The Neo Fisher Effect and Exiting a Liquidity Trap

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This talk is based on the following 4 papers:

Uribe, "The Neo-Fisher Effect: Econometric Evidence from Empirical and Optimizing Models," NBER WP 25089, September 2018.

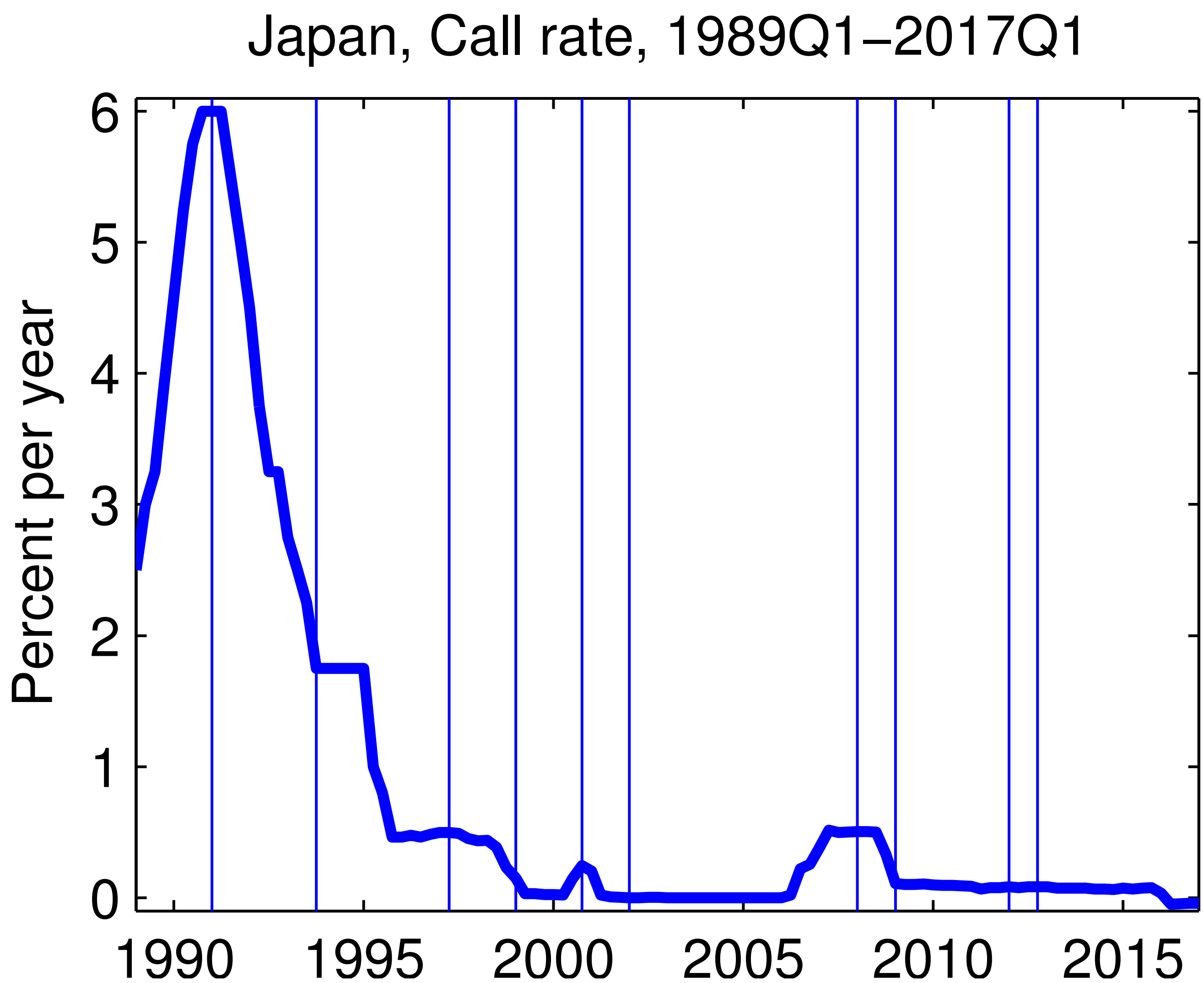
Schmitt-Grohé and Uribe, "Liquidity Traps and Jobless Recoveries," *AEJ: Macroeconomics*, 2017.

Schmitt-Grohé and Uribe, "Liquidity Traps: An Interest-Rate-Based Exit Strategy," *The Manchester School*, 2014.

Benhabib, Schmitt-Grohé, and Uribe, "The Perils of Taylor Rules," *Journal of Economic Theory*, 2001.

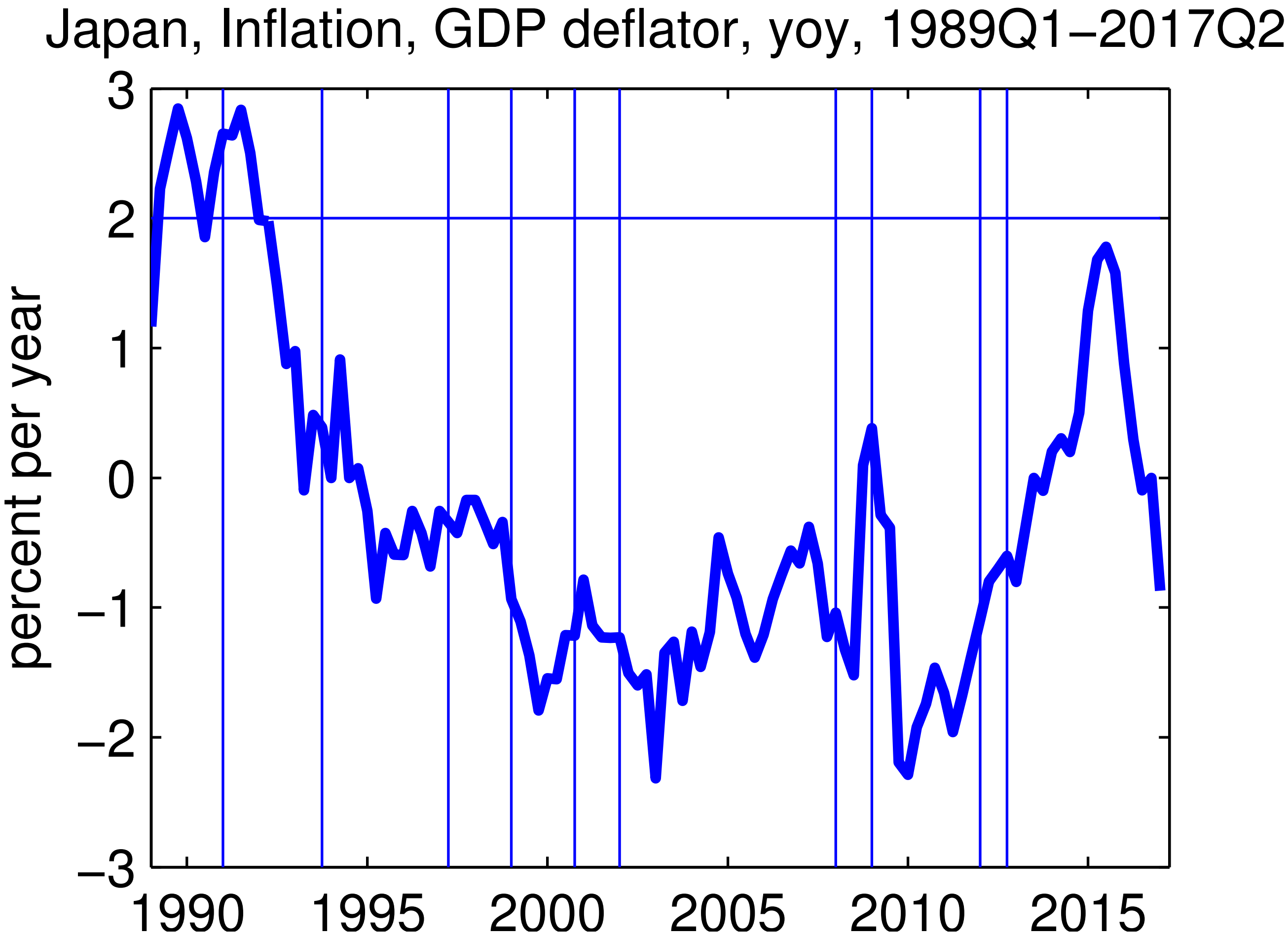
Does setting nominal rates at zero for an extended period of time raise inflation or inflationary expectations?

