On the Limits of Monetary Policy

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Question

What are the consequences of loose control of long-term interest rates?

Rational Expectations Policy

- Precise control of the term structure of interest rates
- By assumption long-term expectations pinned down — emphasis given to short-run stabilization questions
- One example of strong results: Divine Coincidence
  - Holds in general settings
  - Clarida, Gali and Gertler (1999), Justiniano, Primiceri and Tambalotti (2010), Gali and Debortolli (2018)

Question

What are the consequences of loose control of long-term interest rates?

Sources of loose control

- Focus on the role of long-term expectations, not term premia
- Two types of relevant evidence
  - Long-term expectations have substantial low-frequency movement correlated with short-run surprises: Crump, Eusepi and Moench (2015)
  - Substantial literature adducing evidence of trend extrapolation: Fuster, Laibson and Mendel (2010)

Objectives and Findings

Empirical Model

- Medium-scale New Keynesian model with imperfect knowledge about the long run
- Agents use a forecasting model with 'shifting endpoints' — low-frequency movements endogenous
  - Long-run beliefs respond to forecast errors as in the data
  - Bond prices are excessively sensitive to aggregate disturbances

Policy Design: Theory and Evidence

- Distorted interest-rate expectations a constraint on policy — Monetary policy can only partially offset 'demand' shocks
- Trade-off is non-trivial in U.S. monetary history
- But: evidence Great Inflation a policy mistake

A Simple Endowment Economy

Optimal Consumption Decisions

- A continuum of households i

$$c_t(i) = \hat{E}_t^i \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta) y_T - \beta (i_T - \pi_{T+1}) \right]$$

- Optimal decisions given beliefs [Preston (2005) and Adam and Marcet (2011)]
- Decisions depend on variables outside agents' control
  - Aggregate endogenous variables and prices
  - Exogenous shocks: endowment $y_t = \rho y_{t-1} + \epsilon_t$
- Subjective beliefs $\neq$ objective beliefs
- Captures fundamental uncertainty about the long term

A Simple Endowment Economy II

The transmission mechanism of monetary policy

$$c_t(i) = -\beta i_t + \hat{E}_t^i \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta) y_T - \beta \left(\beta i_{T+1} - \pi_{T+1} \right) \right]$$

- Precise control of current i_t
- Imprecise control of $\hat{E}_t^i i_T$ for $T > t$
- Connection between these objects endogenously determined and regulated by informational friction. Confronts policy with a distortion

Monetary Policy and Inflation

- Households know monetary policy determined by the rule

$$i_t = \phi \pi_t$$

- Optimal decisions and market clearing provide

$$\pi_t = -\phi^{-1} y_t + \phi^{-1} \hat{E}_t^i \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta) y_{T+1} - (\beta\phi - 1) \pi_{T+1} \right]$$

— Beliefs about future endowment and inflation determine inflation

— Inflation will determine beliefs—self-referentiality [Marcet and Sargent (1989)]

FORECASTING

- Use a 'shifting end-points' model [Kozicki and Tinsley (2001)]
- Forecasting model

$$\begin{aligned} \pi_t &= \bar{\omega}_{t-1} + \Phi y_{t-1} + e_t \\ \bar{\omega}_t &= \bar{\omega}_{t-1} + u_t \end{aligned}$$

  - e_t and u_t are i.i.d. with variances R and Q, with $Q = g^2 R$
  - Use Kalman filter to learn about unobserved drift, $\bar{\omega}_t$,
  - Know the transitional dynamics Φ—give emphasis to short-run versus long-run uncertainty

Equilibrium Dynamics

- Given estimate of $\bar{\omega}_t$, ω_t, evolution of inflation given by

$$\begin{aligned}\pi_t &= -\frac{\beta - \phi^{-1}}{1-\beta}\omega_{t-1} + \Phi y_{t-1} + \Phi_\epsilon \epsilon_t \\ &= T(\Phi)\,\omega_{t-1} + \Phi y_{t-1} + \Phi_\epsilon \epsilon_t\end{aligned}$$

  and beliefs

$$\begin{aligned}\omega_t &= \omega_{t-1} + g\left(\pi_t - \hat{E}_{t-1}\pi_t\right) \\ &= \left(1 + g[T(\Phi) - 1]\right)\omega_{t-1} + g\Phi_\epsilon \epsilon_t\end{aligned}$$

- Informational friction
  - Households overweight persistence of the drift relative to the true data-generating process: $T(\Phi) < 1$
  - When Kalman gain approaches zero, nests rational expectations

$$\pi_t = \Phi y_{t-1} + \Phi_\epsilon \epsilon_t$$

The Information Friction

Consistent with

- Evolution of survey forecast data — professionals and households did not perceive interest rates and inflation to be mean reverting
- Tight link between surprises and long-term expectations —Carvalho, Eusepi, Moench and Preston (2019)
- Estimates of long-run concepts such as potential output affected by business cycle shocks —Coibion, Gorodnichenko and Ulate (2018)
- Over-sensivity of long-term rates to news —Gurkaynak, Sack and Swansson (2005), Nakamura and Steinsson (2017), Crump, Eusepi and Moench (2017)
- Behavioral theories —Bordalo, Gennaioli, Ma and Schleifer (2018), Evans, Honkapohja and Williams (2010), Fuster, Laibson, Mendel (2010)

The Policy Trade-off

Standard view

- Aggressive monetary policy provides nominal anchor by stabilizing inflation expectations
  - Clarida, Gali and Gertler (1999), Schmitt-Grohe and Uribe (2007), Orphanides and Williams (2005), Ferrero (2007), Molnar and Santoro (2013)

