UNCONVENTIONAL MONETARY POLICY FROM THE PERSPECTIVE OF LONG-TERM RATES

Ricardo Reis

LSE

Based on:

Reis (2018a) "Central banks going long"

Reis (2018b) "The people versus the markets: inflation and monetary policy"

ECB Monetary Policy conference
Frankfurt, 30th of October, 2018

UMP as going long

- UMP steers long rates: forward guidance, quantitative easing, LSAPs, SMP, LTROs.

- Yellen (17) *"For this reason, the Committee turned to asset purchases to help make up for the shortfall by putting additional downward pressure on longer-term interest rates"* Federal Reserve Act of 1913: *"... to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates."*

- Gurkaynak & co: path factor as different UMPs.

Can the CB do it? Theory

- **Directly:** CB accepts deposits and makes loans of any one maturity. It has control of the interest rate at that maturity. Fed's FFR is overnight, ECB's MRO is one week, SNB is LIBOR for 3-months. Could be more.

- **Indirectly:** term structure and UMP

$$i_{t,T} = \upsilon_0 + \upsilon_i i_t + \upsilon_x x_t$$

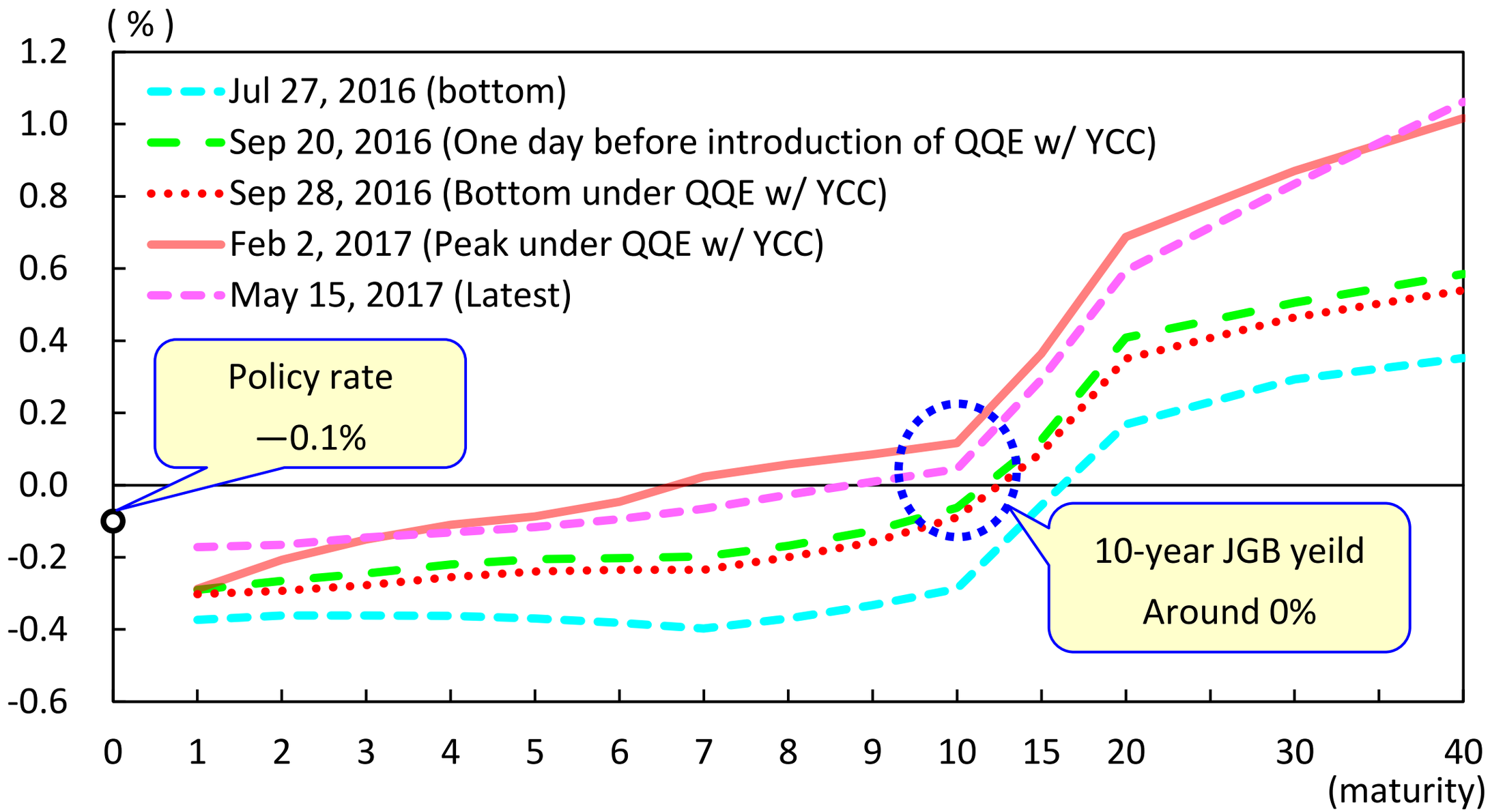
Can the CB do it? Evidence

- Krishnamurthy, Nagel, Vissing-Jorgensen, (2018)

		Avg. yield	6mo	2yr	5yr	10yr	Avg. yield	6mo	2yr	5yr	10yr
Policy	Ann. date	ITALY					SPAIN				
SMP	May 10, 2010	**-47**	-15	**-80**	**-55**	**-31**	**-62**	ND	**-87**	**-75**	**-51**
	Aug 7, 2011	**-84**	-26	**-103**	**-107**	**-92**	**-92**	ND	**-115**	**-112**	**-98**
	Total	**-131**	-41	**-183**	**-162**	**-123**	**-154**	ND	**-202**	**-187**	**-149**
OMT	Jul 26, 2012	**-72**	**-48**	**-116**	**-77**	**-48**	**-89**	**-69**	**-113**	**-89**	**-63**
	Aug 2, 2012	-23	-30	**-64**	-29	11	**-41**	-37	**-98**	**-36**	12
	Sep 6, 2012	**-31**	-15	-21	**-42**	**-46**	**-54**	-7	-37	**-67**	**-78**
	Total	**-126**	**-93**	**-201**	**-148**	**-83**	**-184**	**-113**	**-248**	**-192**	**-129**
3-year LTROs	Dec 1, 2011	**-46**	-25	**-46**	**-69**	**-34**	**-61**	-19	**-79**	**-72**	**-58**
	Dec 8, 2011	**35**	10	30	**47**	**35**	30	36	28	34	**32**
	Total	-11	-15	-16	-22	1	-31	17	-51	-38	-26

Extreme case: Japan today

Yield Curve Control



Source: Shiratsuka (2017)

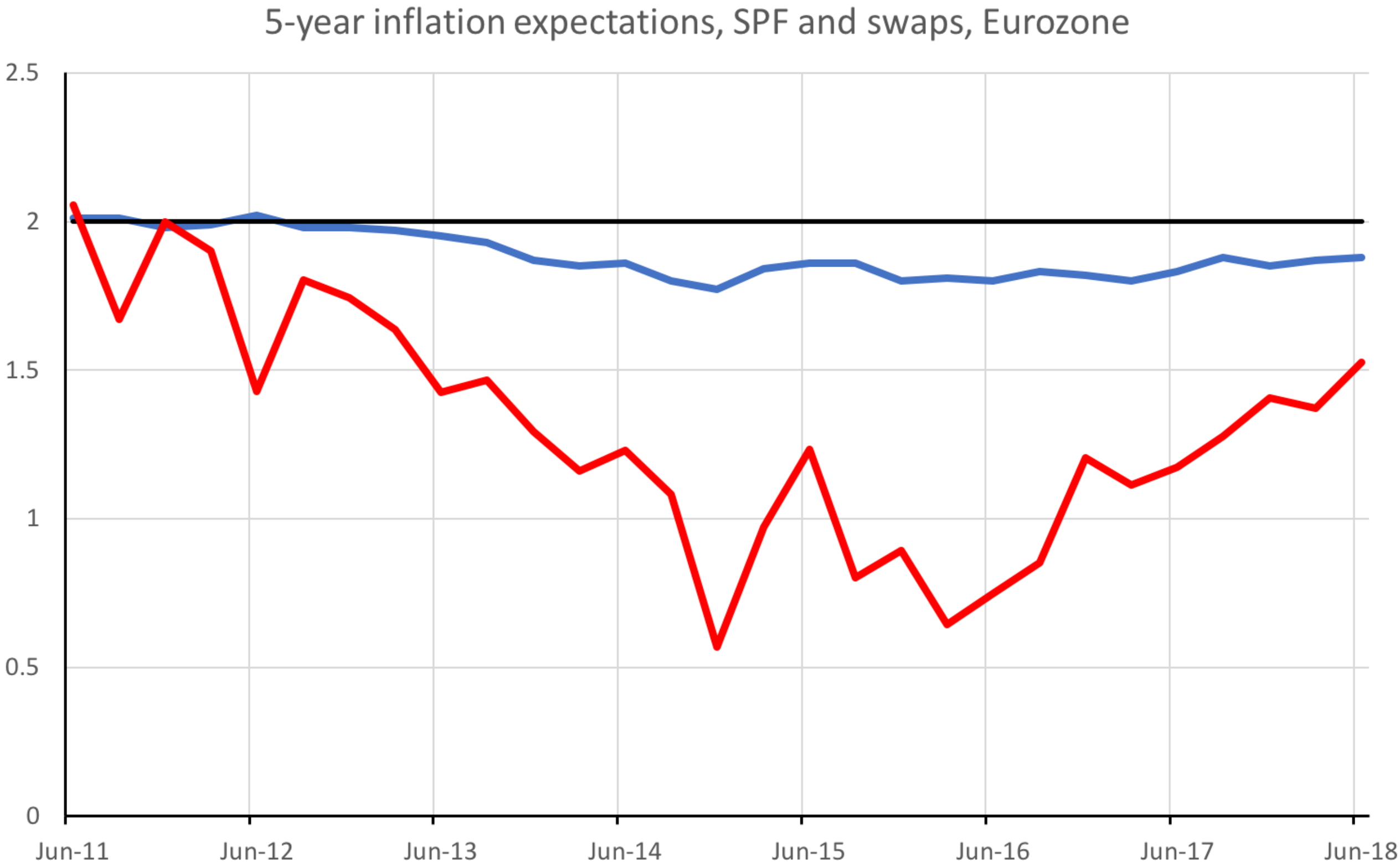
The goal: long-term inflation rate

- Mandate: *"The ECB has defined price stability as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%. In the pursuit of price stability, the ECB aims at maintaining inflation rates below, but close to, 2% over the medium term."*

- Long-run inflation close to long-run expectations.

- Draghi (2018). *"What is key is that inflation expectations remain well anchored. Here we are seeing some positive signs. For example, the latest ECB Survey of Professional Forecasters (SPF) shows longer-term inflation expectations stable at 1.9%."*

Anchored or not?



Source: Reis (2018b)

Relation instrument/target?

To raise the inflation expectations anchor should you:

1. **Lower long-term interest rates:** stimulate investment, raise aggregate demand, firms will raise prices?

2. **Raise long-term interest rates:** raise expected target, since real interest rate is unchanged given long-run monetary neutrality?