Japan has had near zero rates ever since 1995



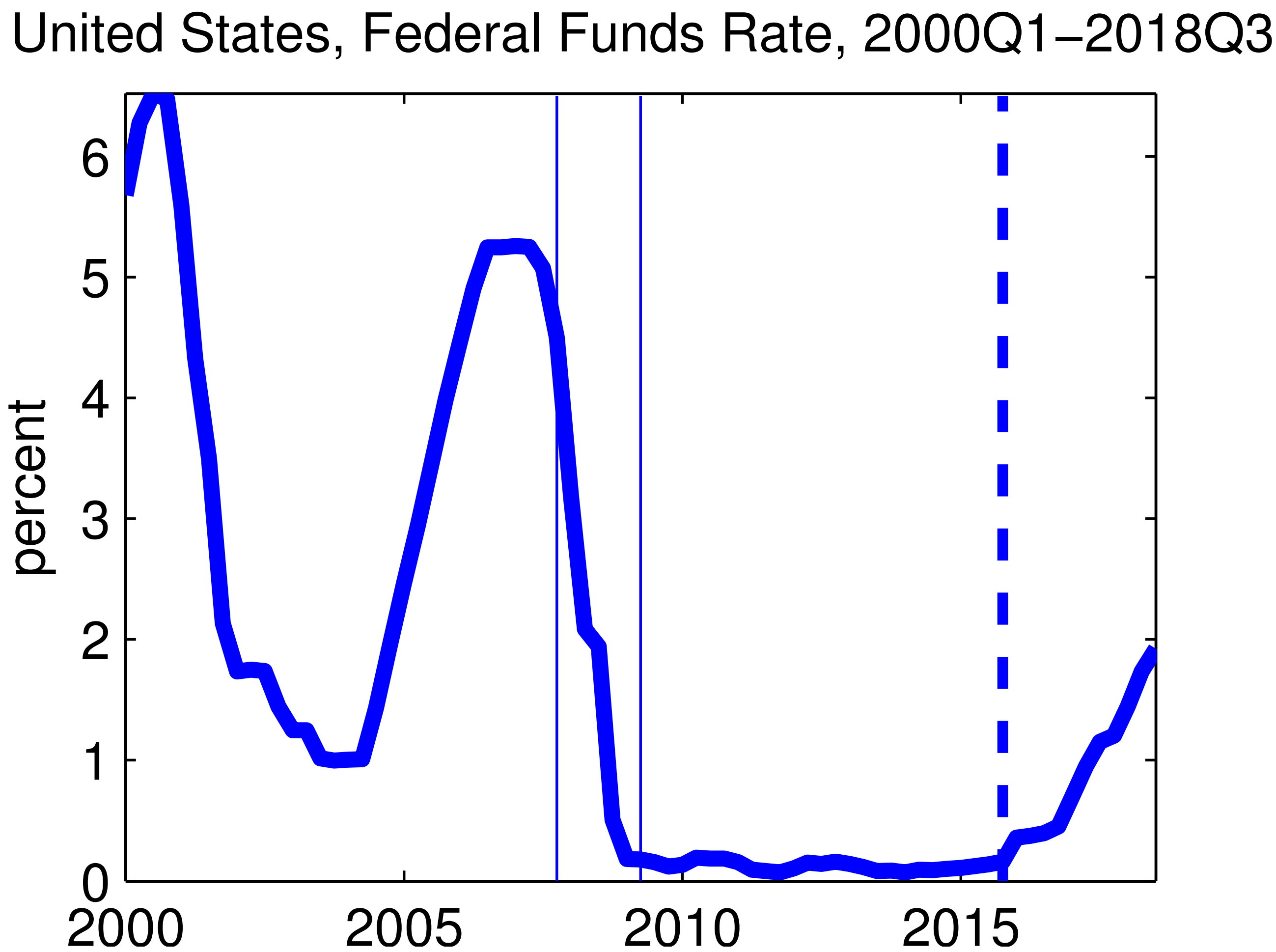
Vertical lines: Cabinet office recession dates, 1991Q1, 1993Q4, 1997Q2, 1999Q1, 2000Q4, 2002Q1, 2008Q1, 2009Q1, 2012Q2, and 2012Q4.

... yet inflation has been below target throughout.



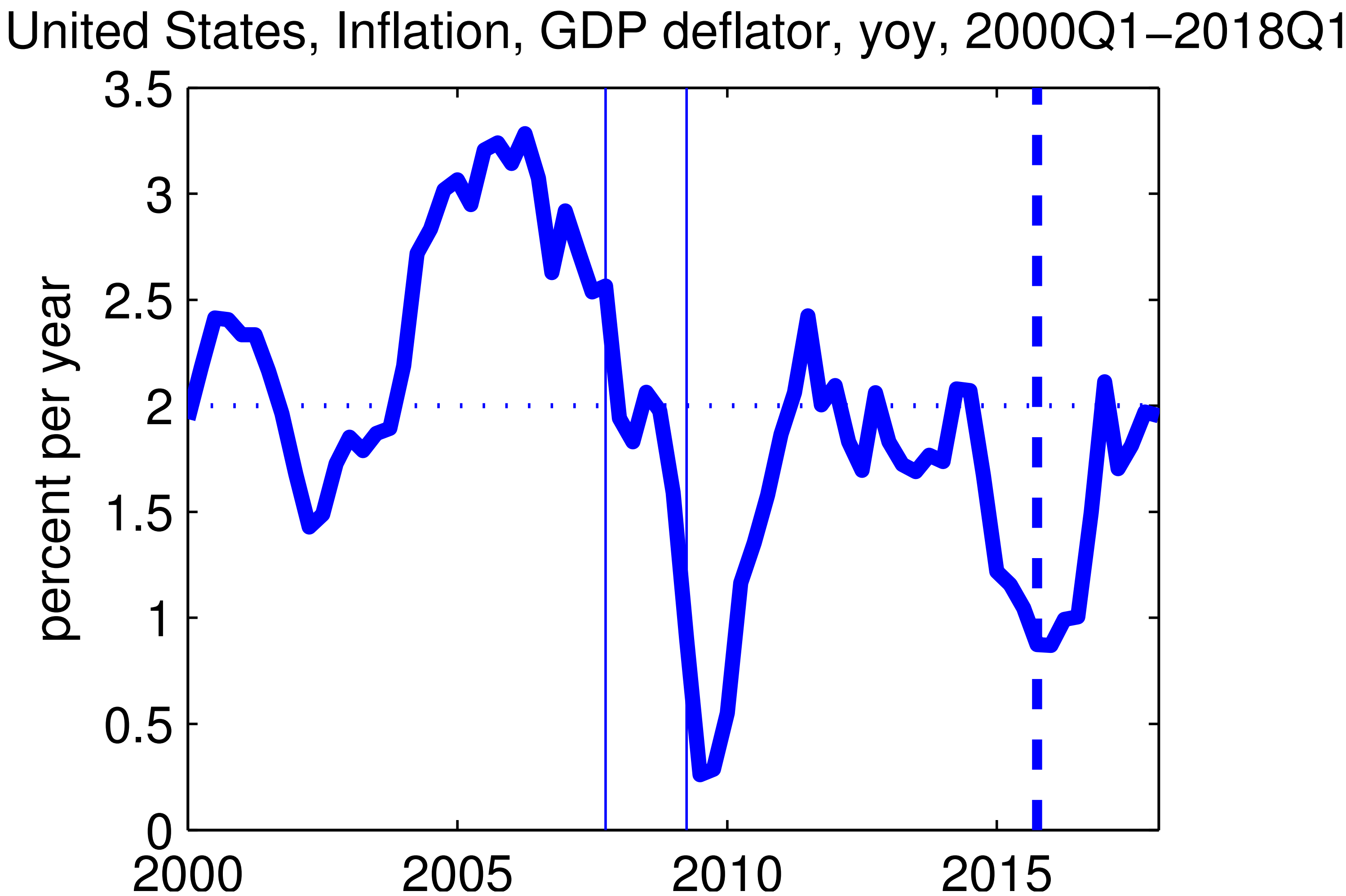
Vertical lines: Cabinet office recession dates, 1991Q1, 1993Q4, 1997Q2, 1999Q1, 2000Q4, 2002Q1, 2008Q1, 2009Q1, 2012Q2, and 2012Q4.
Horizontal line: 2% inflation target.

The U.S. had zero rates until 2015Q4 but then got out.



Vertical solid lines: NBER recession dates, 2007Q4 and 2009Q2.
Vertical broken line: end of liquidity trap, 2015Q4.

... and the exit coincided with an inflection point for inflation.