Our view

- Aggressive monetary policy leads to instability. Equilibrium inflation beliefs evolve as

$$\omega_t = \left(1 - g\frac{1-\phi^{-1}}{1-\beta}\right)\omega_{t-1} + g\Phi_\epsilon \epsilon_t$$

  which places restrictions on policy choice

$$g < \frac{2(1-\beta)}{1-\phi^{-1}}$$

A Model

Standard medium-scale New Keynesian model

- No money; fixed capital stock
- Monopolistic competition
- Staggered price-setting in goods and labor markets
- Indexation in goods and labor markets
- Internal habit formation

Beliefs

- Same friction as simple model. Agents extrapolate, or over-weight the importance of, trend except

$$\begin{aligned} z_t &= S\bar{\omega}_{t-1} + \Phi z_{t-1} + e_t \\ \bar{\omega}_t &= \rho\bar{\omega}_{t-1} + u_t \end{aligned}$$

Bayesian Estimation

Sample

- Quarterly data 1964Q1-2007Q3

Observables standard

- GDP deflator, TBill 3 months, CBO output gap (de-trended output), NIPA and BLS nominal wage growth

Observables to discipline expectations

- 1Q+4Q SPF interest rate (1981Q3) and inflation (1968Q3)
- 1-10 year and 5-10 year interest rate (1985Q1) and inflation (1979Q3), Blue Chip Economics and Financial

Bayesian Estimation II

Shocks

- AR(1): Labor preference; government spending; technology, price-markup
- IID: Monetary policy, wage markup

Measurement error

- All survey data
- The two measures of wages

Policy and Estimates

Fiscal Policy

- Agents are Ricardian: zero debt; balanced budget
- Focus on constraints from beliefs about future interest rates
- Imperfect knowledge about fiscal policy re-weights standard income and substitution effects [Eusepi and Preston (2018)]

Monetary Policy

- Interest rate policy given by the rule

$$R_t = \rho_R R_{t-1} + (1 - \rho_R)\left(\phi_\pi \pi_t + \phi_x x_t\right) + \varepsilon_{M,t}$$

Estimates

- Wage Phillips curve flatter than Price Phillips curve by order of magnitude; policy coefficient ϕ_π close to unity

A Road Map

1. Basic model properties and fit
2. The role of information frictions — over-weighting trends drives low-frequency inflation
3. The role of monetary policy shocks in the Great Inflation
4. Optimal policy counterfactuals

Drifting Expectations: Inflation

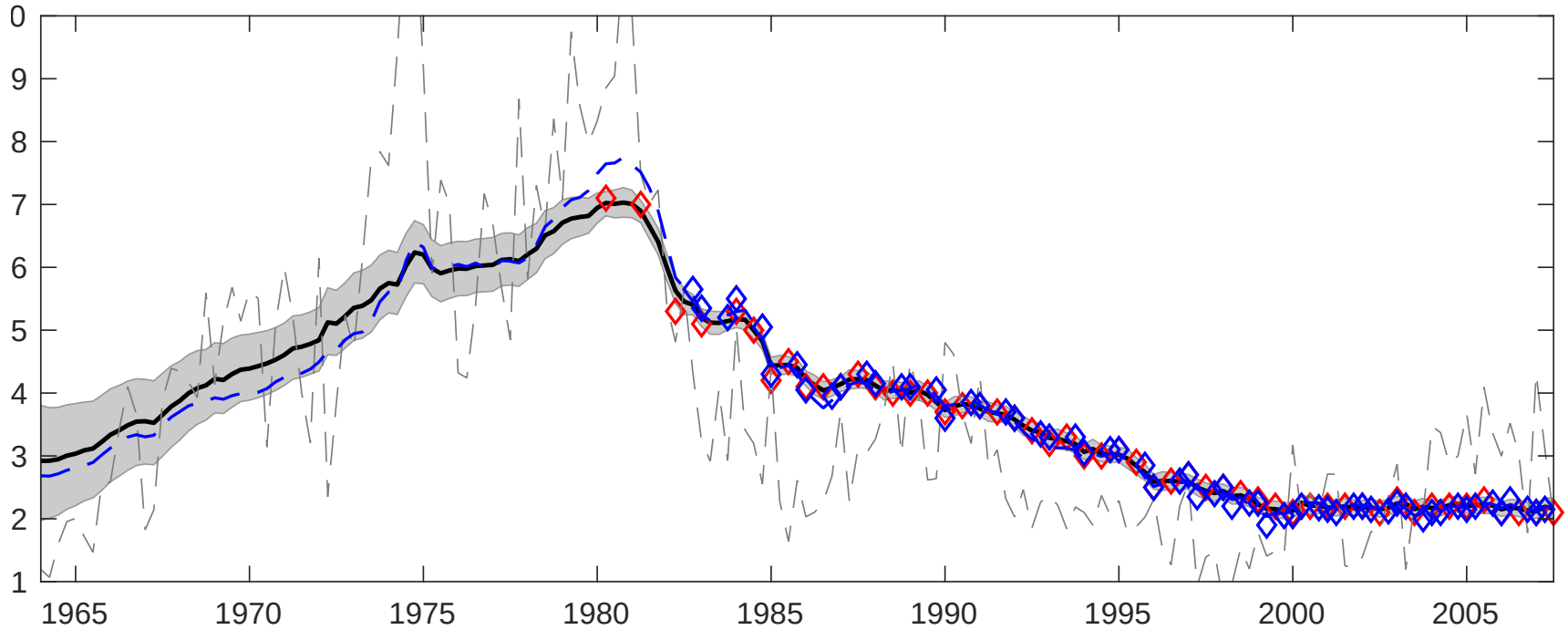

FIGURE: Model implied 5-10 year inflation forecasts (solid black); 1-10 year (dashed blue); survey data (diamonds); actual inflation (black dashed)