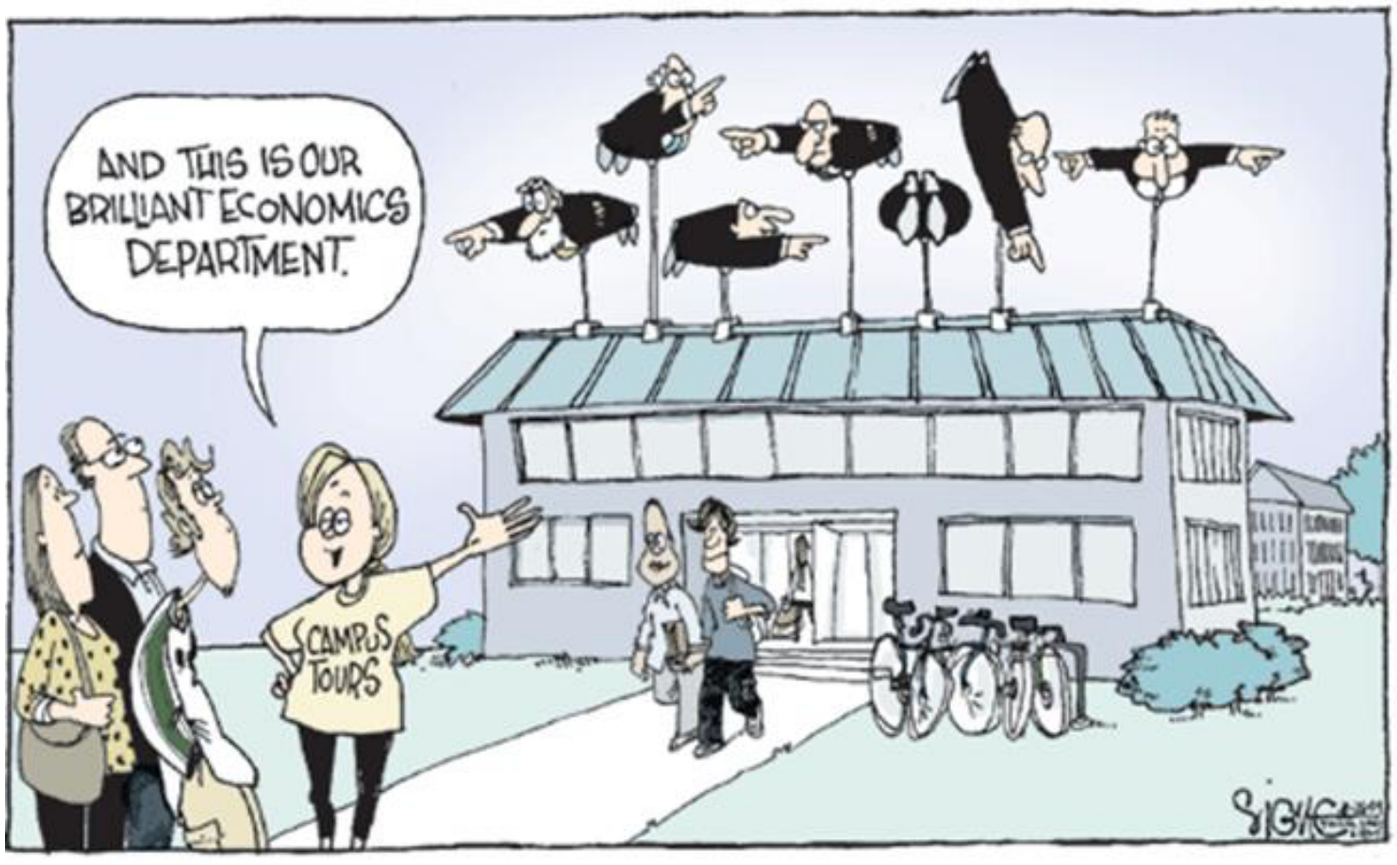
3. **Raise the spread:** it is temporarily low short rates, so short rates below long rates, that stimulates inflation?

Two questions in this talk

- When go long, can monetary policy keep long-run inflation expectations anchored and how?
  - Determinacy
  - Multiplicity
  - Variability

- When markets and people disagree, what is behind it and what does it imply for anchoring of inflation?
  - Close determinants
  - Policy and outcomes
  - Discrepancy as diagnosis

1. Standard theory of monetary policy and inflation



Modeling policy

Fisher equation and classical dichotomy:

$$i_t = r_t + \pi_t^e - \alpha'\alpha - \sigma_m^2 \alpha_m$$

Equilibrium definition

$$\lim_{T\to\infty} \mathbb{E}_t \left(e^{-\epsilon(T-t)} \pi^e(r_T, x_T) \right) = 0$$

Interest-rate policy:

$$d(i_t - x_t) = -\rho(i_t - x_t)dt + \eta \left(\frac{dp_t}{p_t} - \pi^* dt \right)$$

Modeling policy

Proposition: *With conventional monetary policy, expected inflation is:*

i) *Determinate as long as* $\eta > \rho$

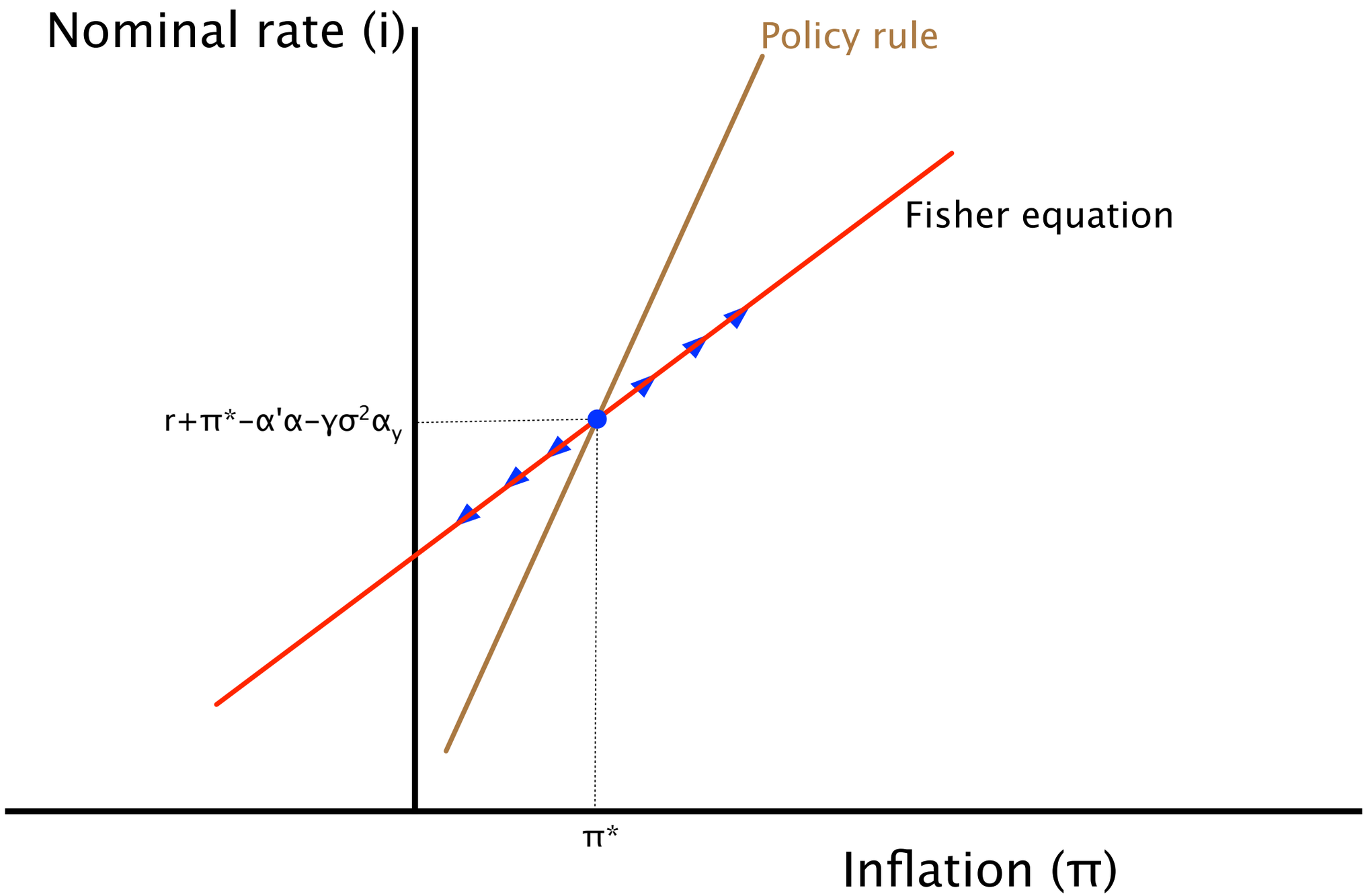
ii) *Given by:*

$$\pi_t^e = \pi^* + \left(\frac{\rho}{\eta - \rho}\right)\varepsilon_t + \int_0^\infty \eta e^{-(\eta-\rho)s}\mathbb{E}_t(\varepsilon_{t+s} - \varepsilon_t)ds$$

iii) *The driving variable is:*

$$\varepsilon_t = r(s_t) + \pi^* - \alpha'\alpha - \sigma_m^2\alpha_m - x_t$$

Taylor rule dynamics



Source: Reis (2018a)

Focus on autoregressive shocks

Proposition: *With autoregressive shocks, expected inflation may rise or fall with contractionary policy shocks, depending on strength of smoothing versus correlated shocks:*

$$\pi^e(r_t, x_t) = \pi^* + \left(\frac{\rho - \kappa_r}{\kappa_r + \eta - \rho}\right)(r_t - \bar{r})$$

$$- \left(\frac{\rho - \kappa_x}{\kappa_x + \eta - \rho}\right)(x_t - \bar{x}).$$

Actual inflation falls after contractionary policy shock:

$$\frac{dp_t}{p_t} = \pi^e(r_t, x_t)dt + \frac{dz_t^r}{\kappa_r + \eta - \rho} - \frac{dz_t^x}{\kappa_x + \eta - \rho}$$

Schmitt-Grohe: long-standing identification challenge

2. When the Fed went long: the 1940s

The Fed 1942-48

1942-45

- **Goal**: answer to Treasury, keep bond prices low.
- **Policy regime** (April 1942 announcement): Fed will stand ready to buy and sell 90-day Treasury bills at a fixed rate of 3/8%.
- **Going long**: explicit ceiling of 2.5% for the 10-year yield.
- Inflation steady, long ceiling did not bind.

1945-48 developments

- Rising inflation
- Fed raises T-bill rate in 7/47; one year later 1 1/8%.
- Long pressure: yield reached 2.37% in 11/1947, 2.45% in 12/47.
- Maturity of the Fed's portfolio increased.

The Korean war, 1949-51

- October 16, 1947 still: *"We can assure you that these actions will not affect the maintenance of the 2 1/2 percent rate for the outstanding long-term government bonds."*

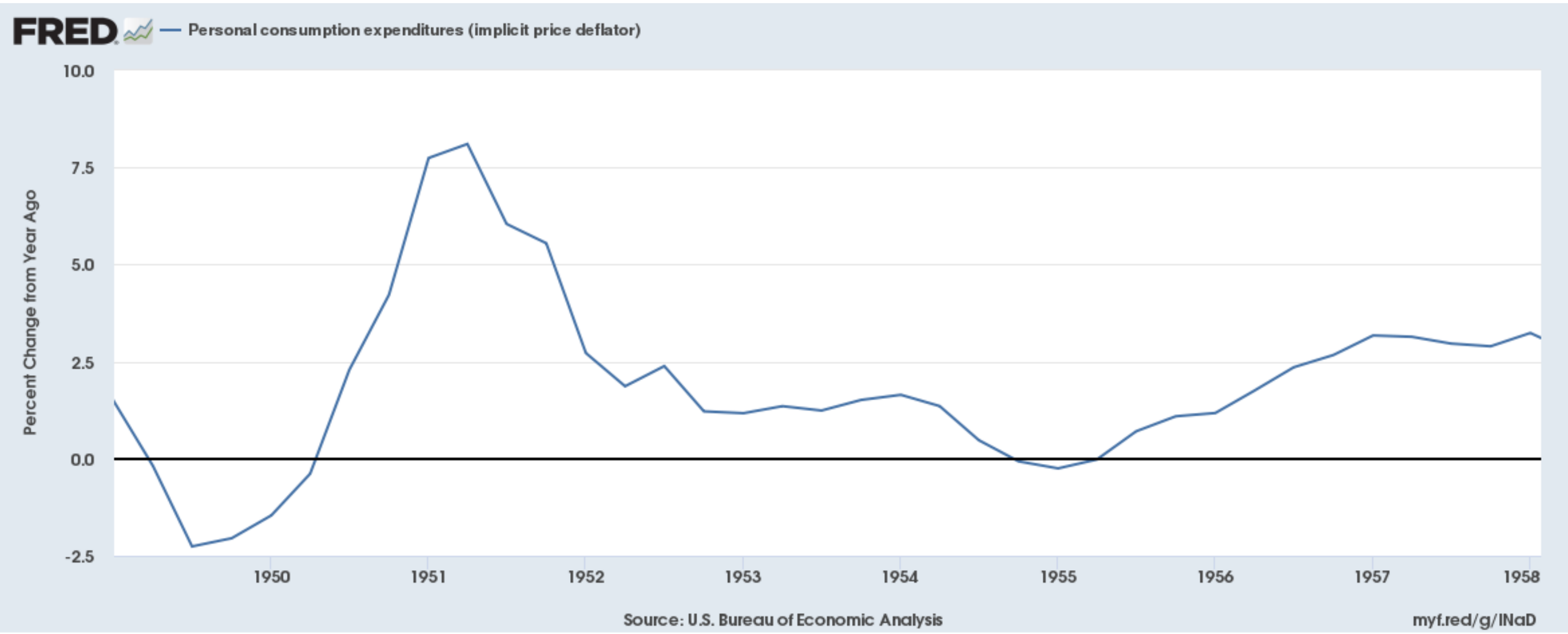
- President Truman insists mortgage rates do not rise.