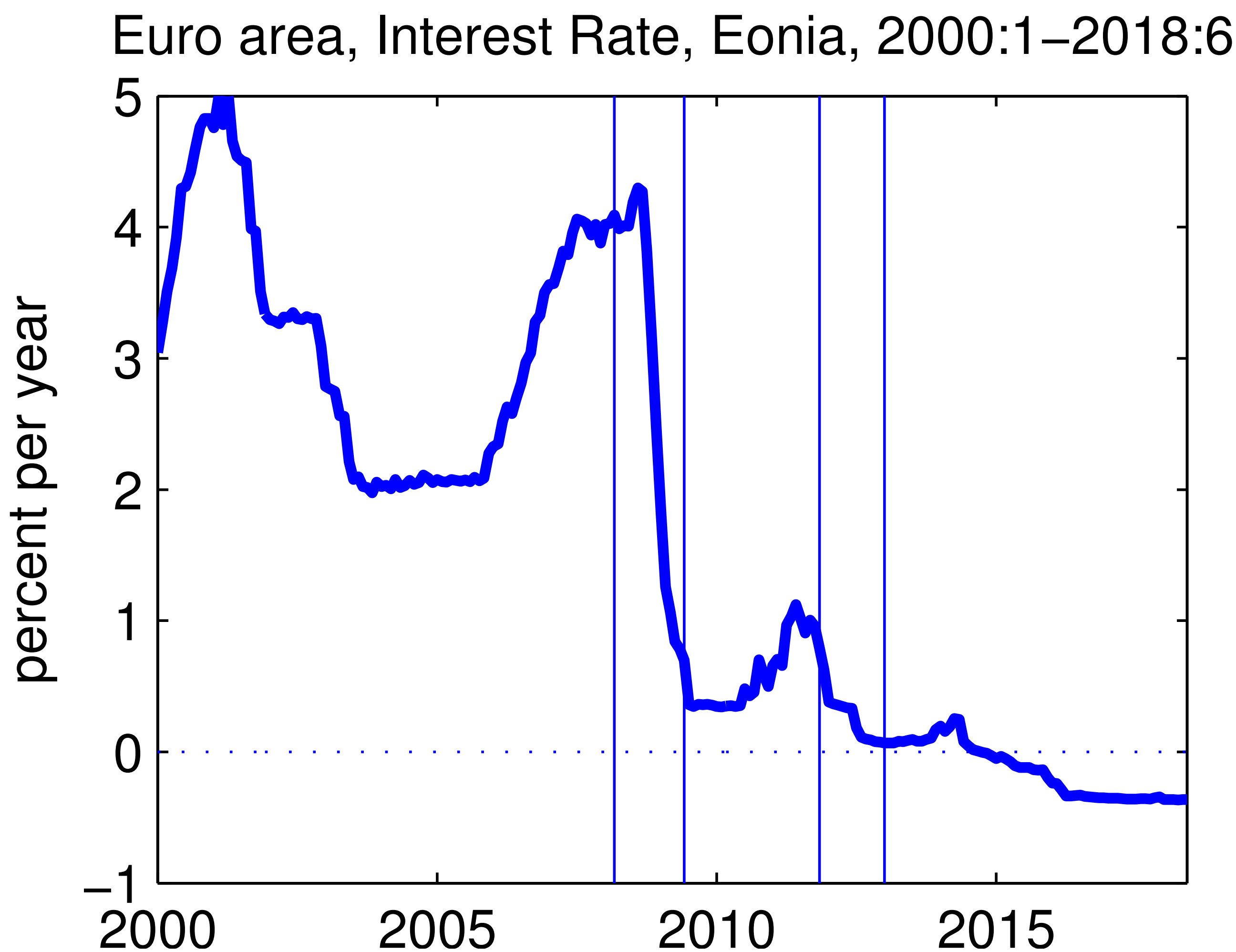
Vertical solid lines: NBER recession dates, 2007Q4 and 2009Q2. Vertical broken line: end of liquidity trap, 2015Q4. Dotted horizontal line, 2% inflation target.

Downward revisions of long-run inflation expectations in the United States?

Options-implied Inflation Probability Density Functions.
Source: FRB Minneapolis, https://www.minneapolisfed.org/banking/mpd.

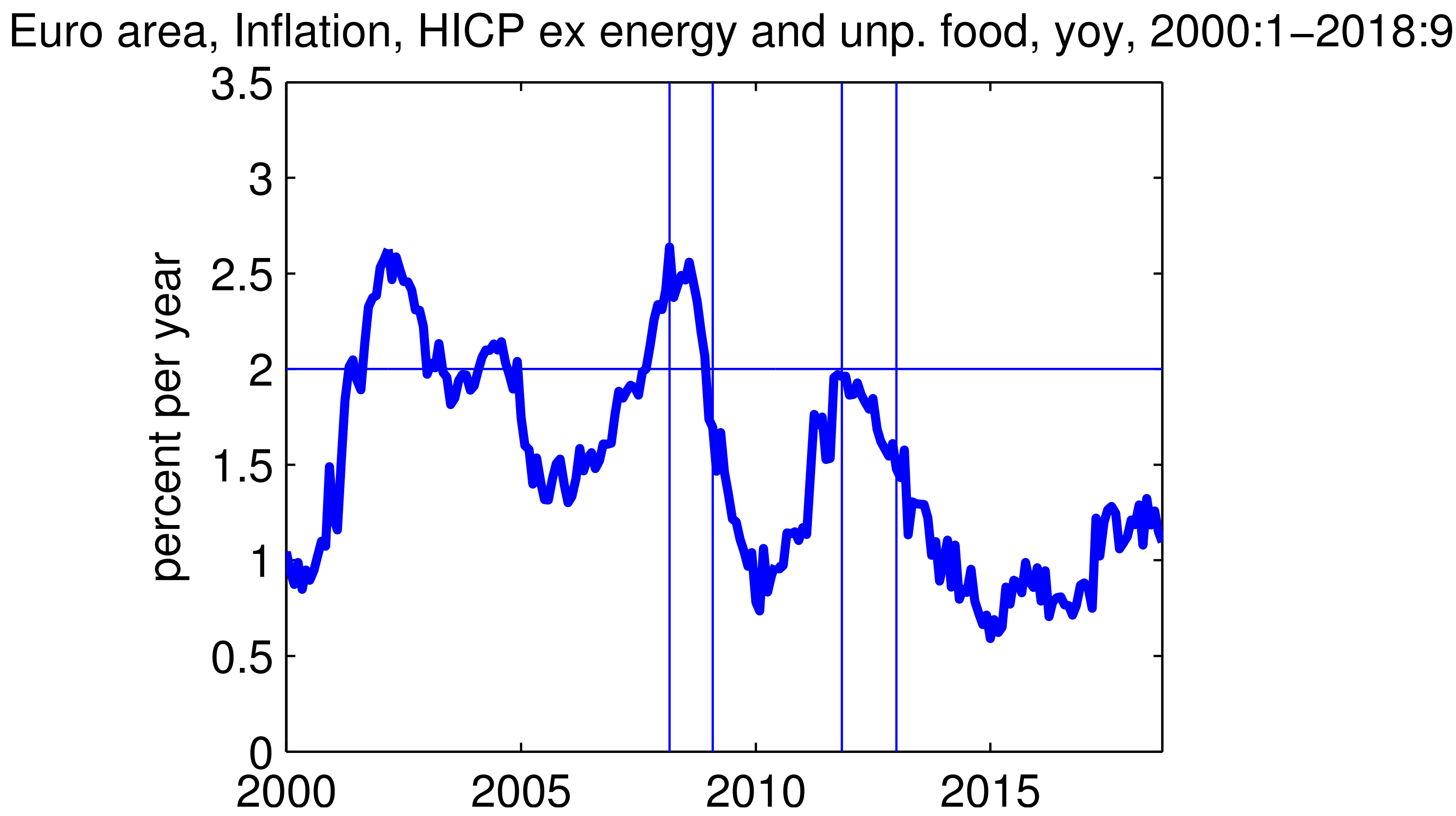
Prior to exit in December 2015, long-run inflation expectations fell.

The Euro area has had near zero rates since 2008 ...



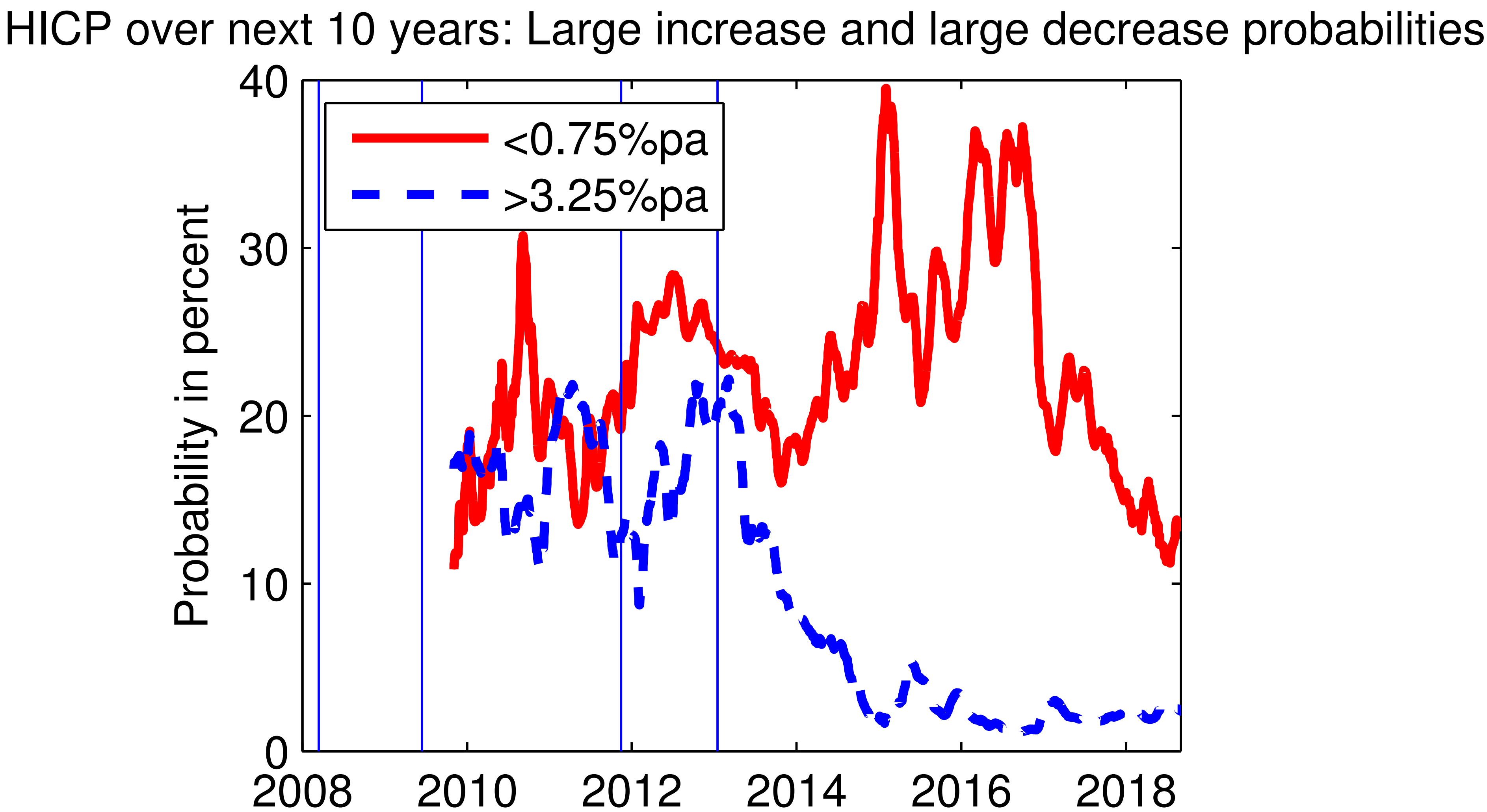
Vertical lines: CEPR business cycles dates, 2008Q1, 2009Q2, 2011Q3, 2013Q1.