- Small measurement error: tight connection between short-run forecast errors and long-term forecasts
- Drift captures low-frequency movement

Drifting Expectations: Real Rates

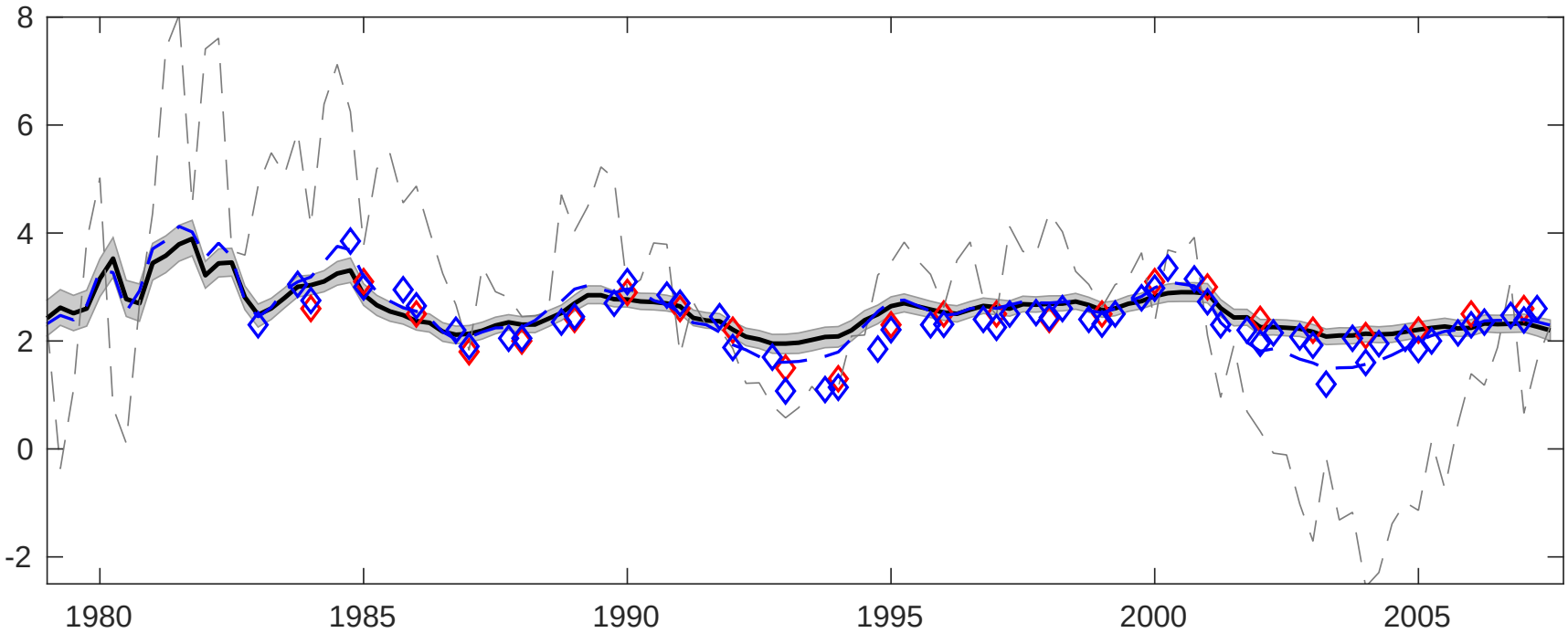

FIGURE: Model implied 5-10 year real rate forecasts (solid black); survey data (diamonds); actual real rate (black dashed)

- Independent evidence of drift in the real rate
- Consistent with Coibion, Gorodnichenko and Ulate (2018)