- Korean War anticipation of spending: rising real rates

- Treasury-Fed accord of March 4, 1951: *"Few episodes in American monetary history have attracted so much attention in the halls of Congress and in academic quarters, alike."* Friedman and Schwartz.

- Fed abandons ceiling in 1953, after which "bills only"

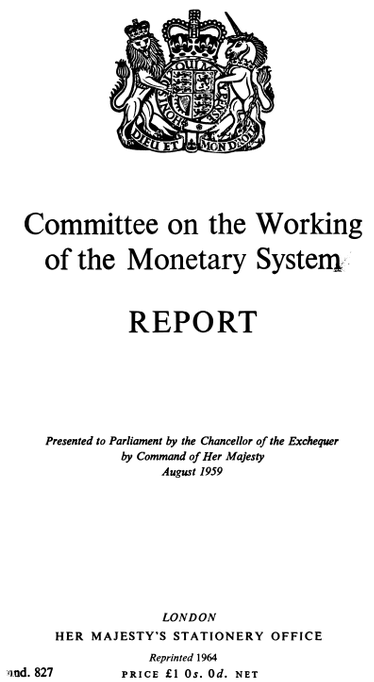
U.S. PCE Inflation



UK monetary policy in 1950s

- Ceiling on 10-year rate of 2.5%, by refusing to sell bonds at lower price. Setting interest rates, let markets determine maturities.

- Increases in bank rate came with maturity of public debt falling



Committee on the Working of the Monetary System

REPORT

Presented to Parliament by the Chancellor of the Exchequer by Command of Her Majesty August 1959

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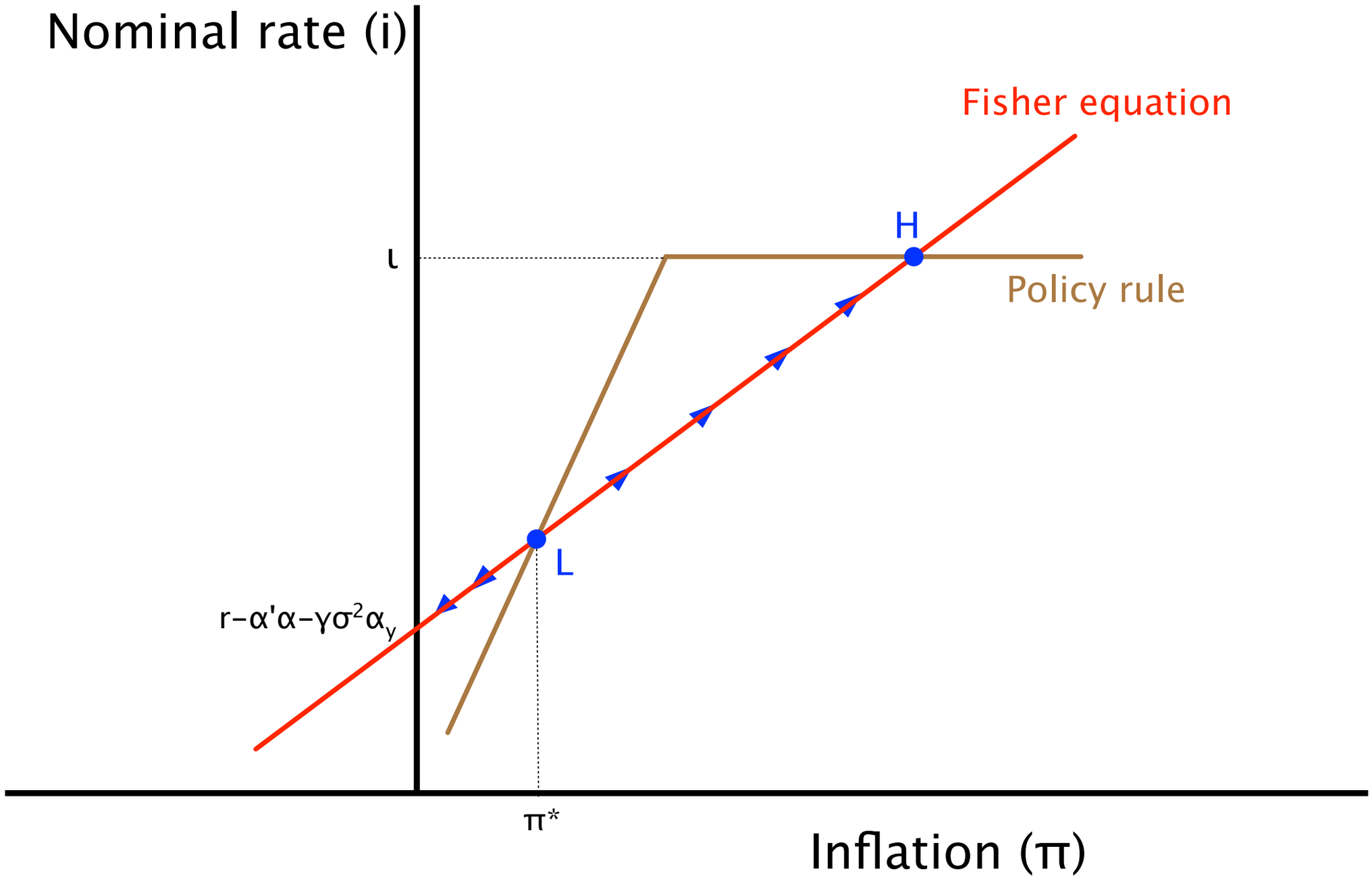
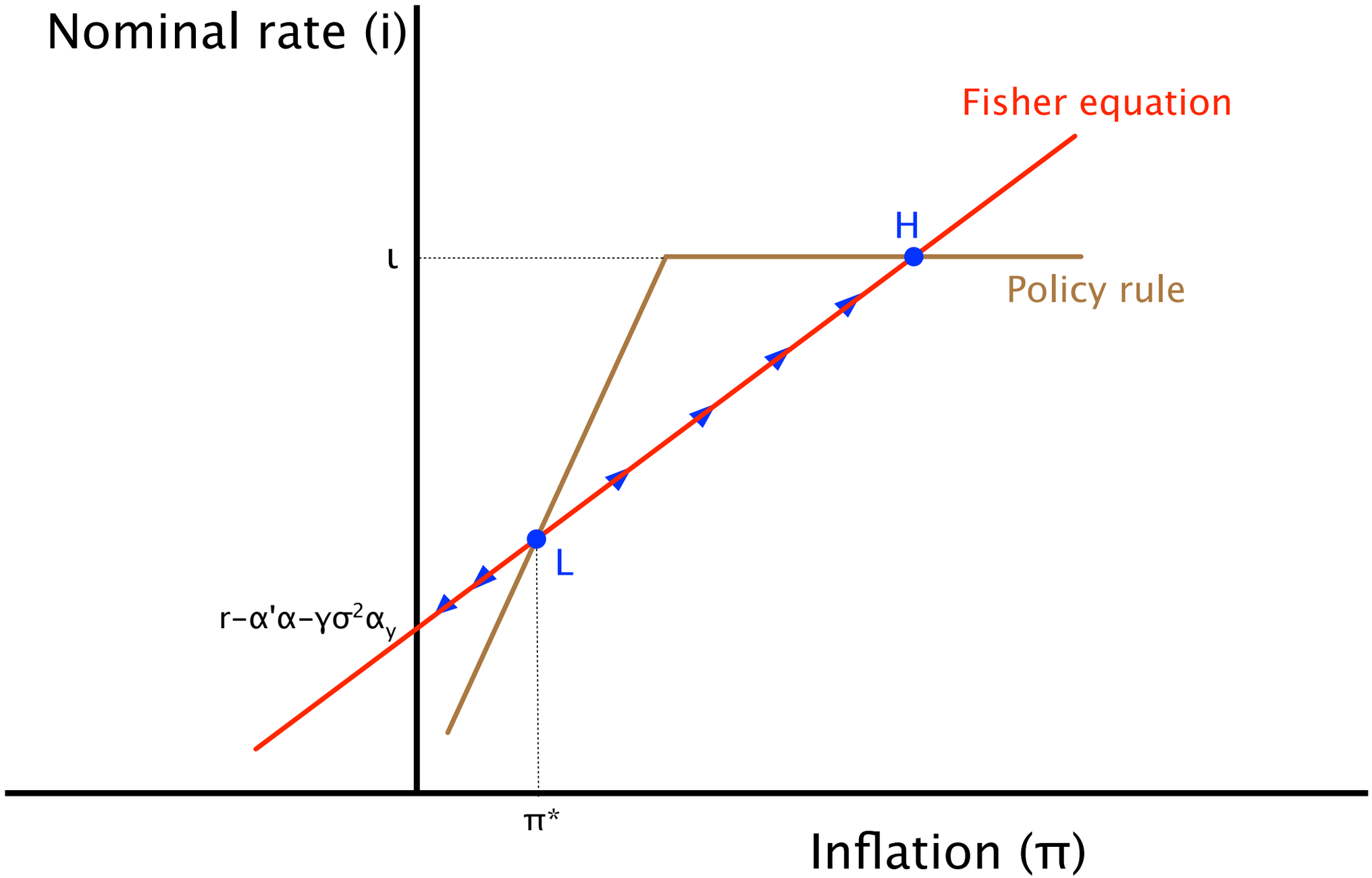
"Policymakers must have and must consciously exercise a positive policy about interest rates, long as well as short, and about the relationship between them."

Ceiling rule



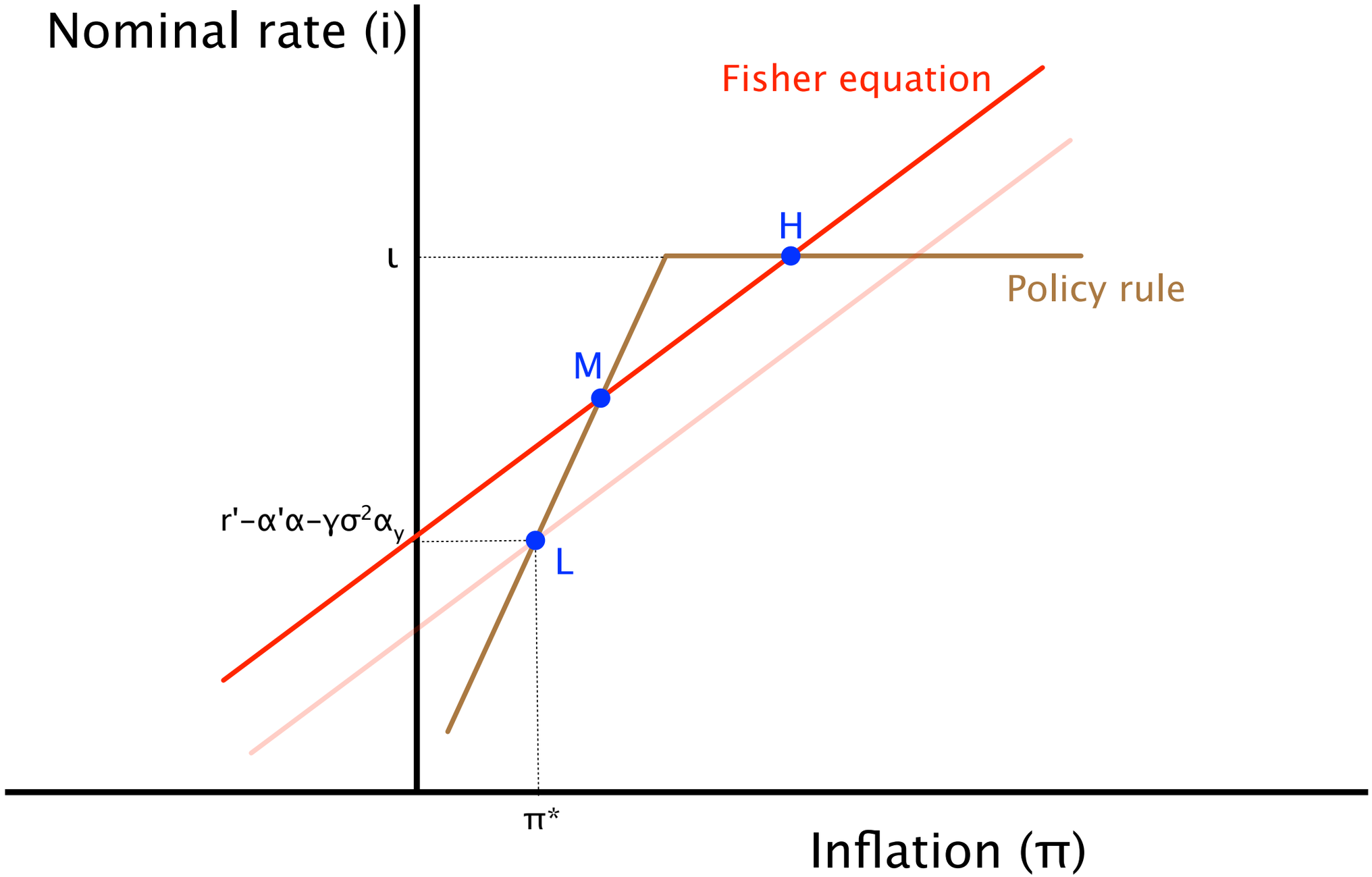
Source: Reis (2018a)

