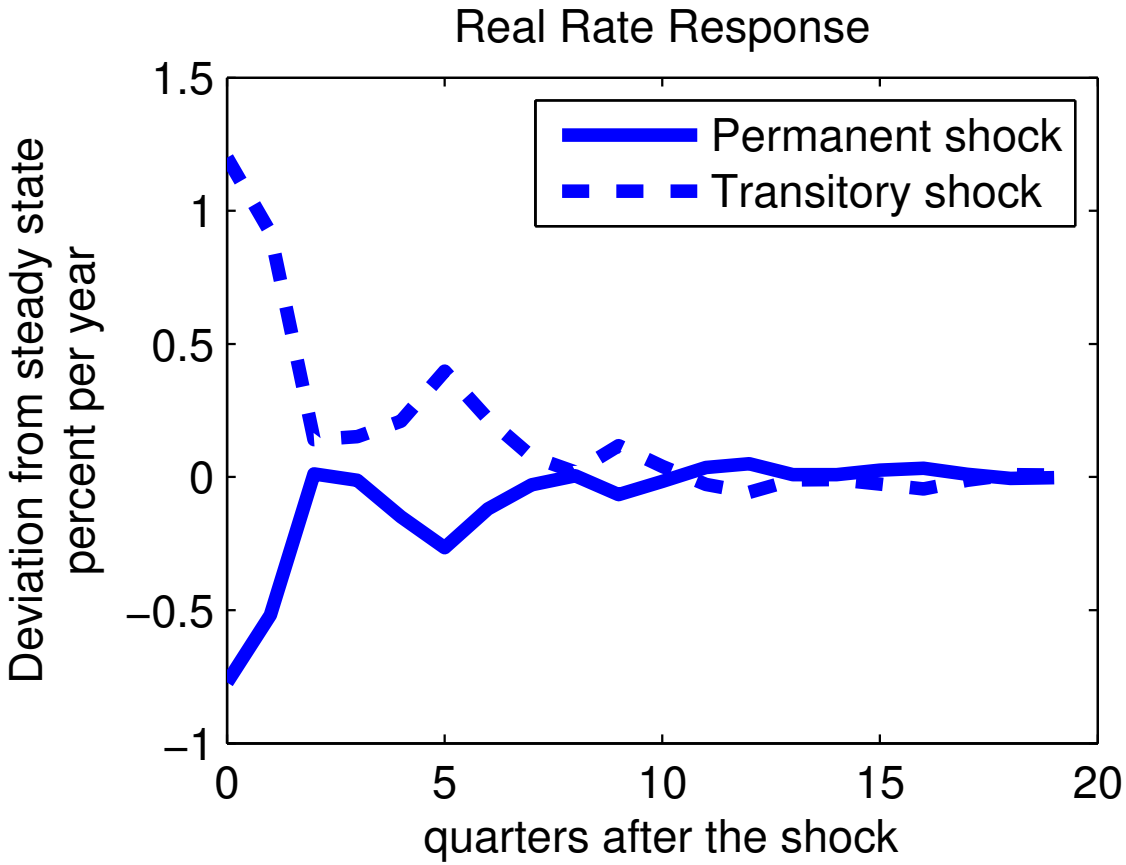
$$\begin{aligned} 100 \times \Delta y_t &= 100 \times \Delta X^n + \widehat{y}_t - \widehat{y}_{t-1} + x_t^n \\ r_t &= r + \widehat{i}_t - \widehat{\pi}_t \\ \Delta i_t &= \Delta X^m + \widehat{i}_t - \widehat{i}_{t-1} + x_t^m \end{aligned} \tag{1}$$

# Estimated Impulse Responses to Interest-Rate Shocks: United States




Source: Uribe, 2017.

# Estimated Response of the Real Interest Rate to Permanent and Transitory Interest-Rate Shocks: United States




Source: Uribe, 2017. The real interest rate is defined as $R_t - E_t\pi_{t+1}$.

# Observations on the Previous Two Figures

• By assumption/construction, in response to a permanent interest-rate shock both the nominal interest rate and inflation increase by 1 percent in the long run.

• The main result conveyed by the figure is that inflation reaches its long-run value in the short run.

• In fact, inflation adjusts faster than the nominal interest rate, so the real interest rate falls on impact and converges from below.

• The adjustment does not entail output loss.

• By contrast, the responses of nominal and real variables to a transitory increase in the nominal interest rate are conventional: The real interest rate increases on impact and converges from above, and output and inflation fall.

## Summary of Lecture 2

- In the context of a model with downward nominal wage rigidity a negative shock to long-run inflation expectations can explain several of the observed characteristics of recoveries from recessions with liquidity traps.

- We suggest a novel strategy to reflate the economy by raising nominal rates — the neo Fisher effect.

- We presented empirical evidence showing that credible permanent increases in nominal rates do reflate the economy without raising real rates in the short run.