Output Gap

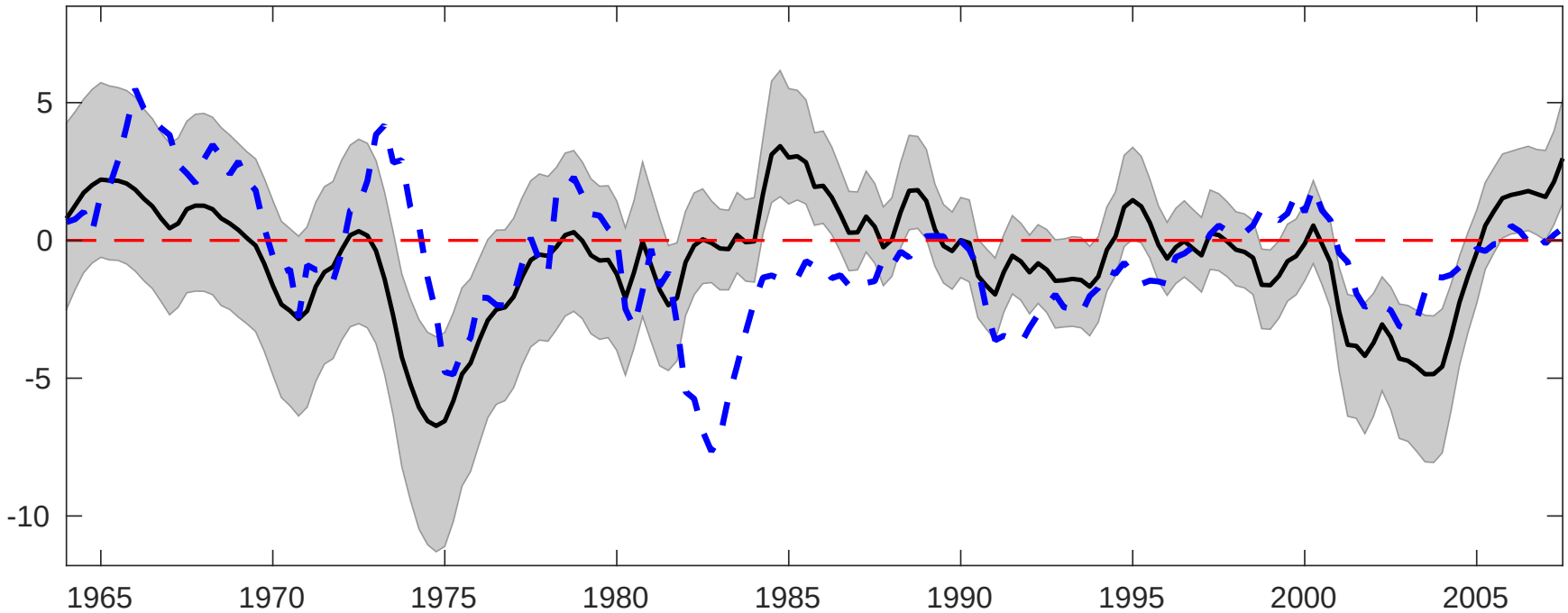

FIGURE: Model-implied output gap (solid black); CBO output gap (dashed blue).

- Captures conventional thinking about business cycles
- Under what conditions can policy close this gap?

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Self-Fulfilling Expectations and Endogenous Trends

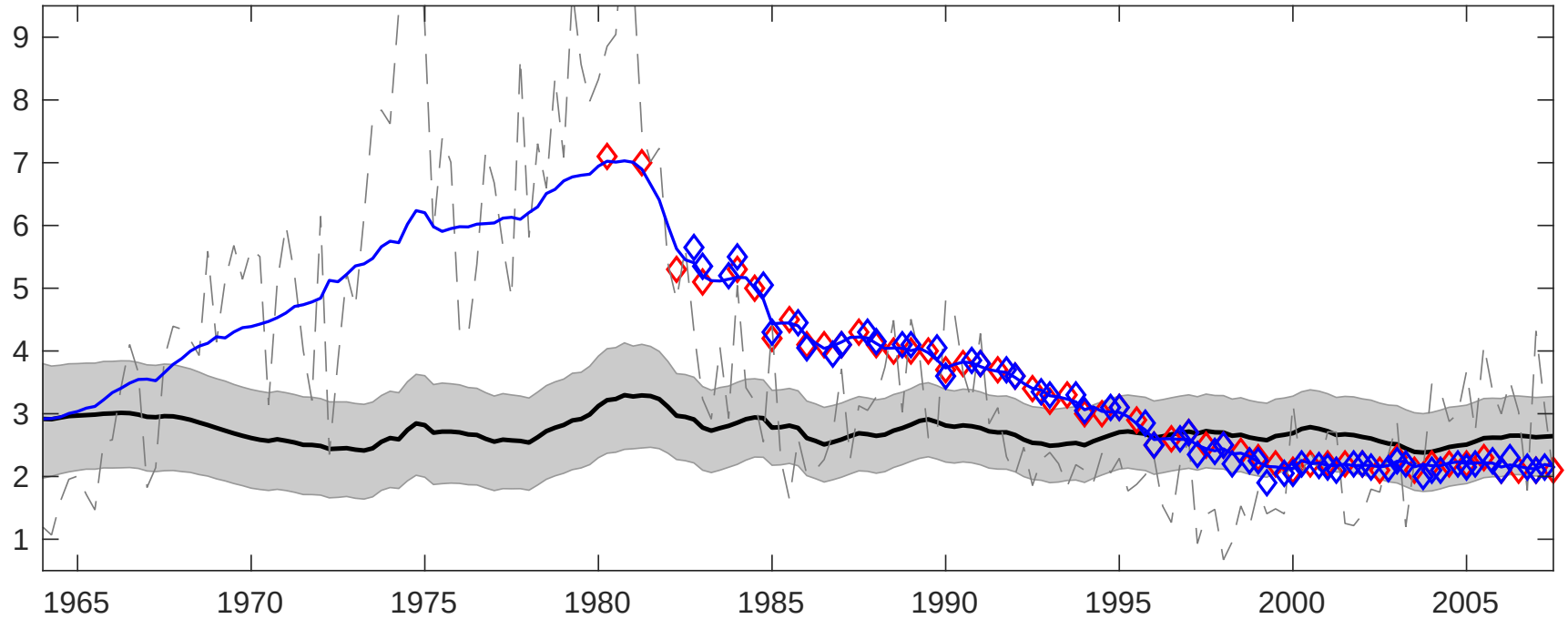

FIGURE: 5-10 year inflation forecasts. Model-implied (solid blue); survey data (diamonds); rational expectations (solid black); actual inflation (dashed)

- Rational beliefs: no Great Inflation
- Drifts endogenously generates inflation trend through propagation of forecast errors