... yet, inflation remains below target...



Vertical lines: CEPR business cycles dates, 2008Q1, 2009Q2, 2011Q3, 2013Q1.

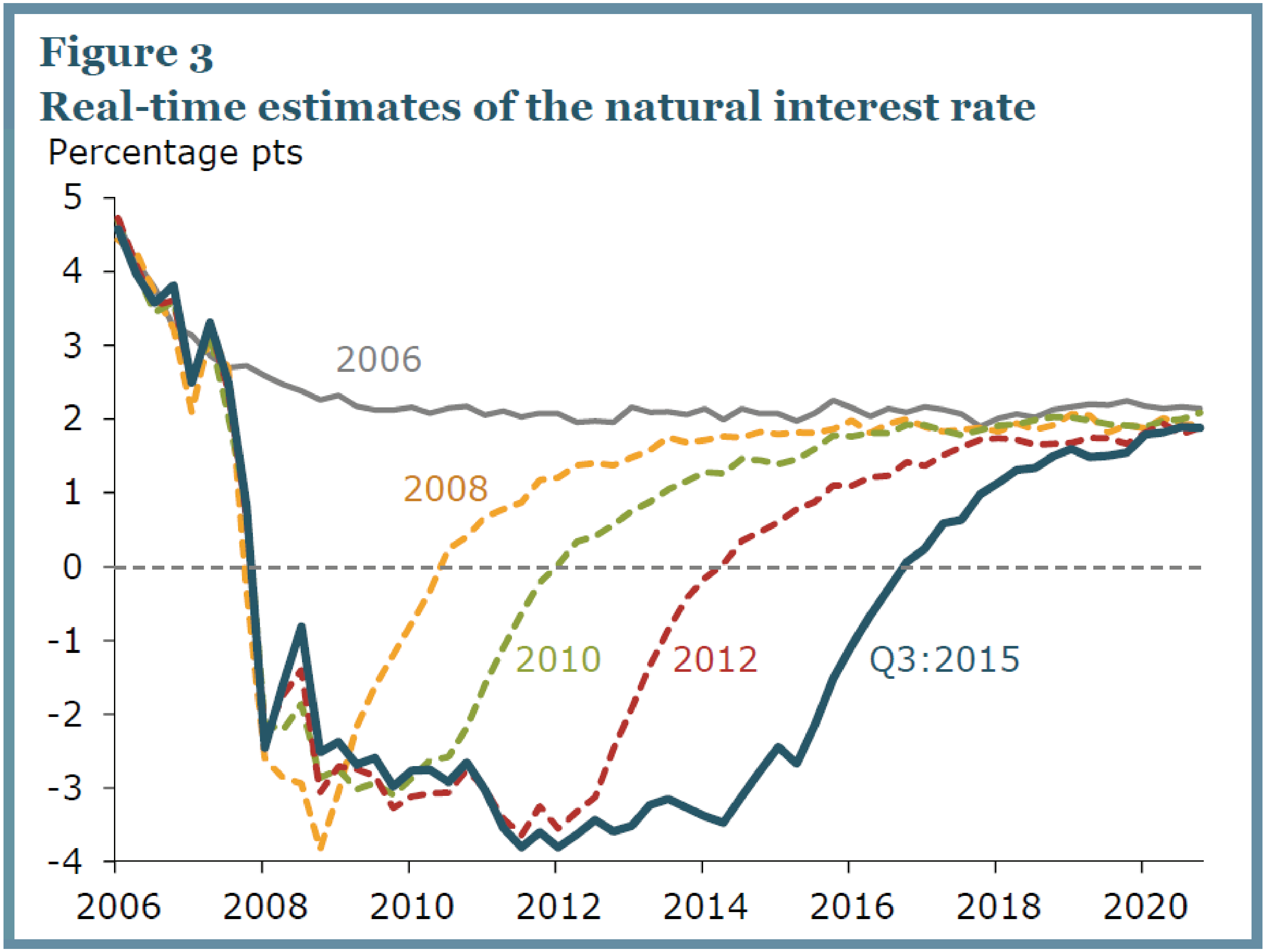
... and long-run inflation expectations are low.



Data source, Vogt, 2018. Twenty-day moving averages of daily options-implied inflation probabilities, Oct 6, 2009 to Aug 31, 2018. Vertical lines: CEPR business cycle dates, 2008Q1, 2009Q2, 2011Q3, 2013Q1.

Standard way to rationalize the joint occurrence of near zero rates for an extended period of time and inflation well below target

Curdia (2015) shows for a standard model to explain this pattern requires that the economy is continuously surprised by yet another negative natural rate shock:



Source: Curdia, FRBSF EL 2015.

An Alternative View: Inflationary expectations fall.

> *Mr. Draghi and his peers are afraid that consumers and investors will increasingly see low inflation as the new normal, creating a self-fulfilling prophecy.*

NYT, page B7, November 22, 2014.

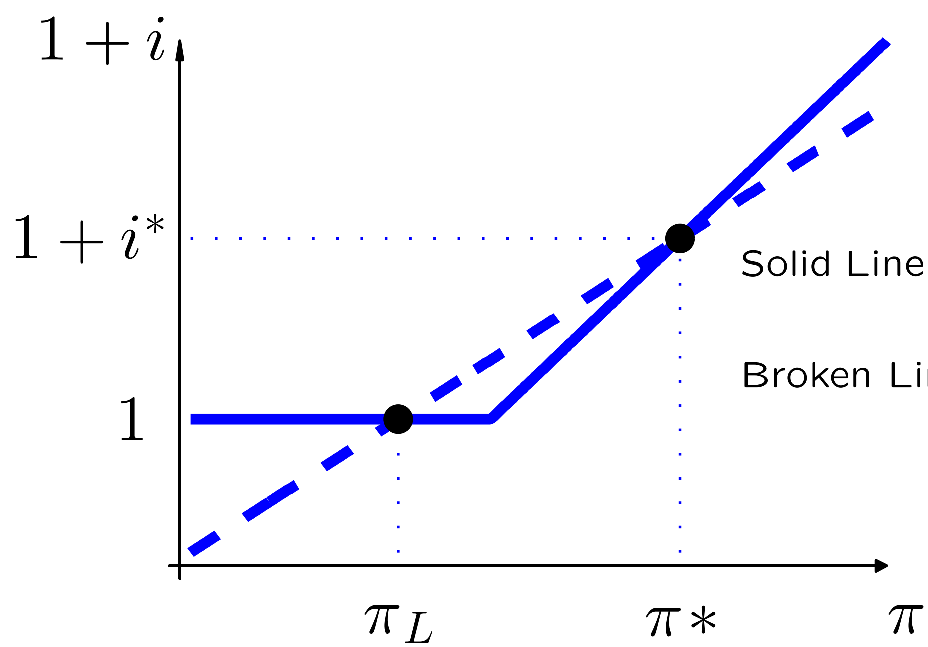
A Brief Exposition of the 'Perils of Taylor Rules', BSU 2001