Until 1949, stay near L



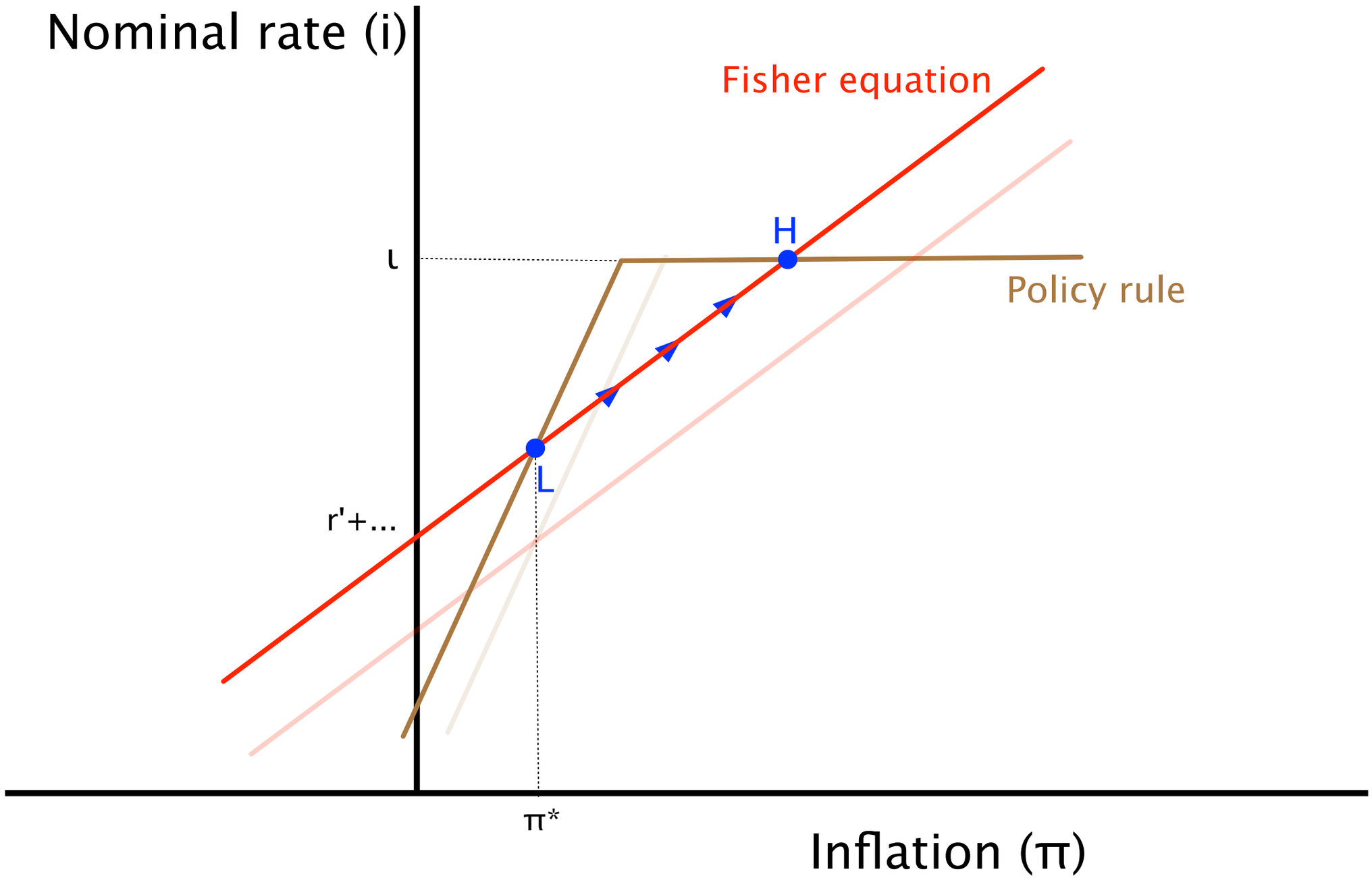
Source: Reis (2018a)

Korean war and M



Source: Reis (2018a)

Trying get back to L, escape fear H



Source: Reis (2018a)

3. The people versus the market

Measurement

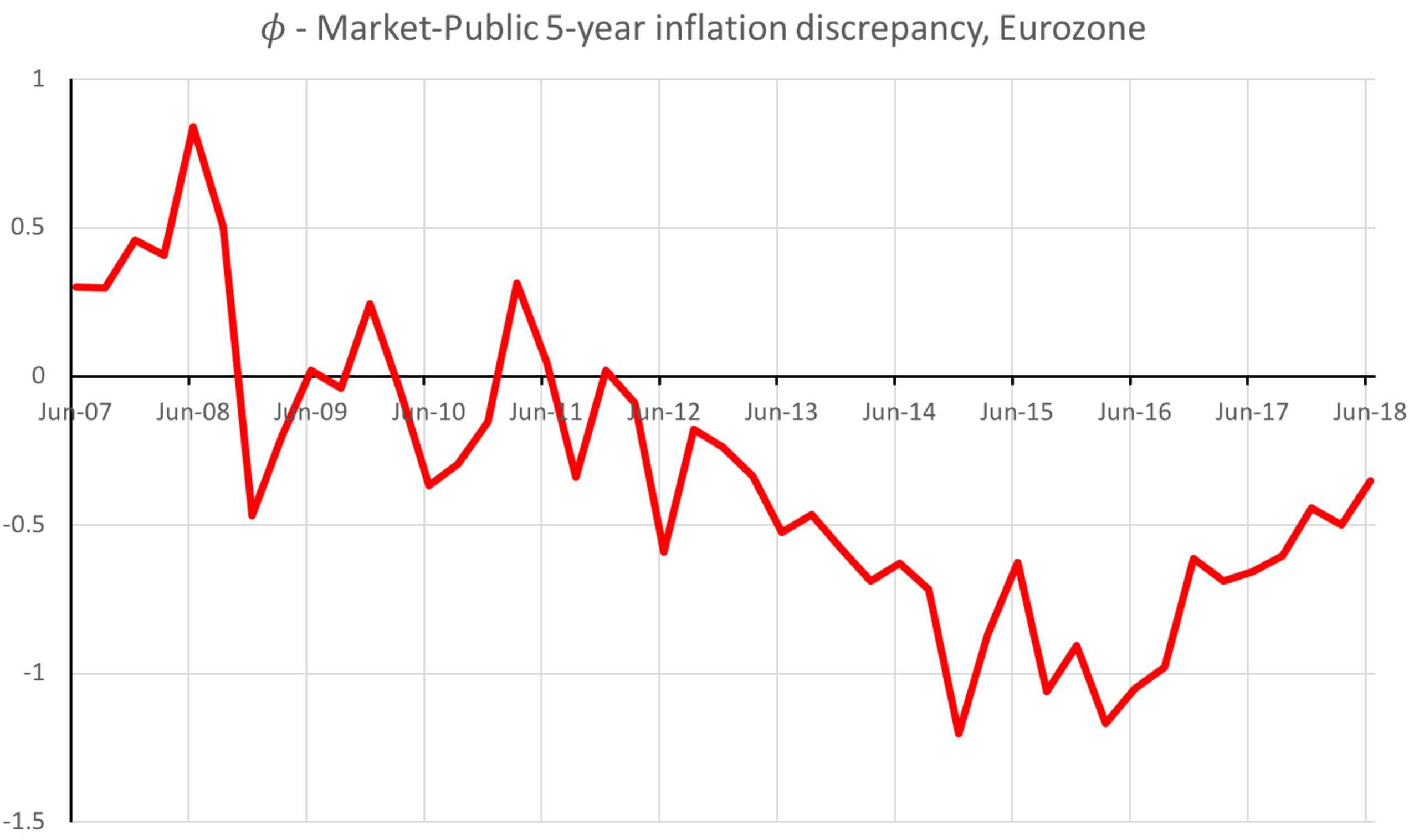
- The **discrepancy**

$$\phi_t = \mathbb{E}_t^*(\pi_{t,T}) - \mathbb{E}_t^p(\pi_{t,T})$$

- **Measurement 1**: Inflation swaps (or break even)

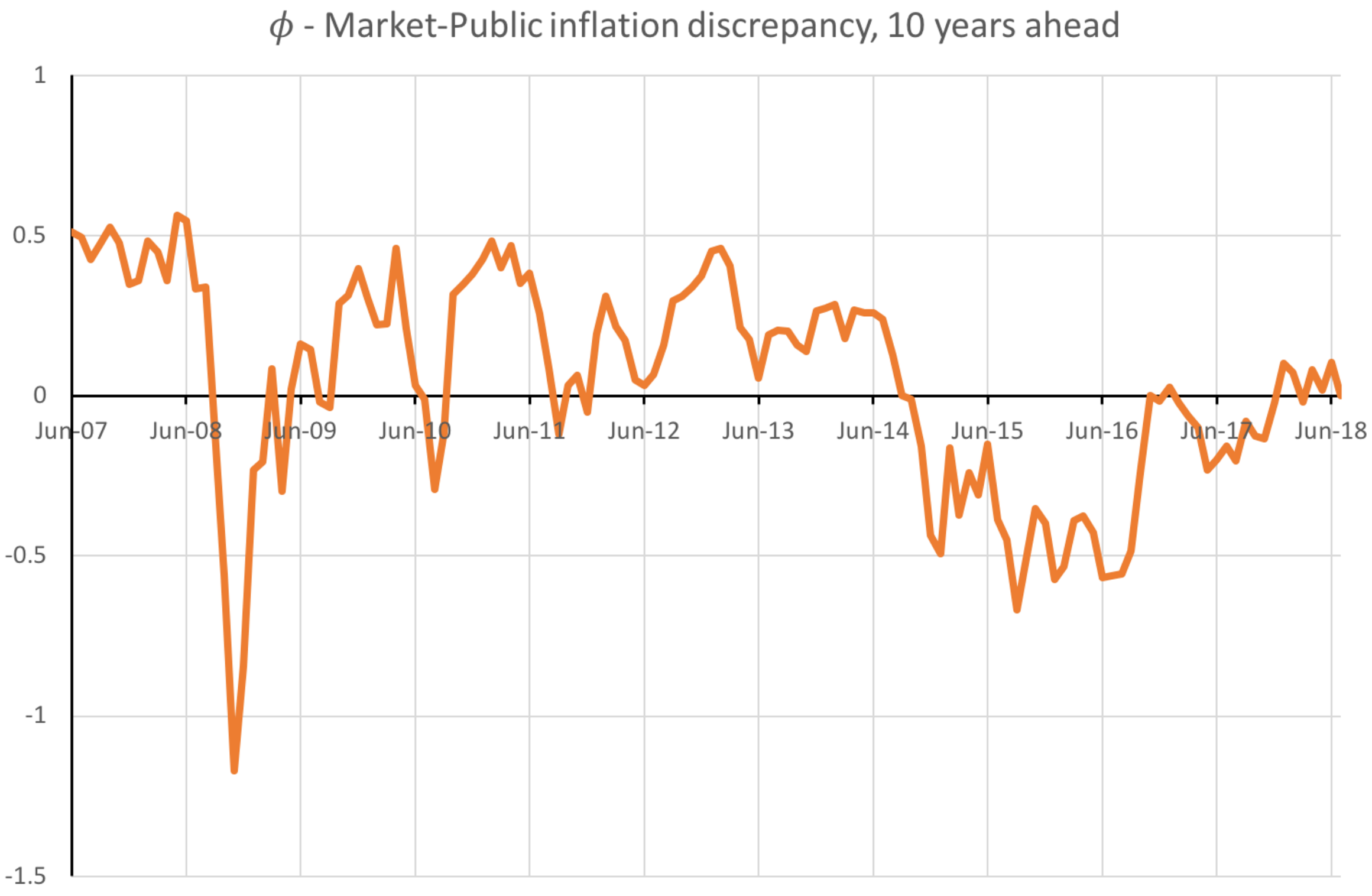
- **Measurement 2**: Surveys of households and professionals