SUBJECTIVE VERSUS OBJECTIVE BELIEFS

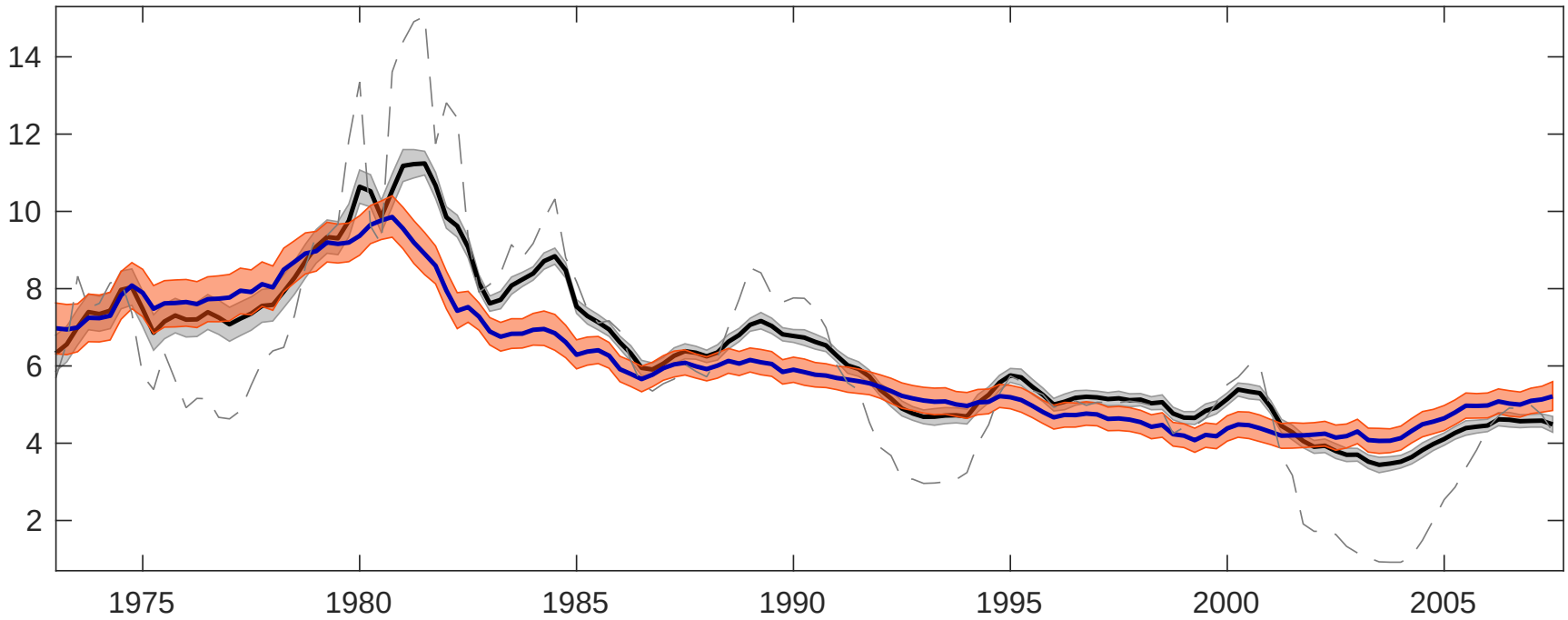

FIGURE: 10-yr Treasury yield (dashed); Yield with subjective beliefs (solid black); Yield with model consistent beliefs (solid blue)

- Sluggish adjustment of expectations over the 1980s relative to 'model consistent' expectations hypothesis

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The Role of Monetary Policy Shocks