The Taylor Rule: $1 + i_t = \max\{1, 1 + i^* + \alpha_\pi (\pi_t - \pi^*)\}$

The Euler Equation: $U'(C_t) = \beta(1 + i_t) E_t \frac{U'(C_{t+1})}{\pi_{t+1}}$

In a steady state they become, respectively,

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



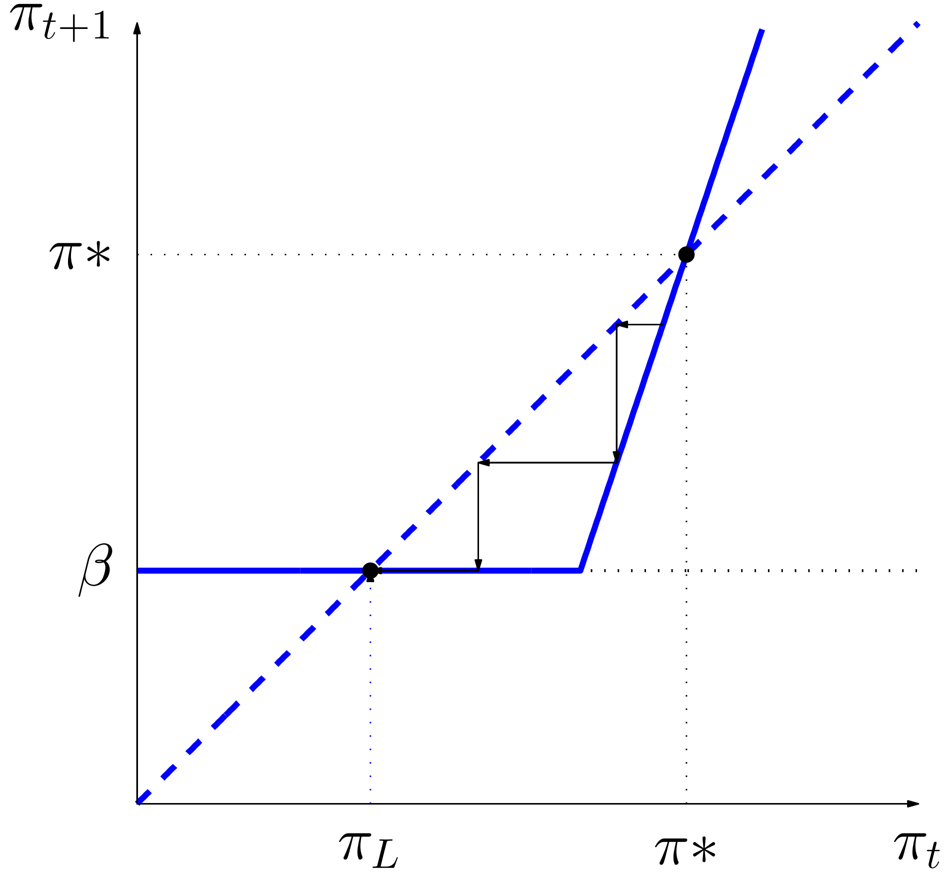
Solid Line: Taylor rule, $1+i = \max\{1, 1 + i^* + \alpha_\pi (\pi - \pi^*)\}$

Broken Line: Euler equation $1 + i = \beta^{-1}\pi$

Two inflation steady states:

The intended steady state (π^*) and the Liquidity Trap (π_L)

Dynamics in a Flexible-Price Endowment Economy



Solid line: $\pi_{t+1} = \max\{\beta, \pi^* + \beta\alpha_\pi(\pi_t - \pi^*)\}$
Broken line: 45-degree line

Comment: Similar results obtain in sticky-price/wage economies (BSU 2001, SGU 2017) and also under time-consistent policy (Nakata & Schmidt, 2017).

How to exit a persistent liquidity trap?

To exit the liquidity trap the central bank should raise nominal interest rates. Doing so will increase inflation not only in the long run but also in the short run **(the neo Fisher effect)**.

Consider a model with nominal rigidities (on the next slide downward nominal wage rigidity).

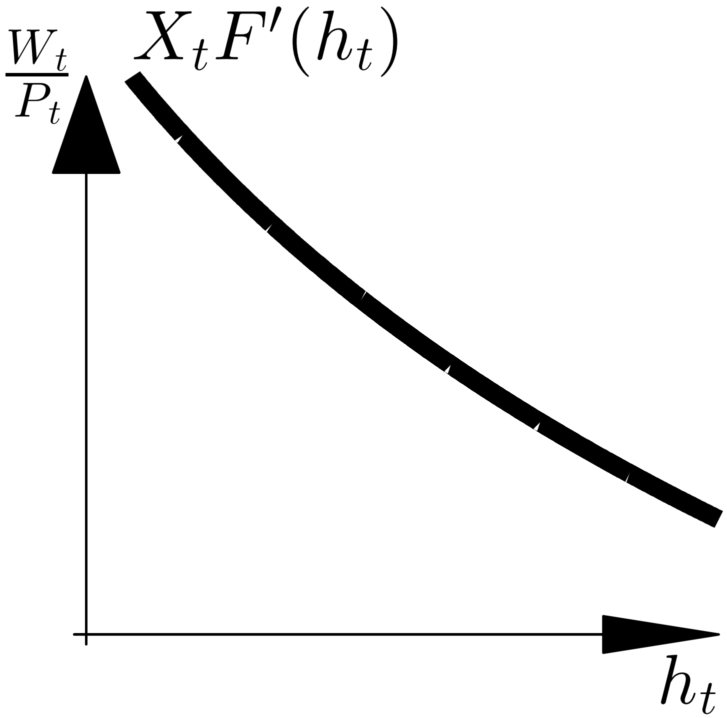
Some more details of the SGU 2017 model...

Labor Demand by Firms

Production function: $Y_t = X_t F(h_t)$,

where

- $Y_t =$ output
- $X_t =$ total factor productivity (TFP), assumed to be exogenous
- $h_t =$ hours
- $X_t / X_{t-1} = \mu > 1$, gross growth rate of TFP



Labor demand:

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

where

- $W_t =$ nominal wage rate
- $P_t =$ price level

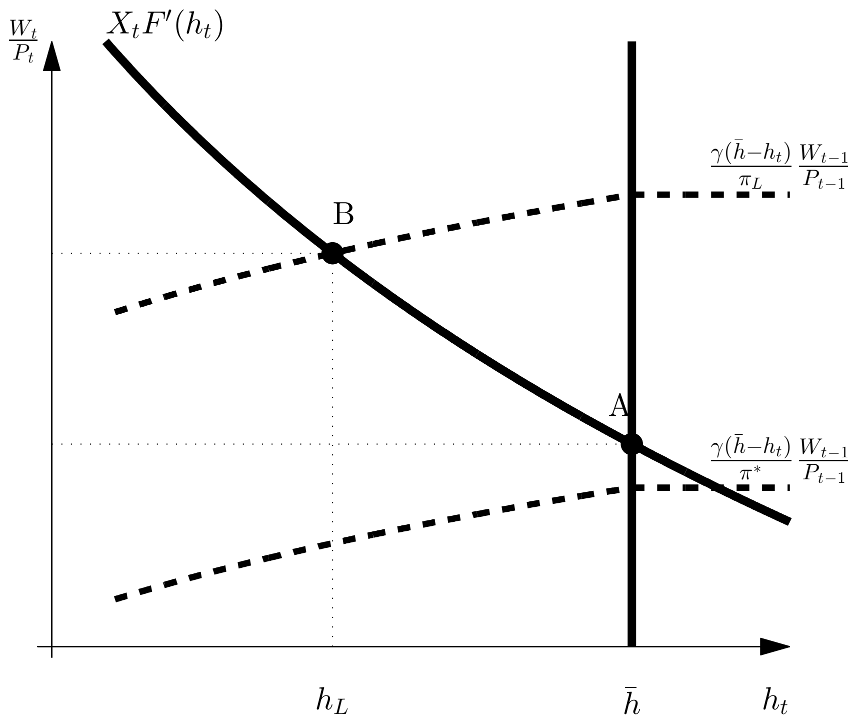
The Labor Market

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

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

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

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.

- Discussions of how monetary policy can lift an economy out of chronic below-target inflation are almost always based on the logic of how transitory interest-rate shocks affect real and nominal variables.

- Within this logic, a central bank trying to reflate a low-inflation economy will tend to set interest rates as low as possible.

- In the context of the SGU model, economies following this strategy can find themselves with zero nominal rates and with the low-inflation problem not going away.

So, what to do?

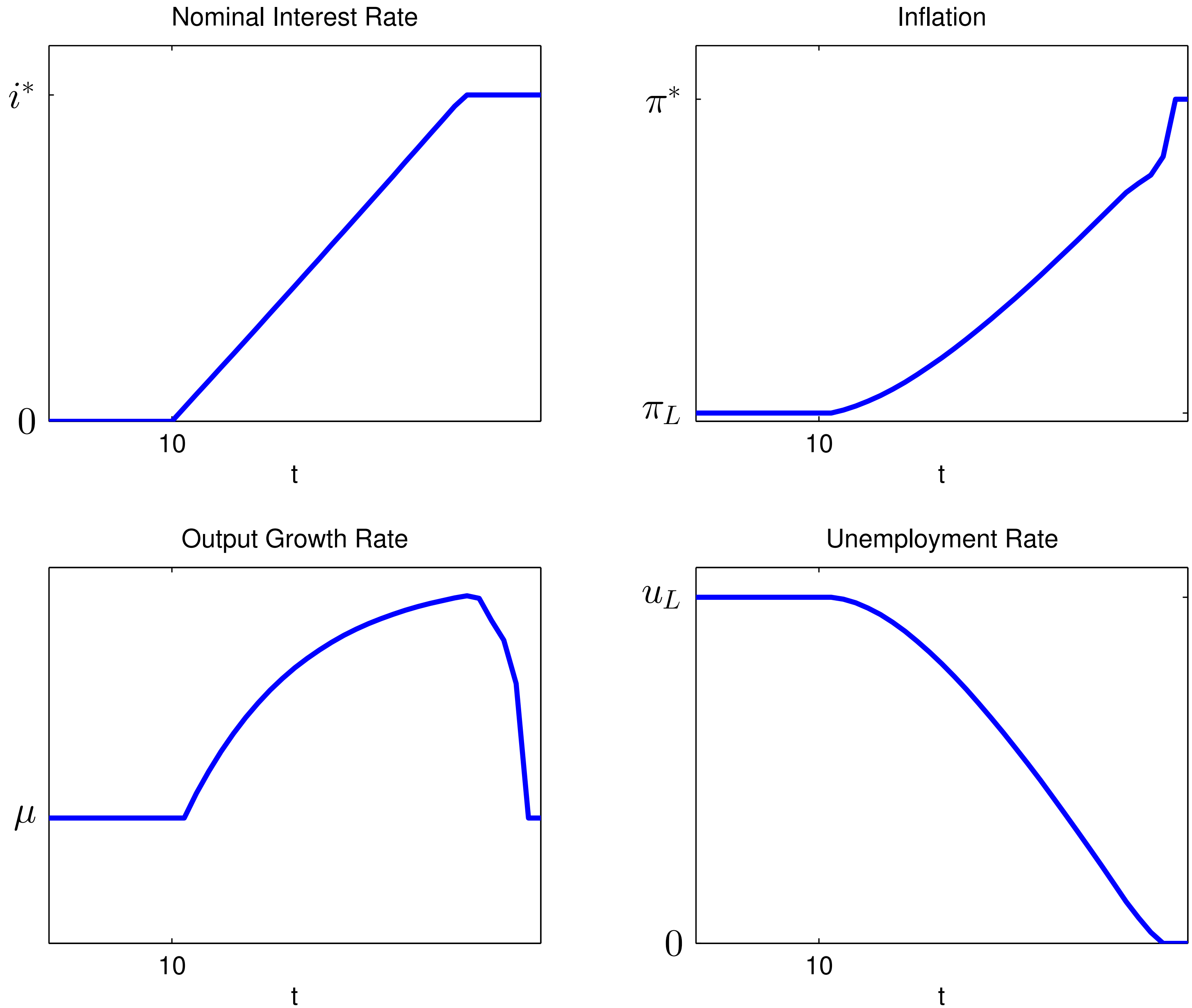
The proposed exit strategy:

Once the economy has been at the zero lower bound for some time, the central bank gradually raises the policy rate to the target level in steps of 25 basis points per quarter. Once rates are back to normal level, the central bank follows again a Taylor rule.

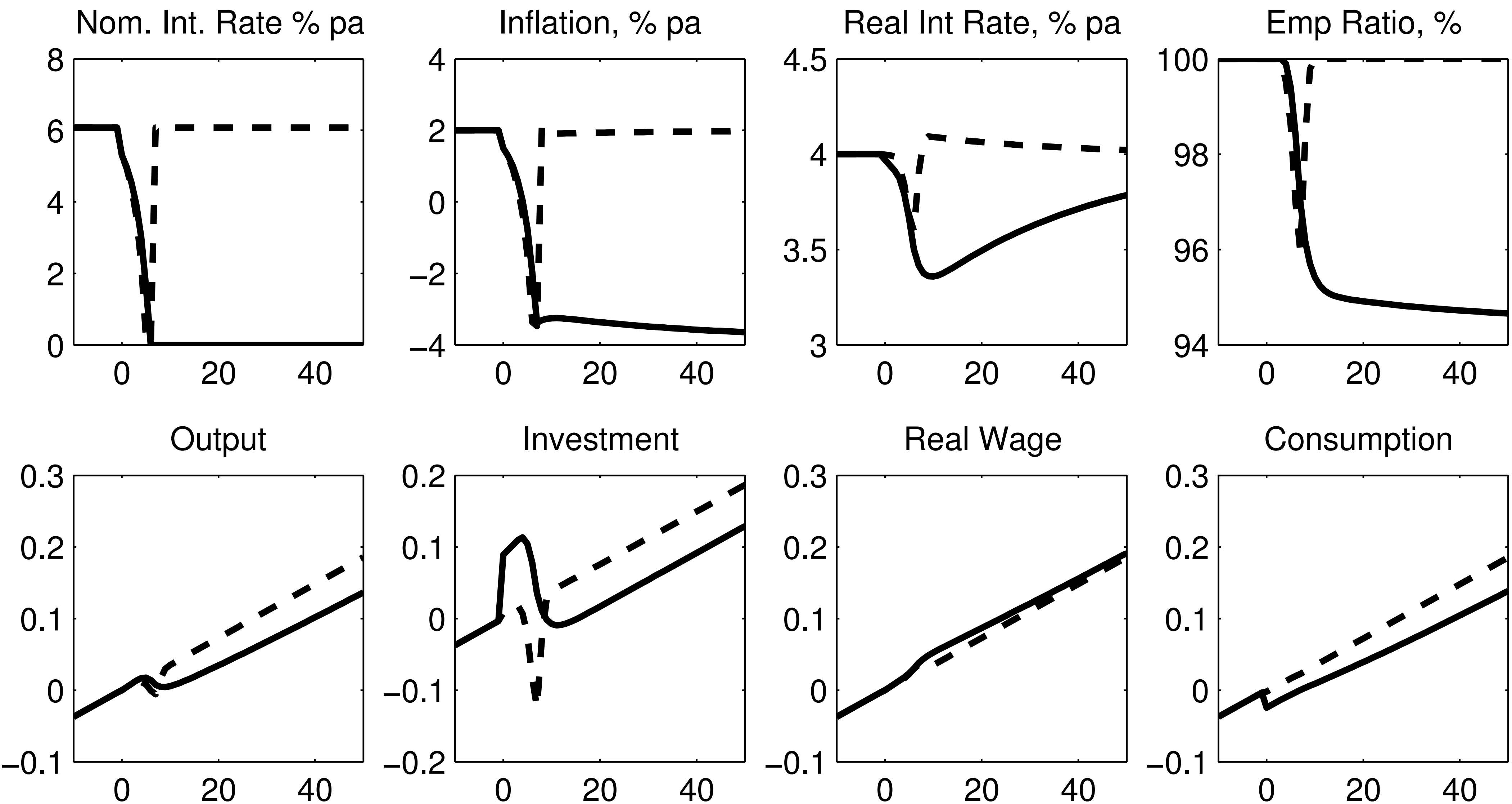
In the context of the model, such a strategy raises long-run inflation expectations.

The next slide illustrate how this exist strategy plays out in the model without capital and the slide thereafter in the model with capital.

Exiting a Chronic Liquidity Trap: Tightening is Easing



Exiting the Liquidity Trap: Tightening is easing also in the model with capital



Taylor-Rule; Exit Strategy. Source: Schmitt-Grohé and Uribe (2017) .

Let's turn to data now, and ask whether the prediction of the model, namely, that a permanent increase in the nominal rate, raises inflation already in the short run, **(the Neo Fisher effect)**, is consistent with empirical evidence.

The Fisher equation:

$$i = r + \pi$$

where

$i =$ nominal interest rate

$r =$ real interest rate

$\pi =$ inflation rate

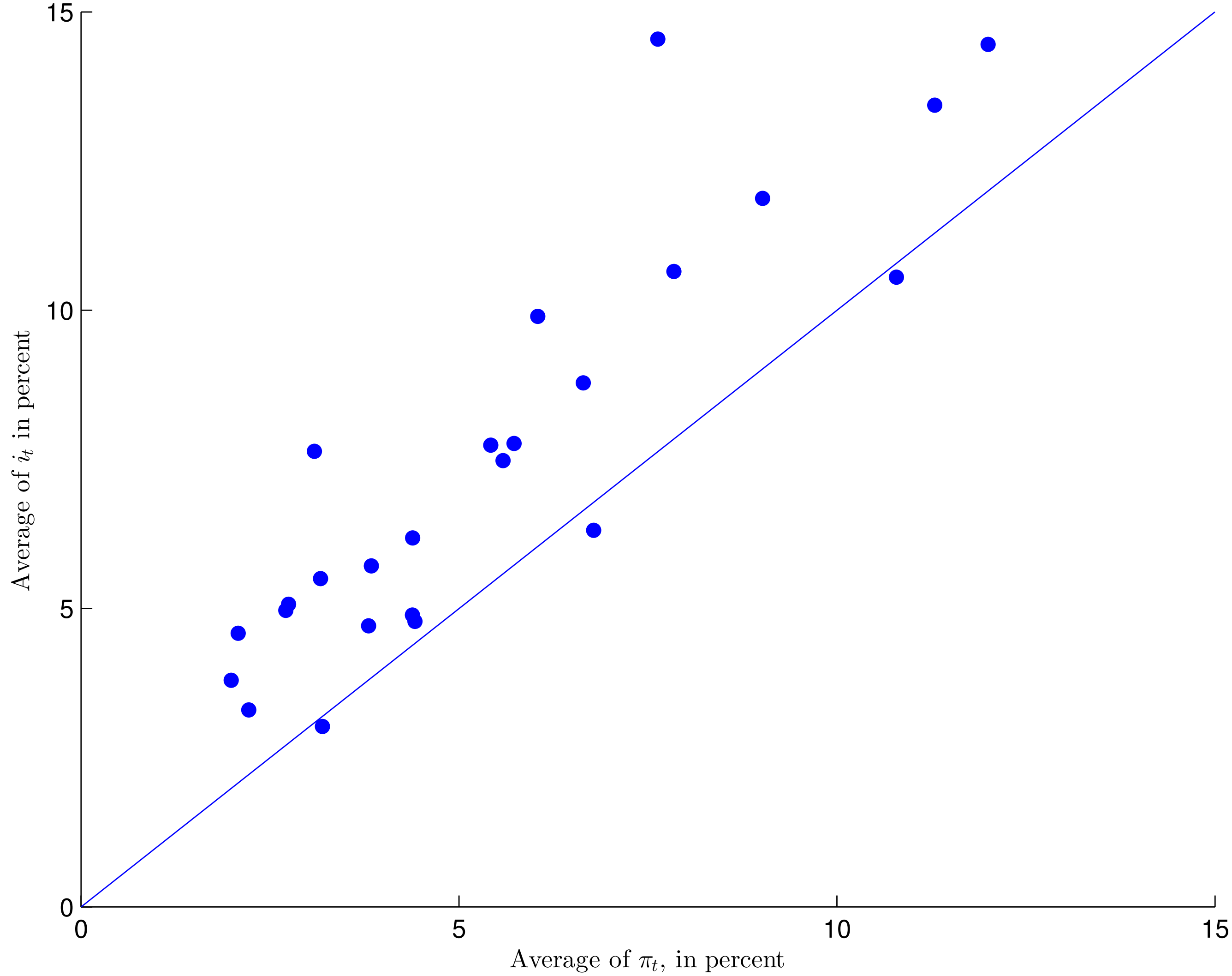
Effect of an increase in the nominal interest rate (i) on inflation (π)