Discrepancy in the Eurozone



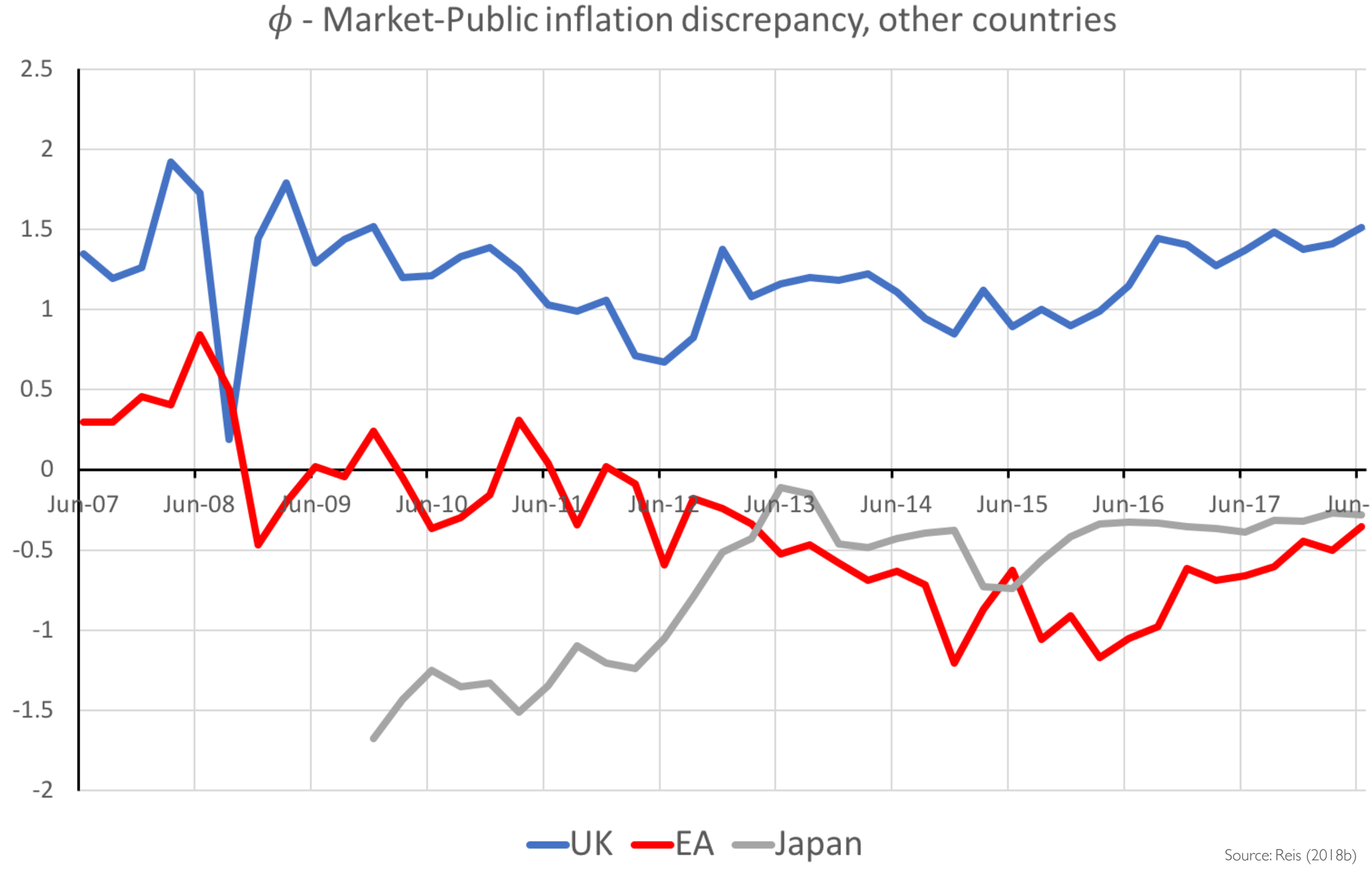
Source: Reis (2018b)

Discrepancy in the US



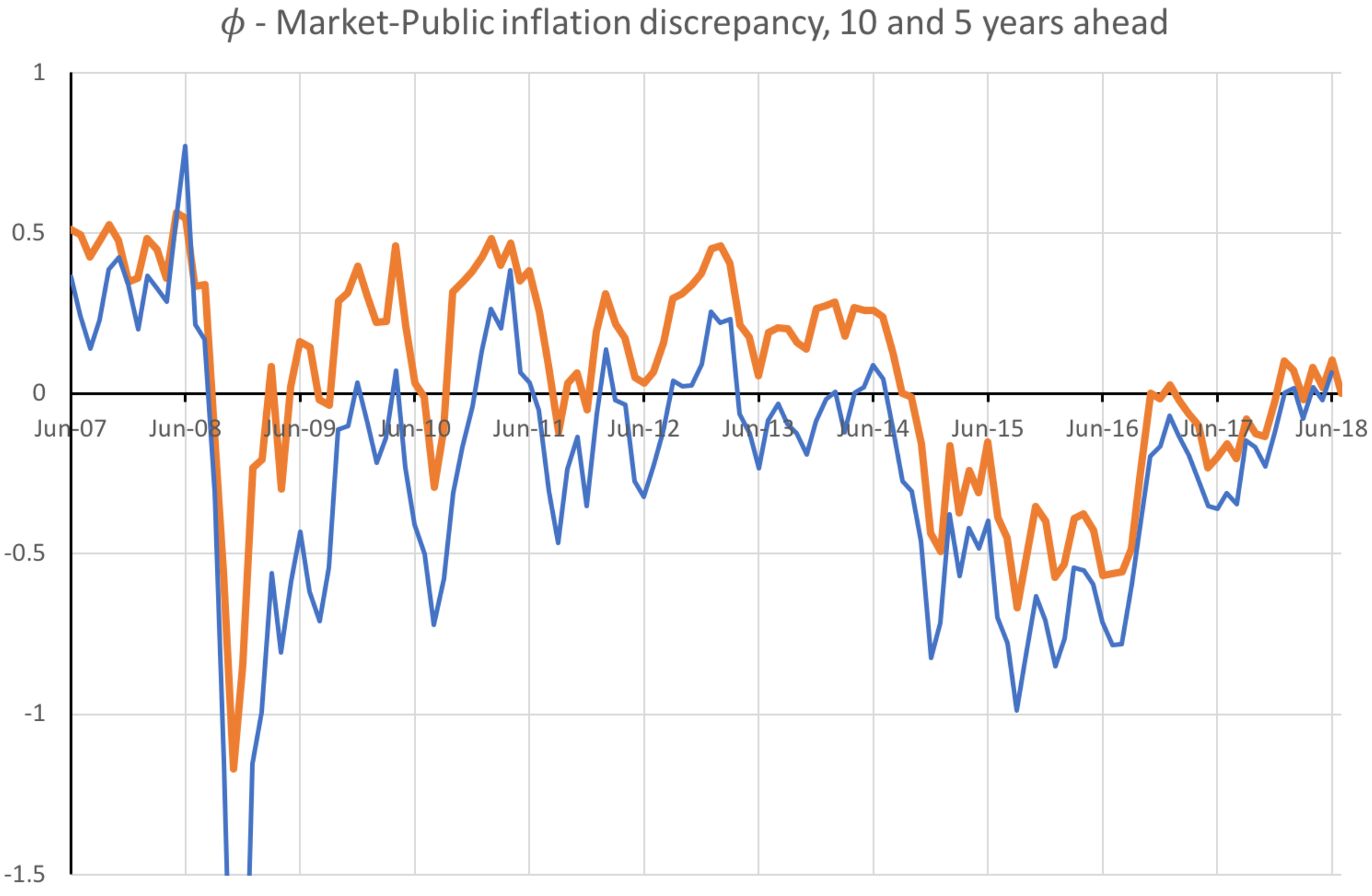
Source: Reis (2018b)

Discrepancy in other countries



Source: Reis (2018b)

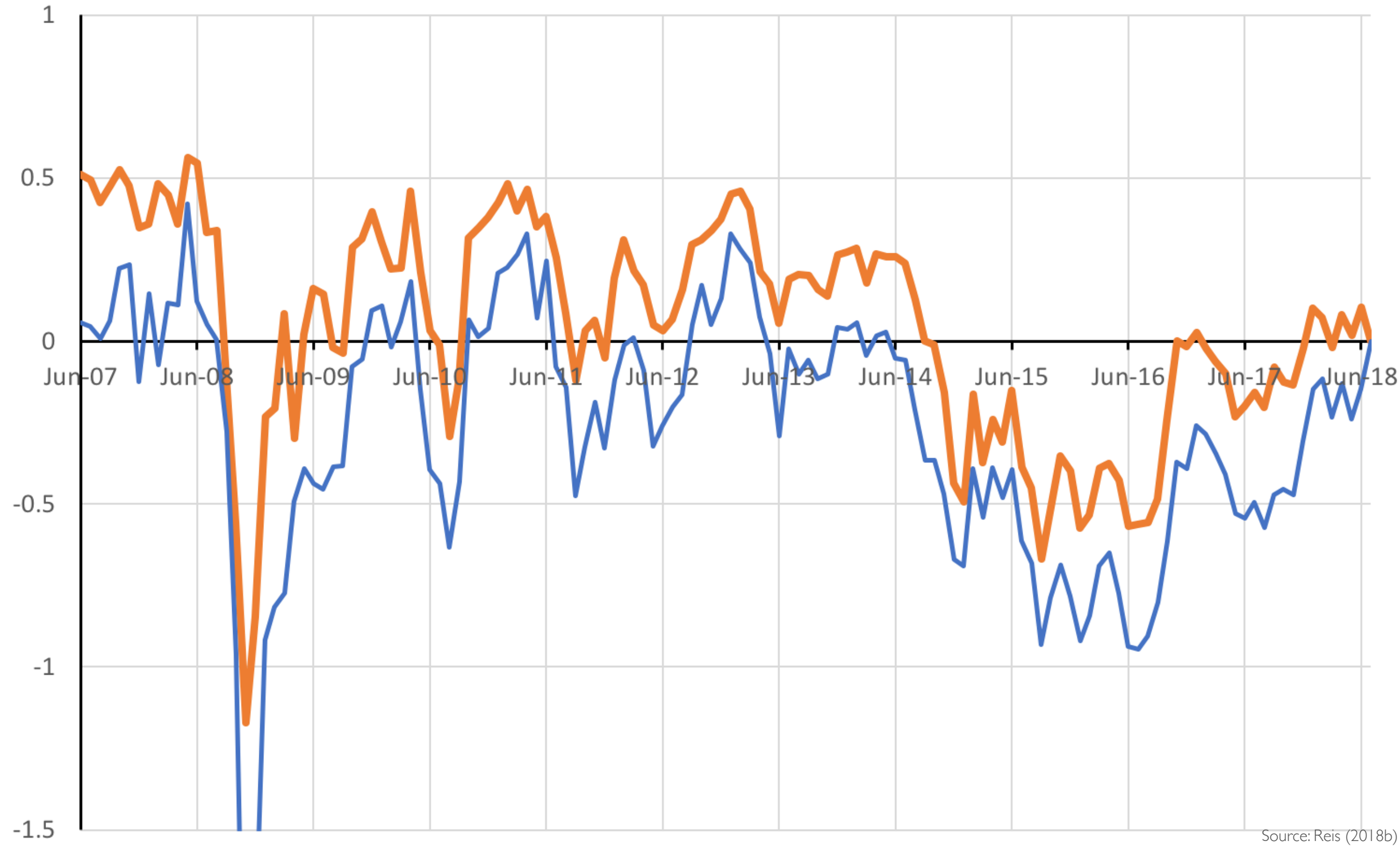
Robustness to horizon (US)



Source: Reis (2018b)

Robustness to break even (US)

ϕ - Market-Public inflation discrepancy, Swaps or TIPS



Source: Reis (2018b)