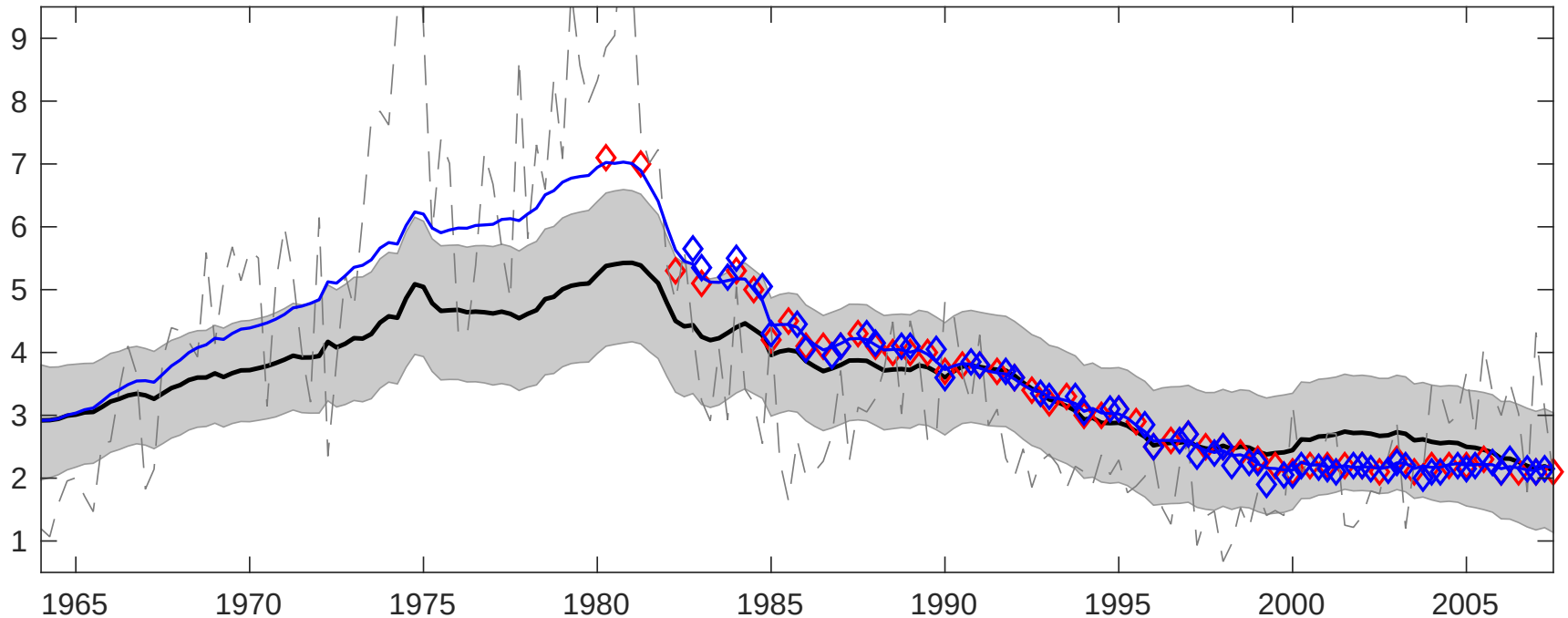
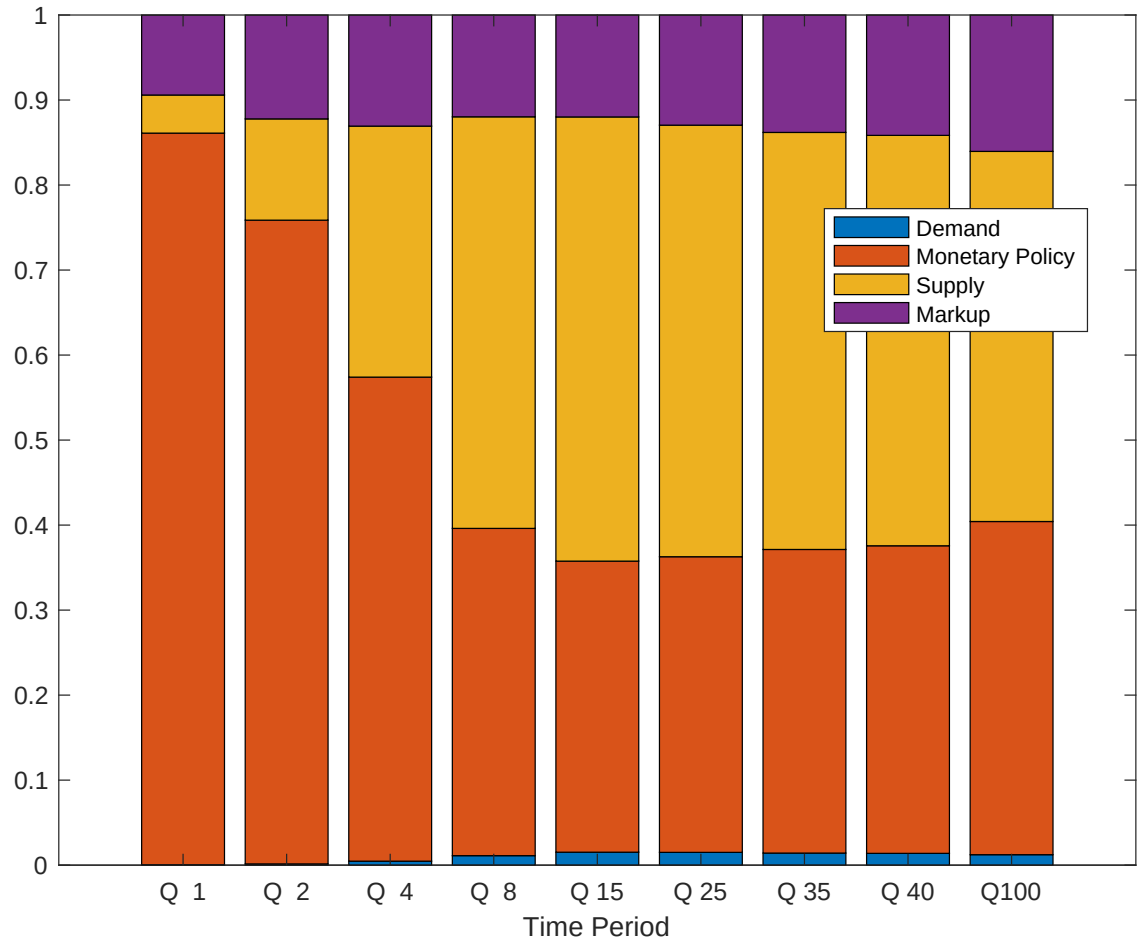


FIGURE: 5-10 year inflation forecasts. Model-implied (solid blue); survey data (diamonds); no monetary policy shocks (solid black); actual inflation (dashed)