	Effect on π in the	
	long-run	**short-run**
Transitory increase in i	0	$\downarrow$
Permanent increase in i	$\uparrow$	$\uparrow$

Entry (2,1): The Fisher Effect

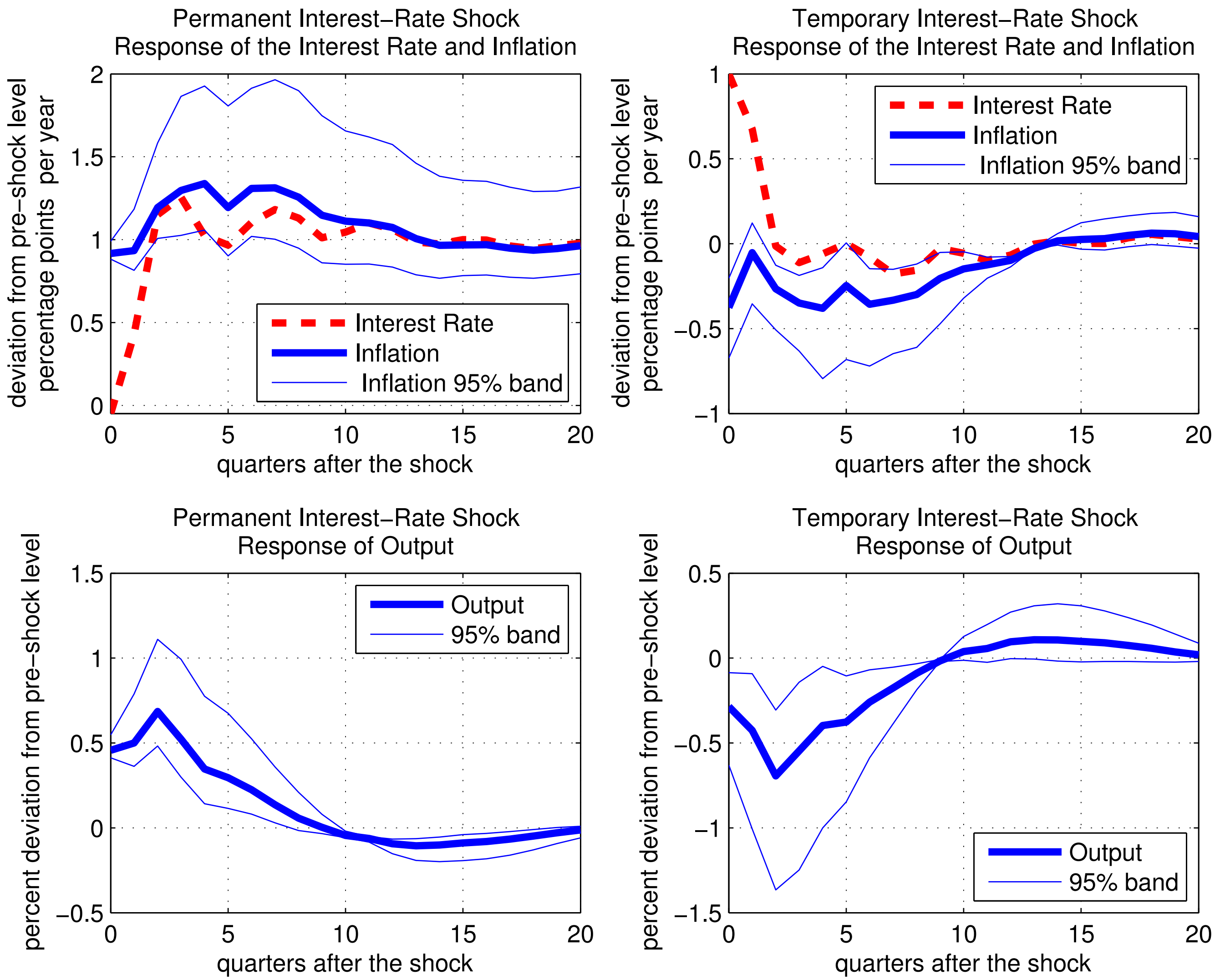
Entry (2,2): The Neo-Fisher Effect

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



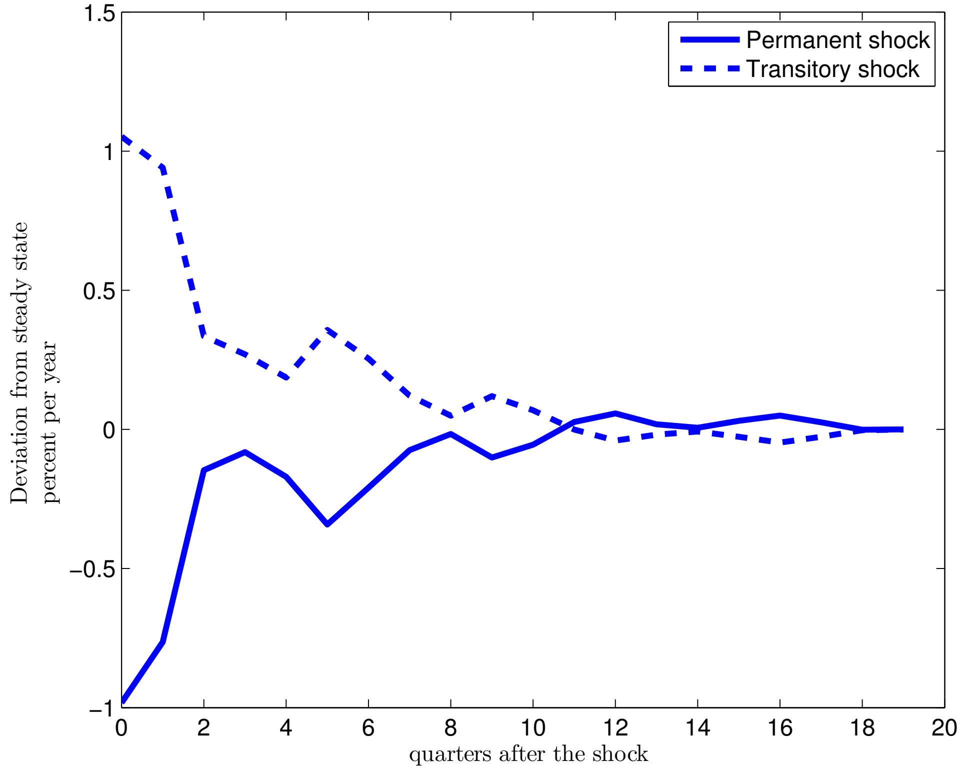
25 OECD countries. Average sample period is 1989 to 2012.

Estimated Impulse Responses to a 1-percent Nominal Rate Increase United States, 1954Q4-2018Q2



Source: Uribe, 2018.

Response of the Real Interest Rate to Permanent and Transitory Interest-Rate Shocks



Source: Uribe, 2018. Posterior mean estimates. The real interest rate is defined as $i_t - E_t\pi_{t+1}$.

Summary

• Models with nominal rigidities are prone to self-perpetuating liquidity traps. This holds for Taylor rules as well as for optimal policy under discretion.

• In such circumstances, models with nominal rigidities predict that a permanent increase in nominal interest rates can raise inflation already in the short run (**Neo Fisher Effect**) and thereby stimulate employment.

• This **neo-Fisherian** prediction of the model is consistent with empirical evidence on the short-run effects of permanent interest rate shocks from Uribe (2018).