Decomposition

Proposition: *The inflation risk premium is the sum of three terms in annualized log-return terms:*

$$\phi = Var^*(\pi_T)\mathbb{E}^*(1+\pi_T) \qquad \text{risk}$$

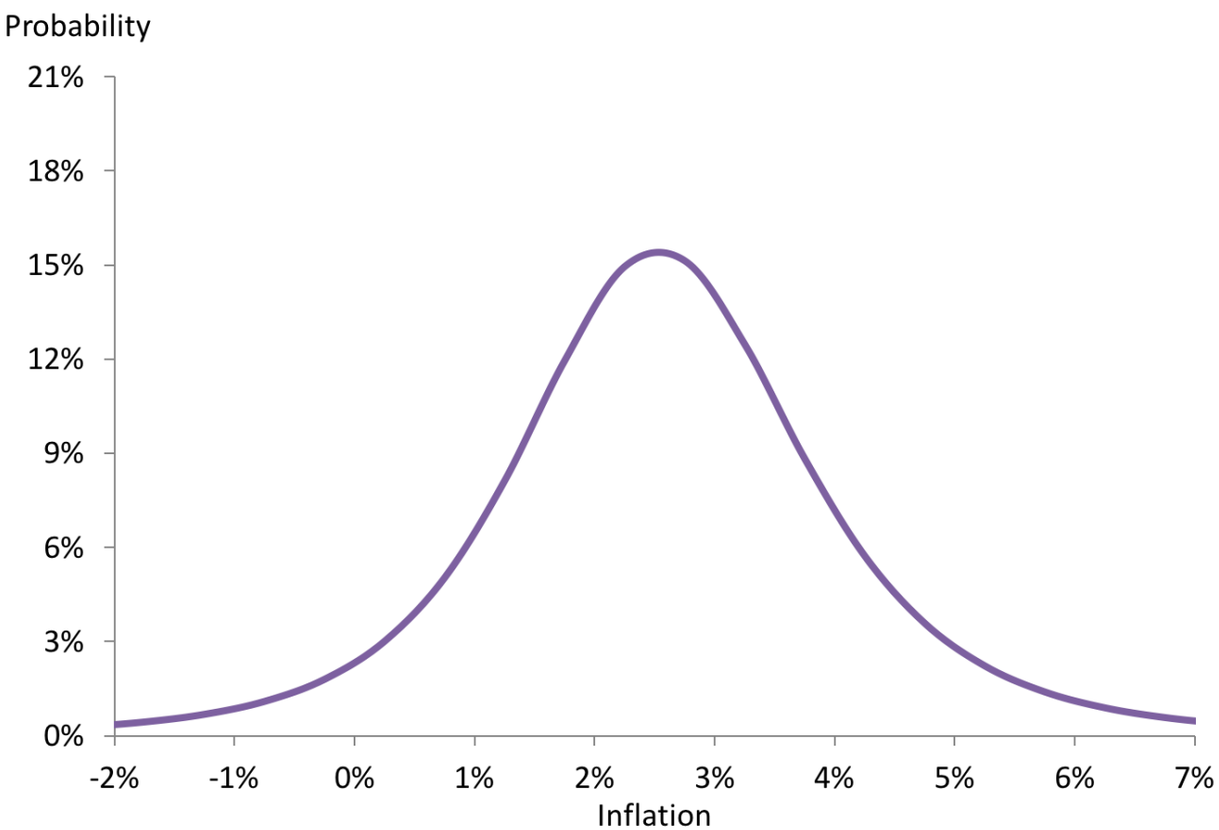
$$-Cov(n_T, i_T - \pi_T) \qquad \text{covariance}$$

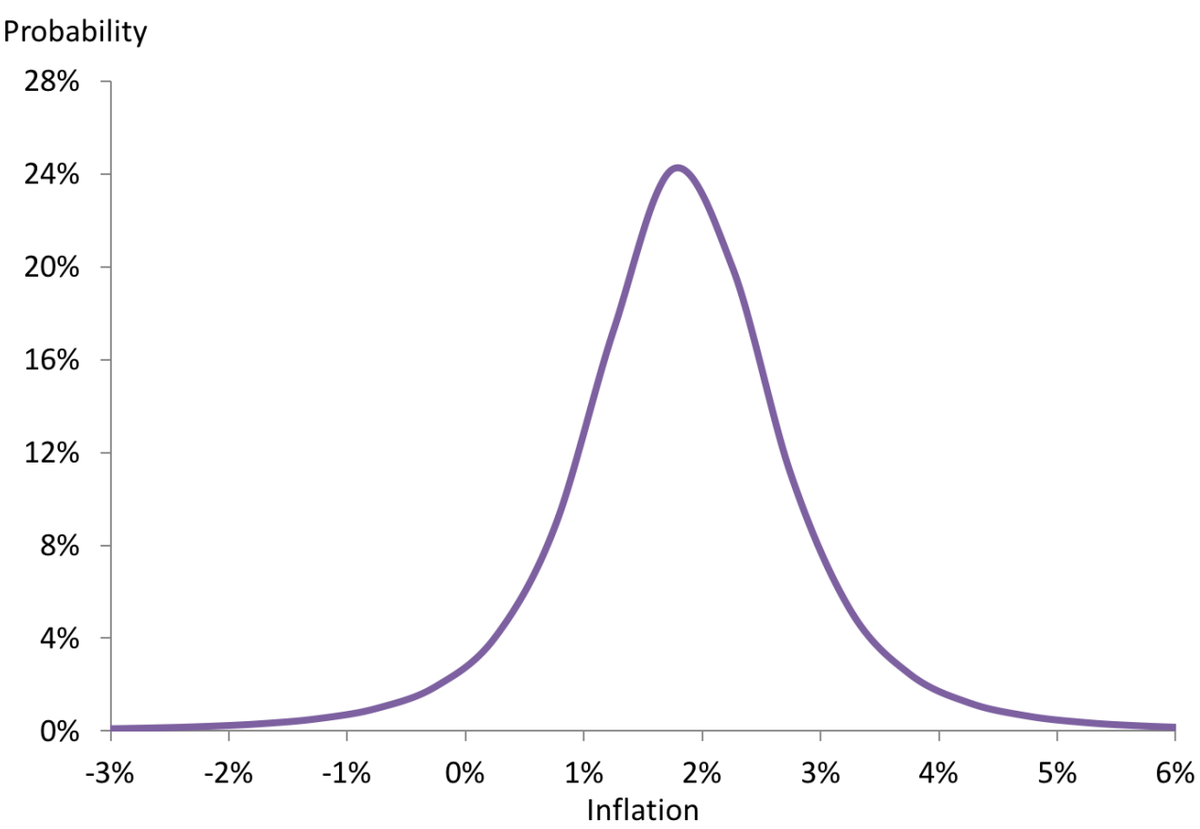
$$+\mathbb{E}^m(\pi_T) - \mathbb{E}^p(\pi_T) \qquad \text{disagreement}$$

Measurement

- Risk term: date-t risk-neutral variance of inflation over the next 10 years.

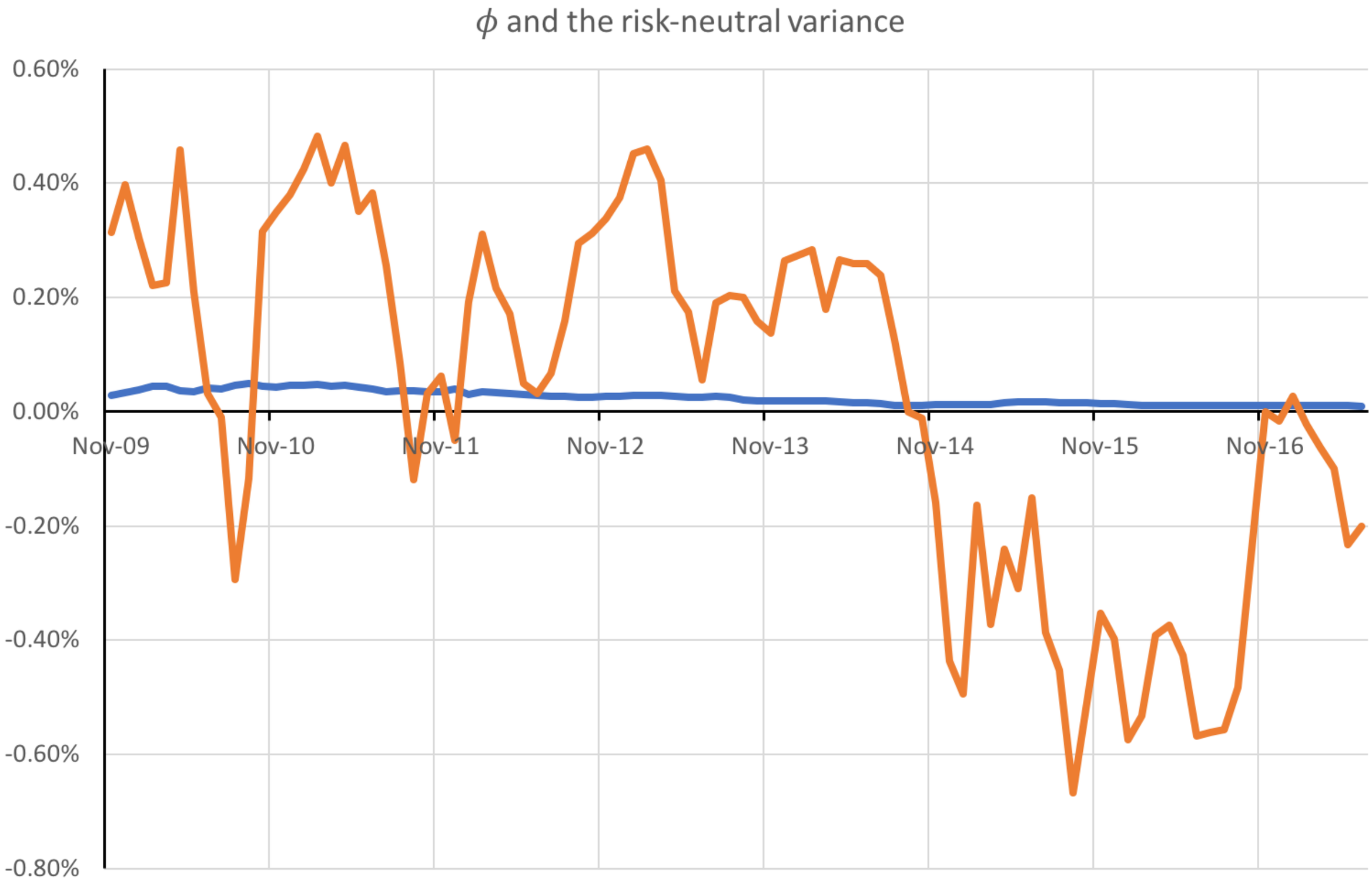
- Data from CPI options, caps and floors, increments of 0.5%, Hilscher, Raviv, Reis (2016). 2012 vs 2015:





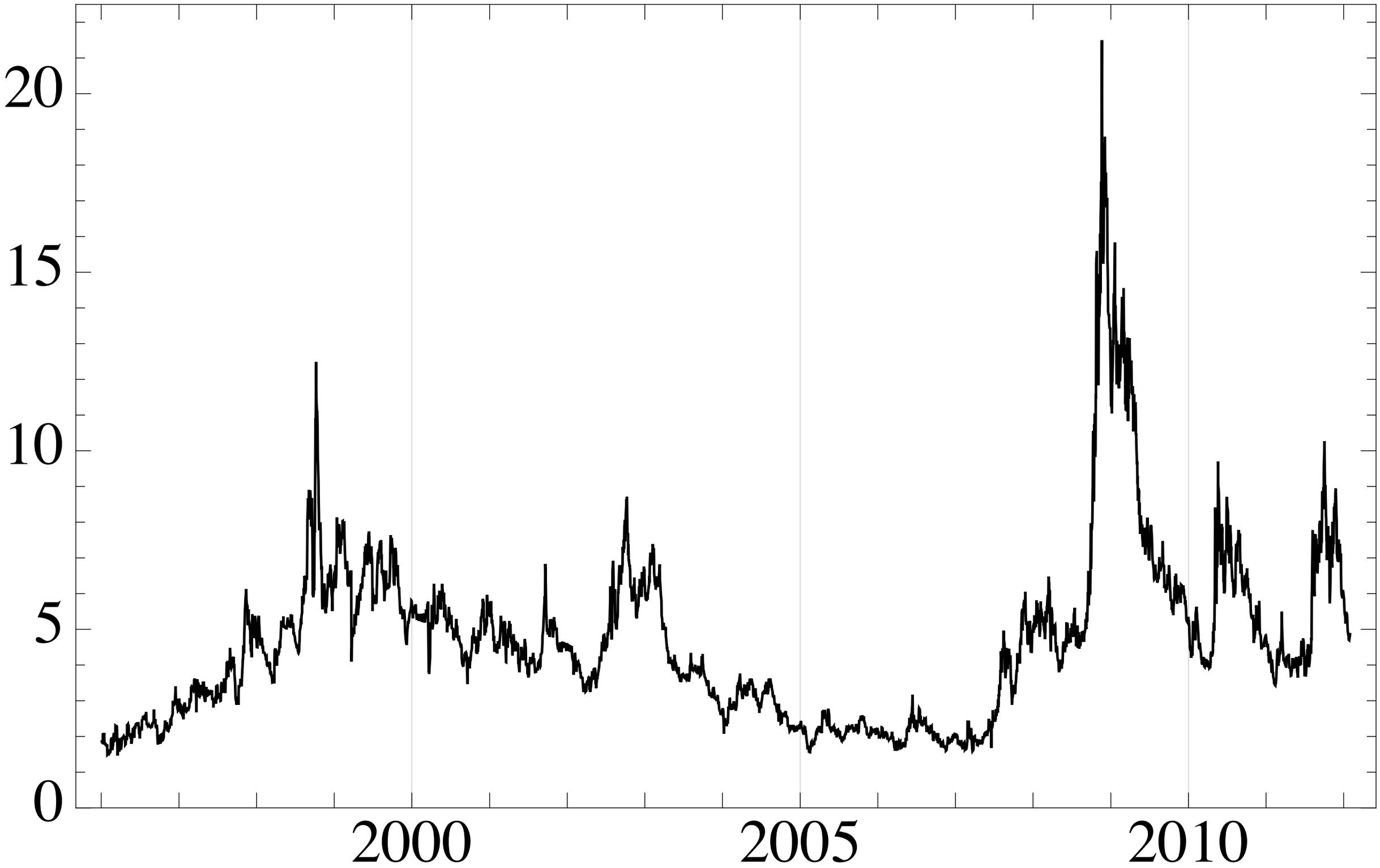
Source: Hilscher, Raviv, Reis (2016)