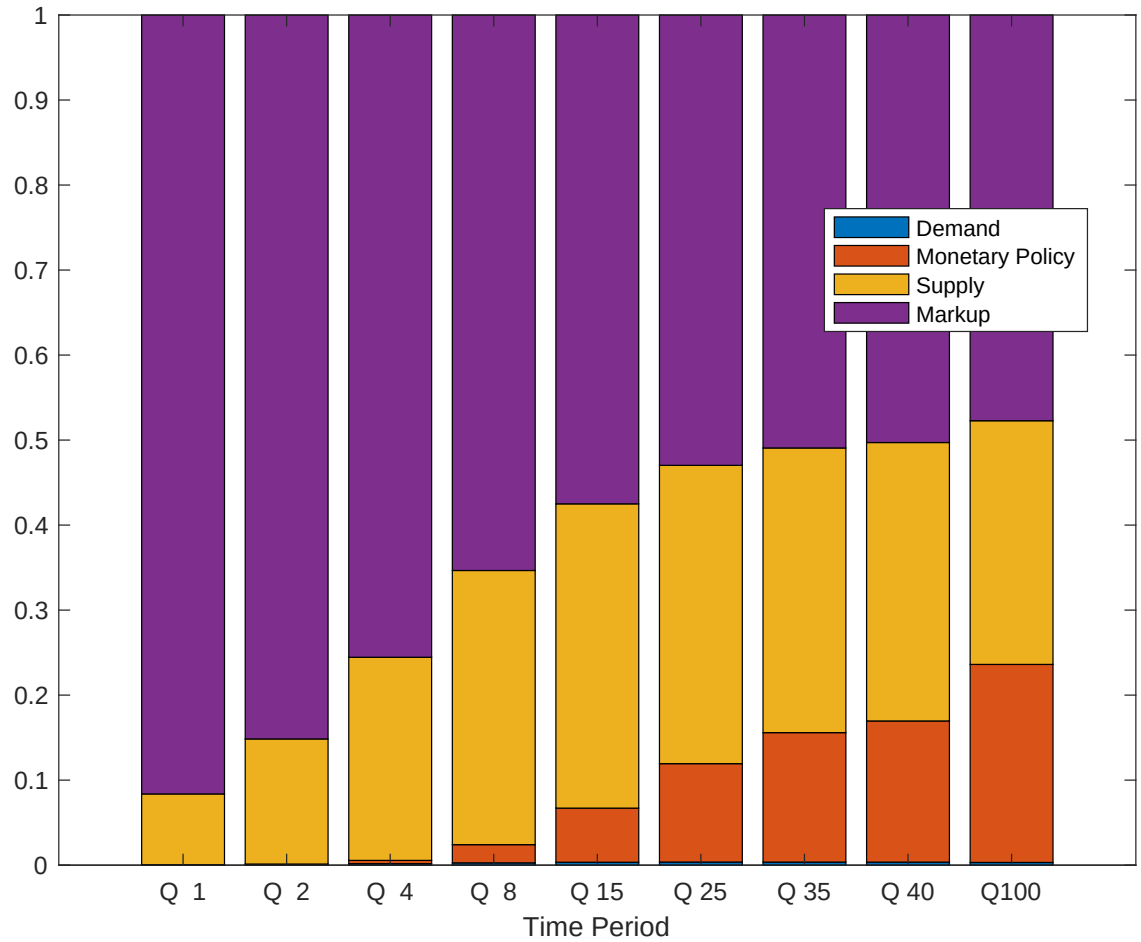
- Despite IID Monetary shocks, drivers of Great Inflation

Variance Decomposition: Interest Rates



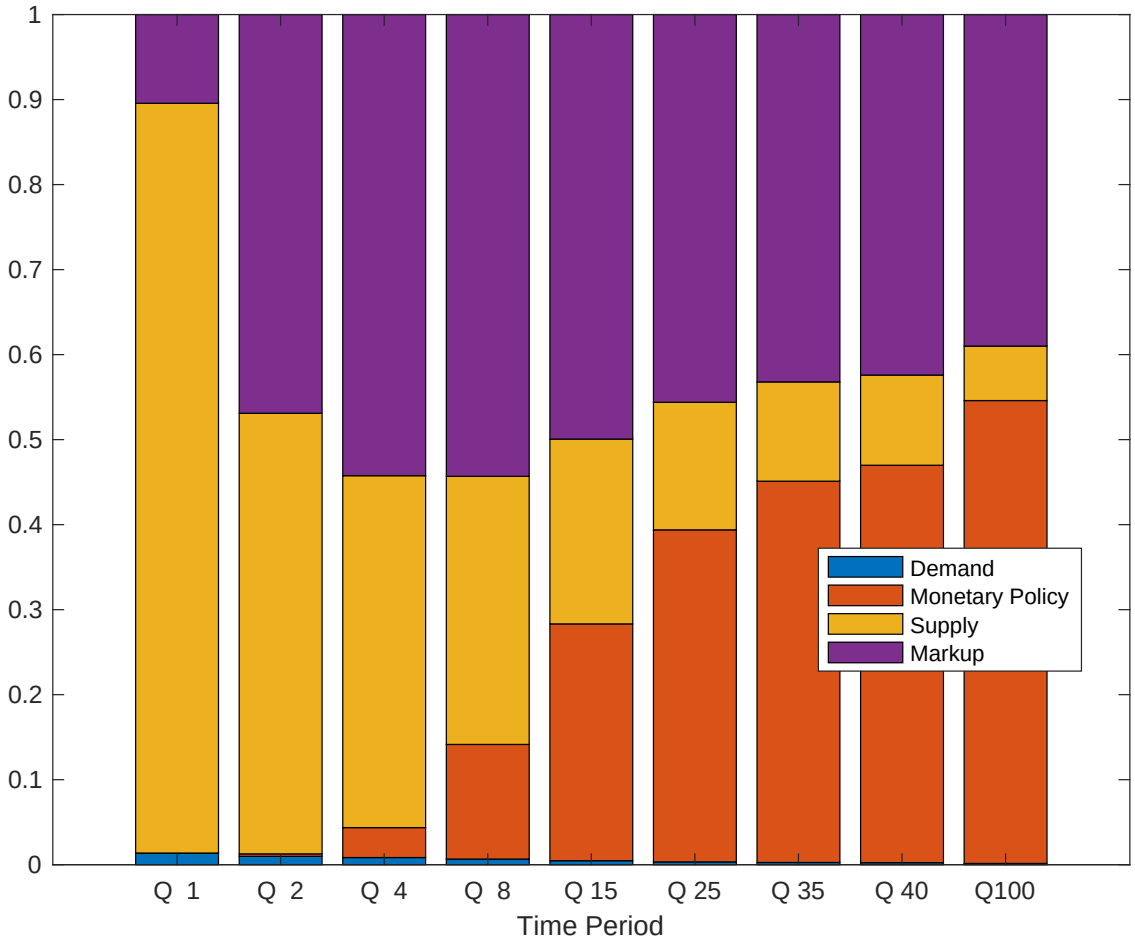
- Monetary policy shocks important at high and low frequency