Extras

The empirical model of Uribe, 2018.

all slides that follow are taken from Uribe 2018

The Empirical Model

$$\begin{bmatrix} y_t \\ \pi_t \\ i_t \end{bmatrix} \equiv \begin{bmatrix} \text{log of real output} \\ \text{inflation} \\ \text{nominal interest rate} \end{bmatrix}; \qquad \begin{bmatrix} \hat{y}_t \\ \hat{\pi}_t \\ \hat{i}_t \end{bmatrix} \equiv \begin{bmatrix} y_t - X_t^n \\ \pi_t - X_t^m \\ i_t - X_t^m \end{bmatrix}.$$

$$\begin{bmatrix} \hat{y}_t \\ \hat{\pi}_t \\ \hat{i}_t \end{bmatrix} = B(L) \begin{bmatrix} \hat{y}_{t-1} \\ \hat{\pi}_{t-1} \\ \hat{i}_{t-1} \end{bmatrix} + C \begin{bmatrix} \Delta X_t^m \\ \Delta X_t^n \\ z_t^m \\ z_t^n \end{bmatrix}$$

$$\begin{bmatrix} \Delta X_t^m \\ \Delta X_t^n \\ z_t^m \\ z_t^n \end{bmatrix} = \Lambda \begin{bmatrix} \Delta X_{t-1}^m \\ \Delta X_{t-1}^n \\ z_{t-1}^m \\ z_{t-1}^n \end{bmatrix} + \Gamma \begin{bmatrix} \epsilon_t^1 \\ \epsilon_t^2 \\ \epsilon_t^3 \\ \epsilon_t^4 \end{bmatrix}$$

where X_t^m =permanent monetary shock; X_t^n =permanent nonmonetary shock; z_t^m =transitory monetary shock; and z_t^n =transitory nonmonetary shock. Innovations $\epsilon_t^i \sim N(0,1)$ iid, for $i = 1, 2, 3, 4$.

Three Observables

- Δy_t, growth rate of real output per capita.
- $r_t \equiv i_t - \pi_t$, the interest-rate-inflation differential.
- $\Delta i_t \equiv i_t - i_{t-1}$, time difference of the nominal interest rate.

We then have the following **observation equations**:

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

Identification Assumptions

- Output, y_t, is cointegrated with the permanent nonmonetary shock, X_t^n.

- Inflation, π_t, is cointegrated with the permanent monetary shock, X_t^m.

- The nominal interest rate, i_t, is cointegrated with the permanent monetary shock, X_t^m.

- Transitory interest-rate shocks, $z_t^m \uparrow$ have a nonpositive impact effect on inflation.

- Transitory interest-rate shocks, $z_t^m \uparrow$ have a nonpositive impact effect on output.

Variance Decomposition: Empirical Model

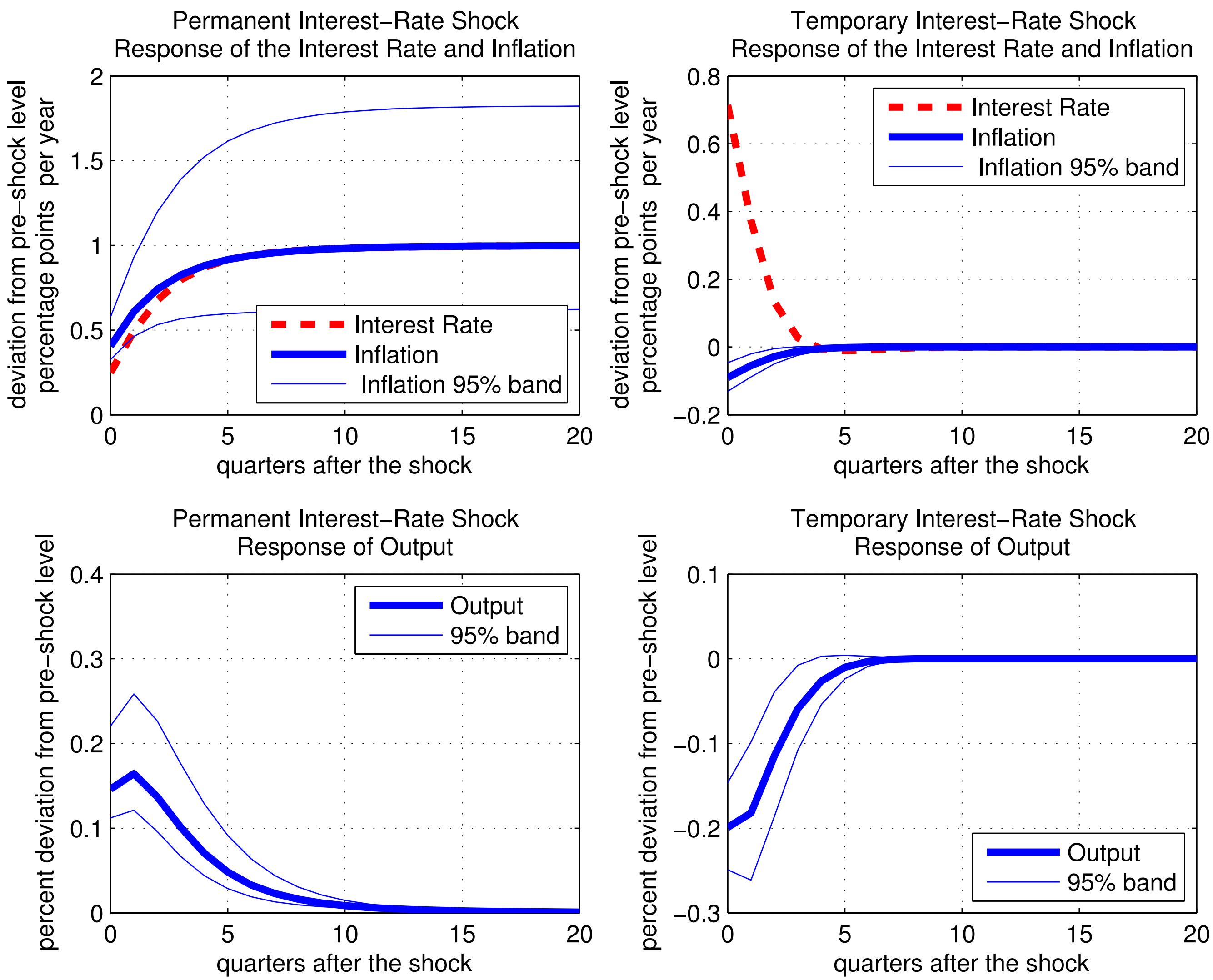
	Δy_t	$\Delta \pi_t$	Δi_t
Permanent Monetary Shock, ΔX_t^m	9.1	44.6	21.9
Transitory Monetary Shock, z_t^m	2.1	6.2	10.9
Permanent Non-Monetary Shock, ΔX_t^n	49.8	27.9	13.5
Transitory Non-Monetary Shock, z_t^n	39.1	21.4	53.7

Note. Posterior means. The variables Δy_t, $\Delta \pi_t$, and Δi_t denote output growth, the change in inflation, and the change in the nominal interest rate, respectively.

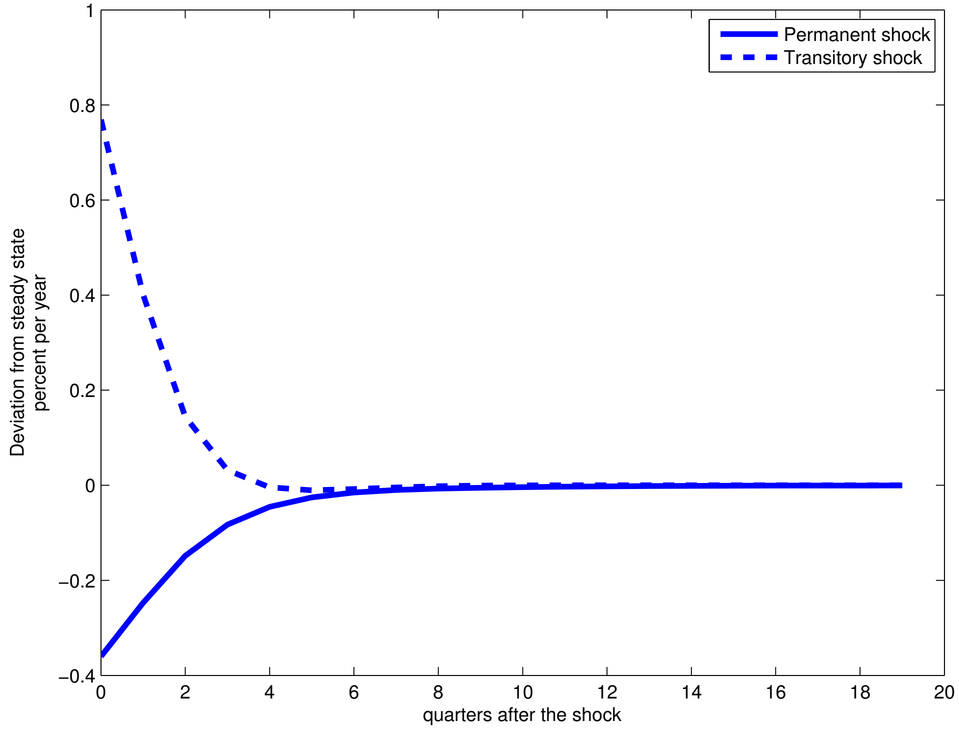
Variance Decomposition: New Keynesian Model

	Δy_t	$\Delta \pi_t$	Δi_t
Permanent Monetary Shock, g_t^m	1.7	42.8	9.3
Transitory Monetary Shock, z_t^m	3.0	2.1	35.7
Permanent Productivity Shock, g_t	84.7	2.2	4.8
Transitory Productivity Shock, z_t	0.4	5.1	2.1
Preference Shock, ξ_t	9.7	42.8	46.0
Labor-Supply Shock, θ_t	0.4	5.1	2.0

Impulse Responses to Interest-Rate Shocks: New Keynesian Model



Response of the Real Interest Rate to Permanent and Transitory Interest-Rate Shocks in the New-Keynesian Model



Notes. Posterior mean estimates. The real interest rate is defined as $i_t - E_t\pi_{t+1}$.