Estimates of US risk's contribution



Source: Reis (2018b)

Compare: 1-year ahead equity premium risk



Source: Martin (2017)

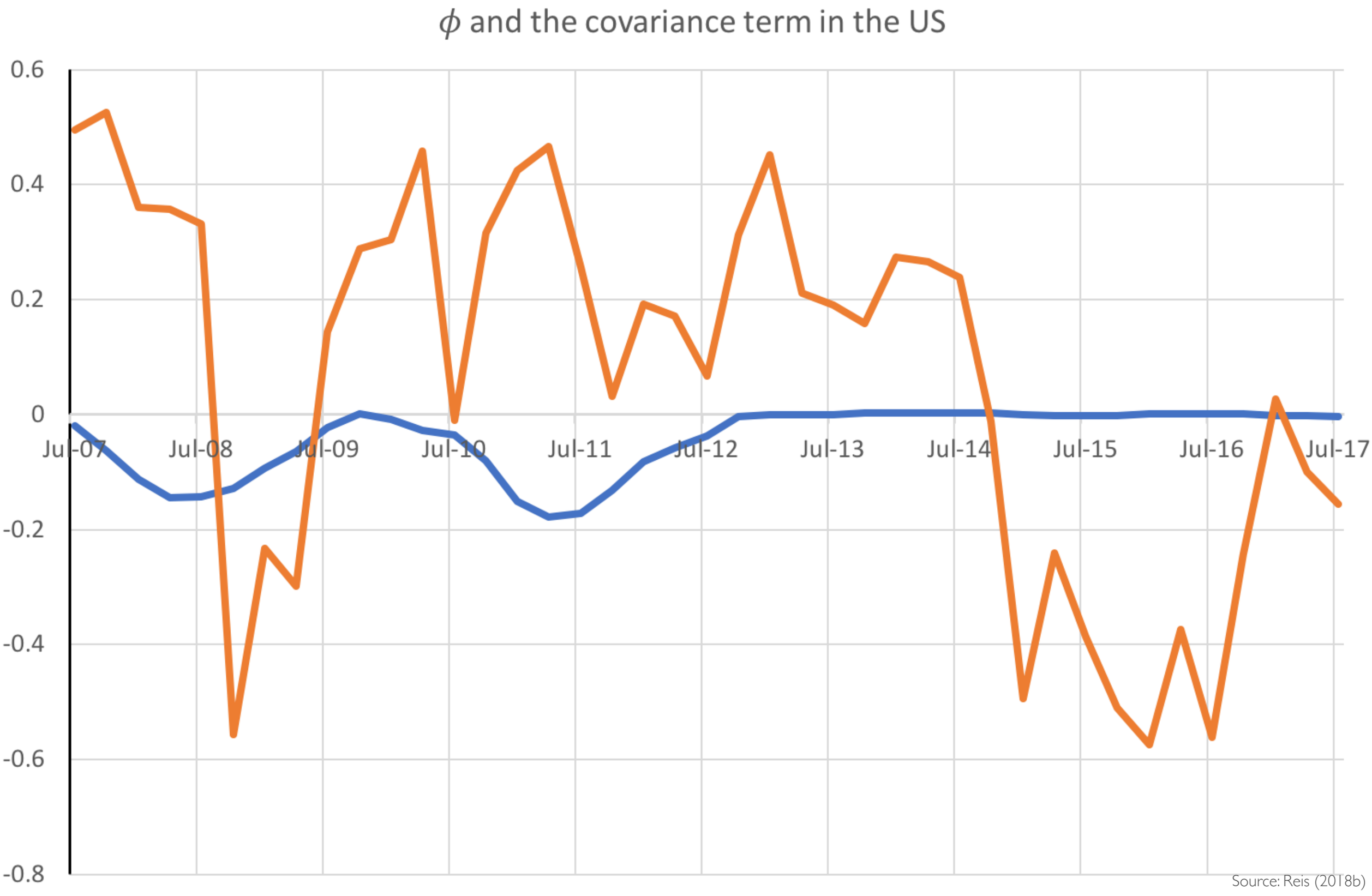
Measurement

- Covariance term: date-t covariance between nominal SDF over the next T years, and the realized real returns on a T-year government bond

- Data from SP500 or consumption growth. Big change in 1997. But not much after 2011.

- Duffee and Moench: a different covariance, tied to inflation alone.

Estimate of US cov's contribution



Source: Reis (2018b)

4. Disagreement

"Since we can't agree to disagree, how about we disagree on agreeing?"

Information and people's disagreement

- Expected inflation π^e is the fundamental. From representative agent, not necessarily rational can accommodate inattention.

$$\pi^e \sim N(\pi^*, \sigma_\pi^2)$$

- Each survey respondent is individual with private signal:

$$v_i \sim N(\pi^e, \sigma_\pi^2/\tau)$$

- Survey the continuum, get expected people inflation:

$$\mathbb{E}^p(\pi) = \int_0^1 \mathbb{E}(\pi^e|v_i)di = \pi^* + \theta^p(\pi^e - \pi^*)$$

where: $\theta^p = \dfrac{\tau}{1+\tau}$

Market traders

- Also observe market price. Form beliefs using:

$$F(\pi^e|v,q)$$

- Market must clear (King and shocks)

$$\int_0^1 b^i di = S(u), \qquad u \sim N(\bar{u}, \sigma_u^2)$$

- So price is

$$q^* = \int \underbrace{[\mathbb{E}_\pi(m/\Pi|\pi^e)]}_{\equiv d(\pi^e)} dF(\pi^e|v,q)$$

$$\approx d'(\pi^*)[(1-\theta^m)\pi^* + \theta^m(\pi^e - u\sigma_\pi/\sqrt{\tau})], \quad \text{Taylor approx.}$$

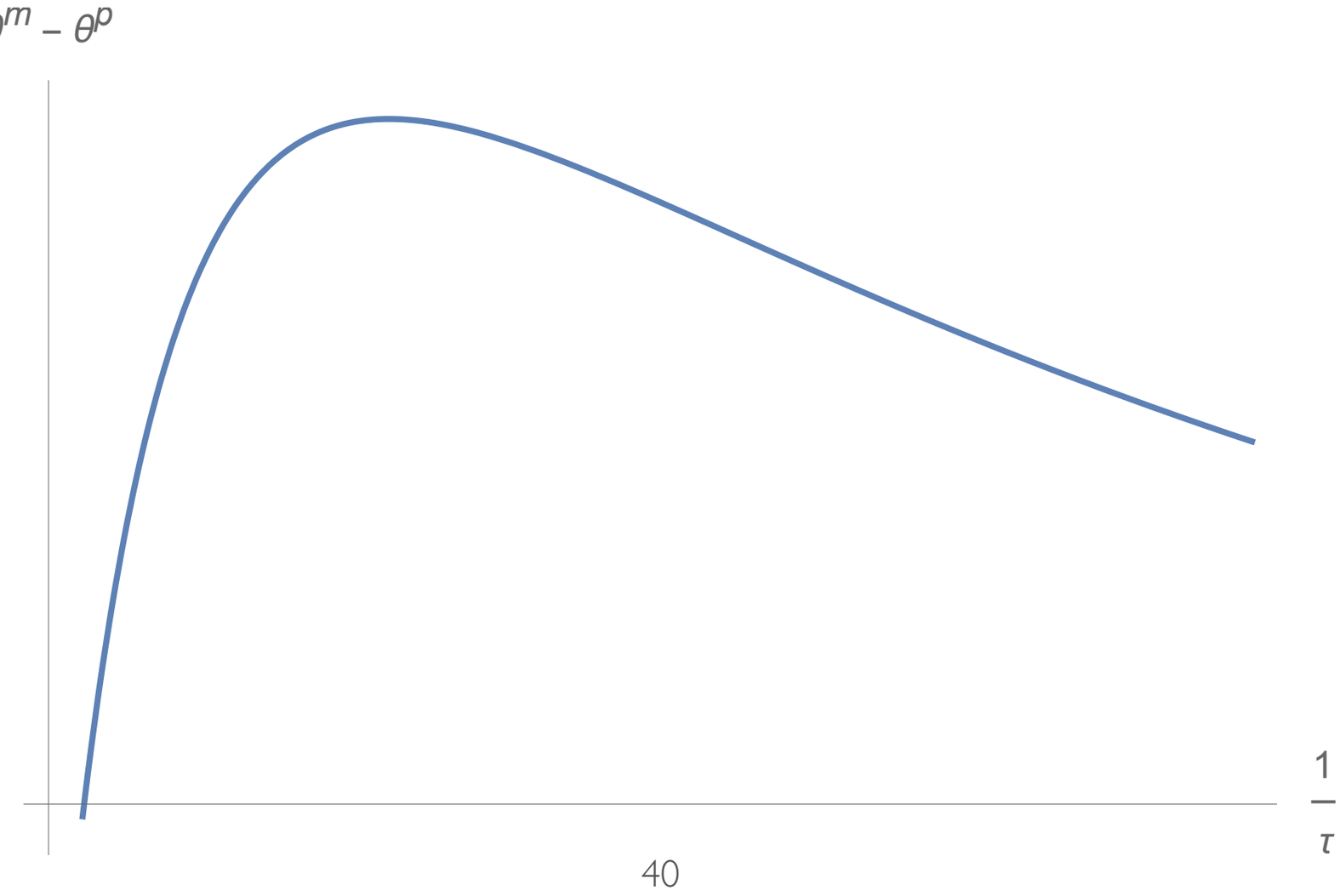
- where: $\theta^m = \dfrac{\tau}{\frac{\sigma_u^2}{1+\sigma_u^2} + \tau} > \theta^p$

Effect on discrepancy

Proposition: *The disagreement term is equal to:*

$$\mathbb{E}_t^m(\pi_{t,T}) - \mathbb{E}_t^p(\pi_{t,T}) = (\theta_t^m - \theta_t^p)\pi_{t,T}^e - \xi u_t$$

Response to fundamental non-monotonic on disagreement:



Predictors of disagreement

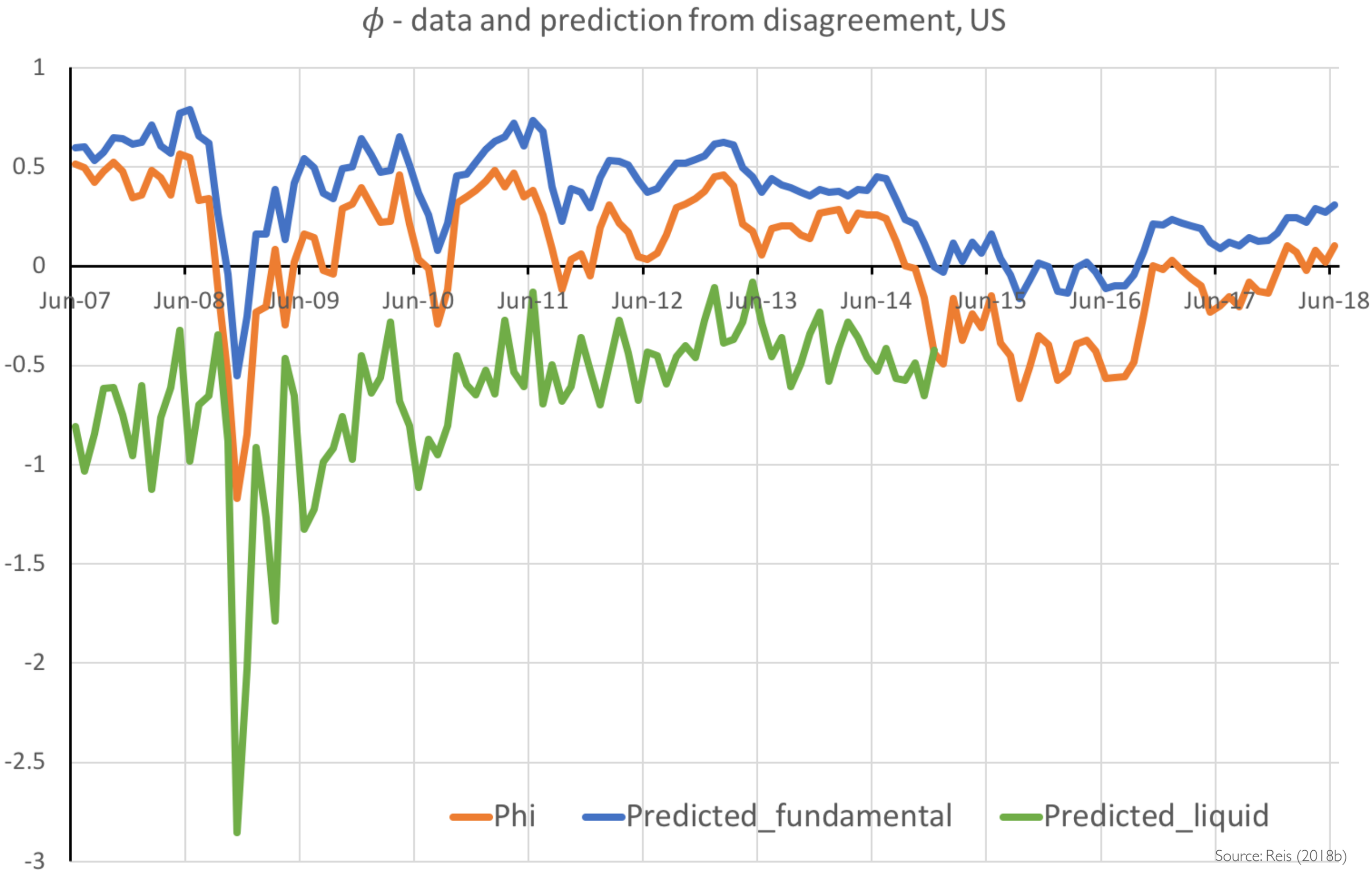
Series:

- Fundamental expectation π^e. Invert market forecast.
- Liquidity shocks u. Relative liquidity of TIPS using three proxies: nominal off-the-run spread, relative transaction volume, and cost of funding a levered investment. Pfuegler and Viceira (2010)

Parameters:

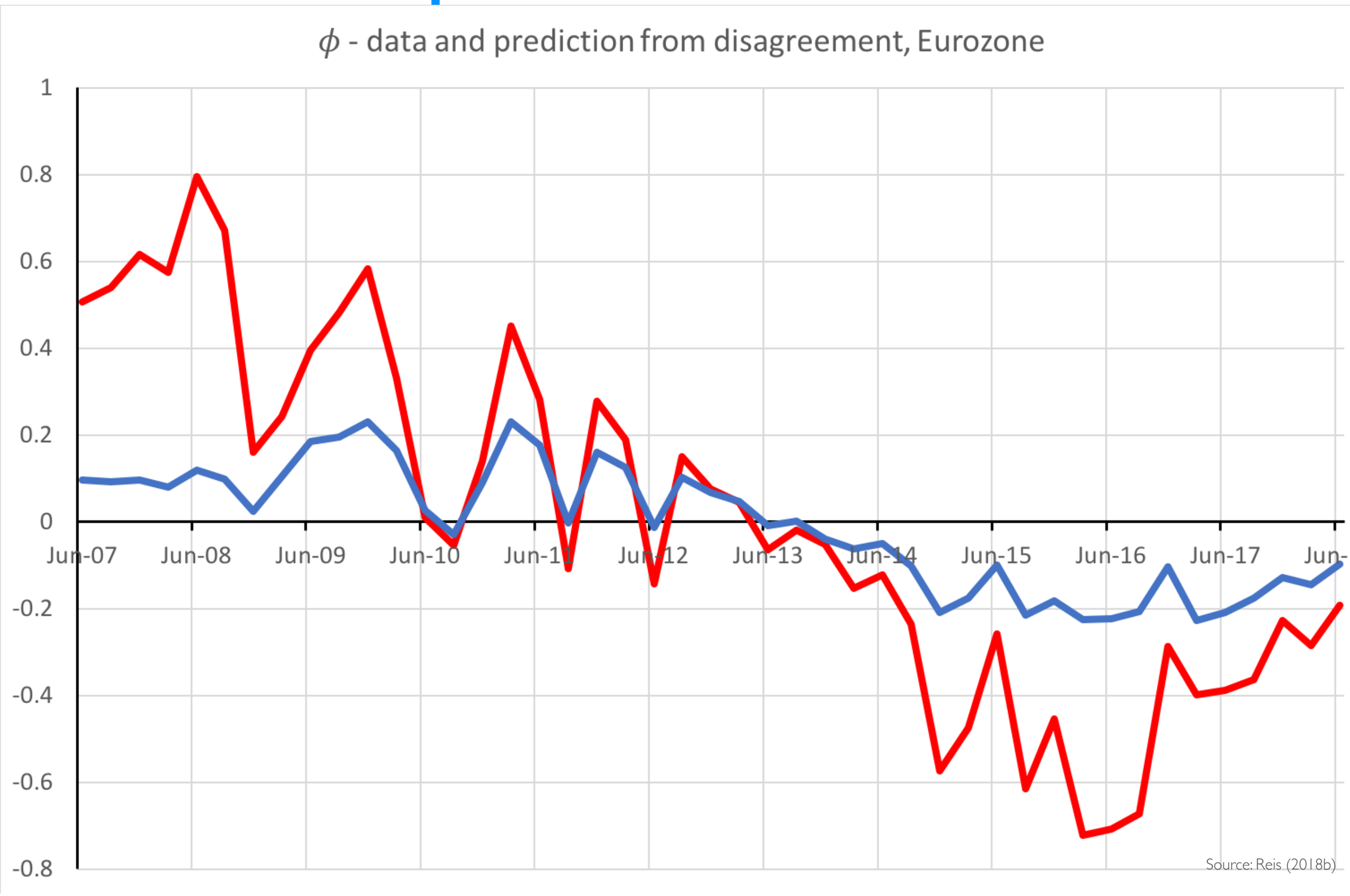
- Variance of expected inflation and liquidity σ^2_π and σ^2_u
- Within survey disagreement $1/\tau$. SPF disagreement within people (Mankiw, Reis, Wolfers, 04).

US model predictions and fit

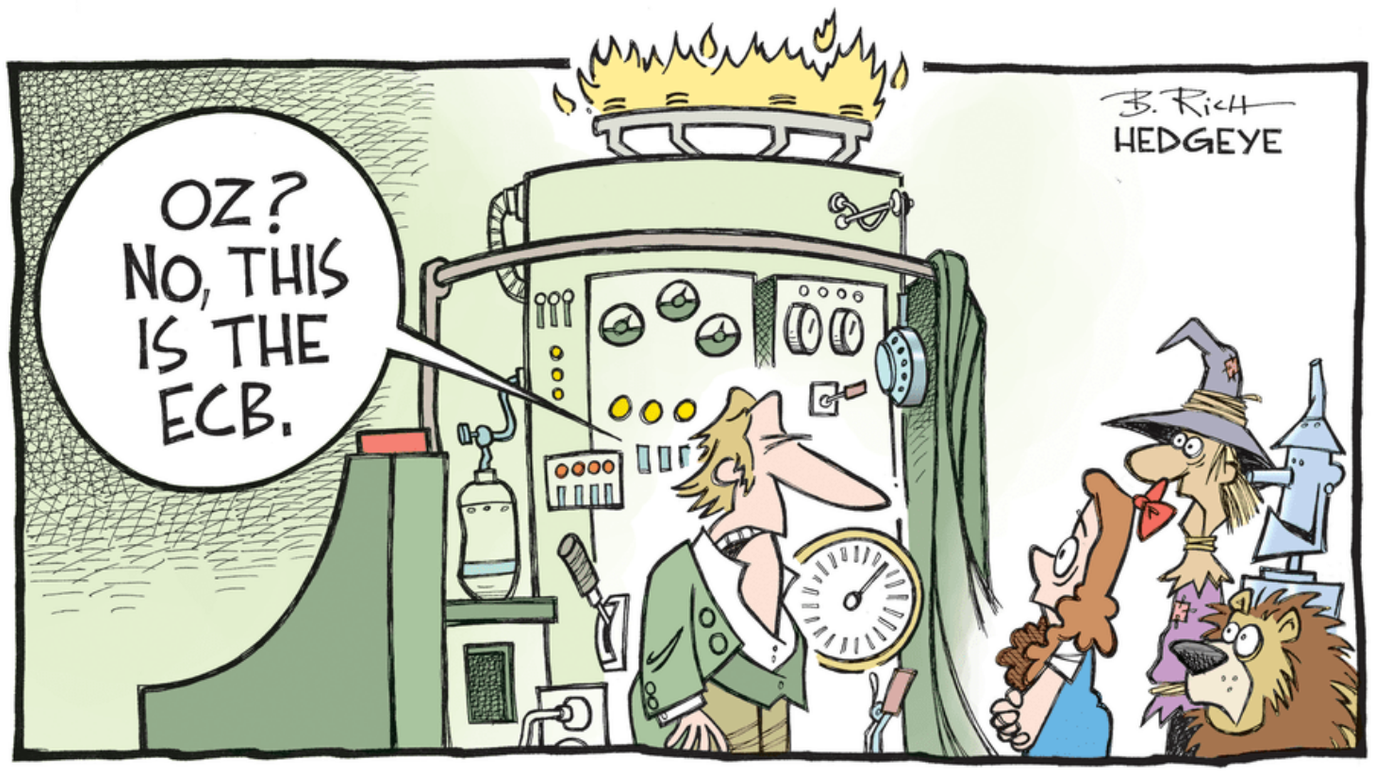


Source: Reis (2018b)

EZ model predictions and fit



5. Going long again



Monetary policy

- With unconventional policy that is not YCC, interfere in markets for long-term bonds and liquidity shocks

- Going long policy:

$$d(i_{t,T} - x_t) = -\rho(i_{t,T} - x_t)dt + \eta\left(\frac{dp_t}{p_t} - \pi^* dt\right)$$

Lemma: The equilibrium yield curve is an affine model:

$$i_{t,T} = \upsilon_0 + \upsilon_i i_t + \upsilon_x x_t$$

where $\upsilon_i = \dfrac{1 - e^{-\kappa_r(T-t)}}{\kappa_r(T-t)}$ (Wright & co)

Unconditional inflation

Proposition: *With a going long unconventional monetary policy:*

(i) *inflation is determinate subject to the condition*

$$\eta > \rho\ \theta^m\ \upsilon_i$$

(ii) *The target for interest rates depends on term premia and average liquidity:*

$$\mathbb{E}(\pi_t^e) = \pi^* + \left(\frac{\rho\theta^m}{\eta - \rho\upsilon_i\theta^m}\right)[\upsilon_i(\bar{r} + \pi^* - \xi\bar{u}) + \upsilon_0 - (1-\upsilon_x)\bar{x}]$$

Expected inflation over time

Proposition: *With a going long unconventional monetary policy:*

(iii) *Expected inflation falls after a liquidity shock (all* $\boldsymbol{\nu_i > 0}$*):*

$$\pi_t^e = \mathbb{E}(\pi_t^e) + \nu_1(r - \bar{r}) - \nu_2(x - \bar{x}) - \nu_3(u - \bar{u})$$

(iv) *The discrepancy falls after a monetary policy shock:*

$$\frac{\partial \phi}{\partial x} < 0$$

Effect of monetary policy

Effect of monetary policy shocks on the discrepancy

	Estimate	St. Error
Daily data (Em only)		
EZ	-0.68**	(0.31)
US	-1.40**	(0.50)
Monthly data		
US	-1.49*	(0.50)
Quarterly data		
Pooled EZ-US-UK	-0.56	(0.68)

Notes: Daily shocks from Andrade Ferroni (2017) and Nakamura Steinsson (2017). Quarterly shocks from Miranda-Agripino (2017) for US and UK, and Jarocinski Karadi (2018) for EZ

Source: Reis (2018b)

5. Conclusion

Answers

- **When go long, can monetary policy keep long-run inflation expectations anchored and how?**
  - Determinacy: weaker on i, but takes a lot of QE
  - Multiplicity: danger of ceilings.
  - Variability: new shocks to liquidity and term premia

- **When markets and people disagree, what is behind it and what does it imply for anchoring of inflation?**
  - Close determinants: not risk but disagreement
  - Policy and outcomes: transmission is attenuated
  - Discrepancy as diagnosis: tight policy, focussed public