Variance Decomposition: Inflation



- Monetary shocks more important at low frequency

Variance Decomposition: Long-term Inflation Expectations



- Monetary shocks propagated by expectations and policy

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Optimal Policy Problem

- Rational policy maker minimizes welfare-theoretic loss

$$E_t \sum_{T=t}^{\infty} \beta^{T-t} L_T$$

where

$$L_t = \lambda_p \left(\pi_t - \iota_p \pi_{t+1}\right)^2 + \lambda_w \left(\pi_t^w - \iota_w \pi_{t-1}\right)^2 + \lambda_x \left(x_t - \bar{b} x_{t-1} - x^*\right)^2$$

- Subject to constraints implied by optimization and beliefs (under learning)
- Using the target criterion that is optimal under rational expectations ($TC_t = 0$) choose policy in the class

$$R_t = \rho_R R_{t-1} + \phi_\pi TC_t$$

- Counterfactual assumptions — see the paper

Optimal Policy under REE

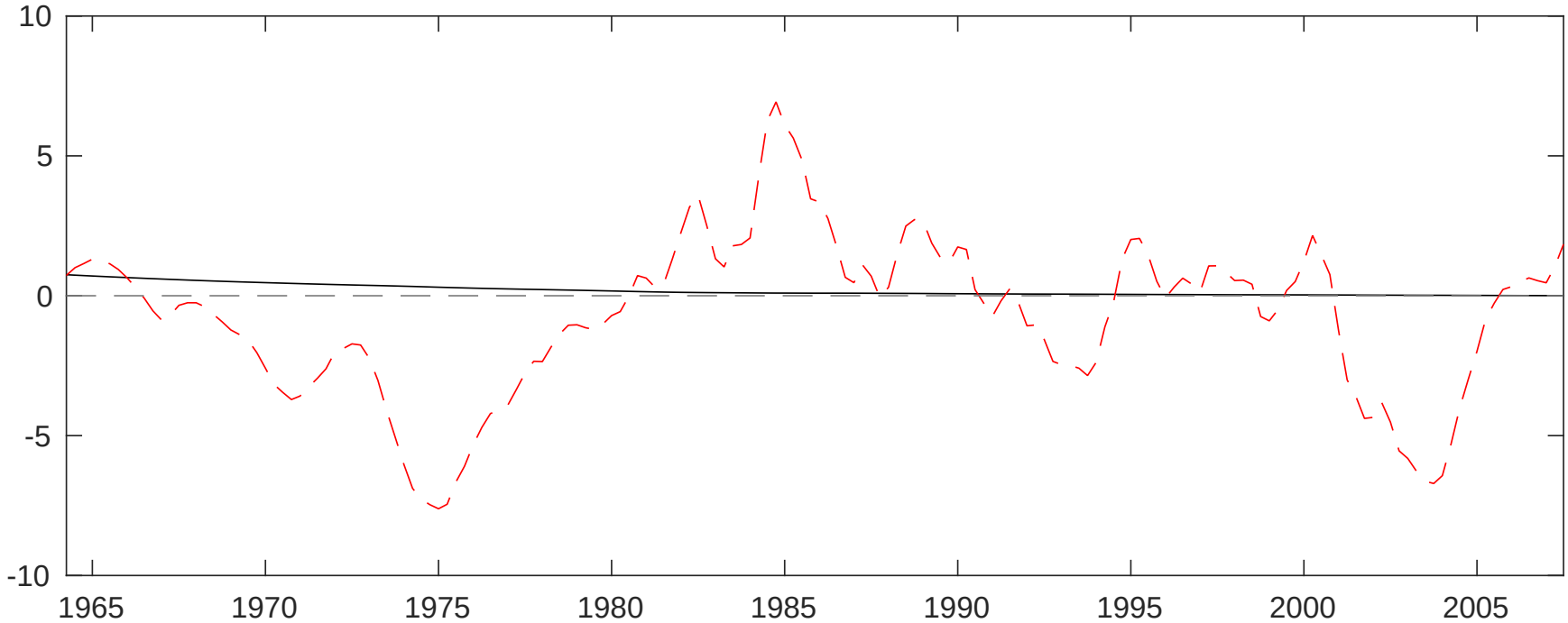

FIGURE: Output gap counterfactuals with no markup shock, rational expectations: Baseline (dashed red); optimal policy (solid black)

- Justiniano, Primiceri and Tambalotti (2012) again

Optimal Policy Under Learning

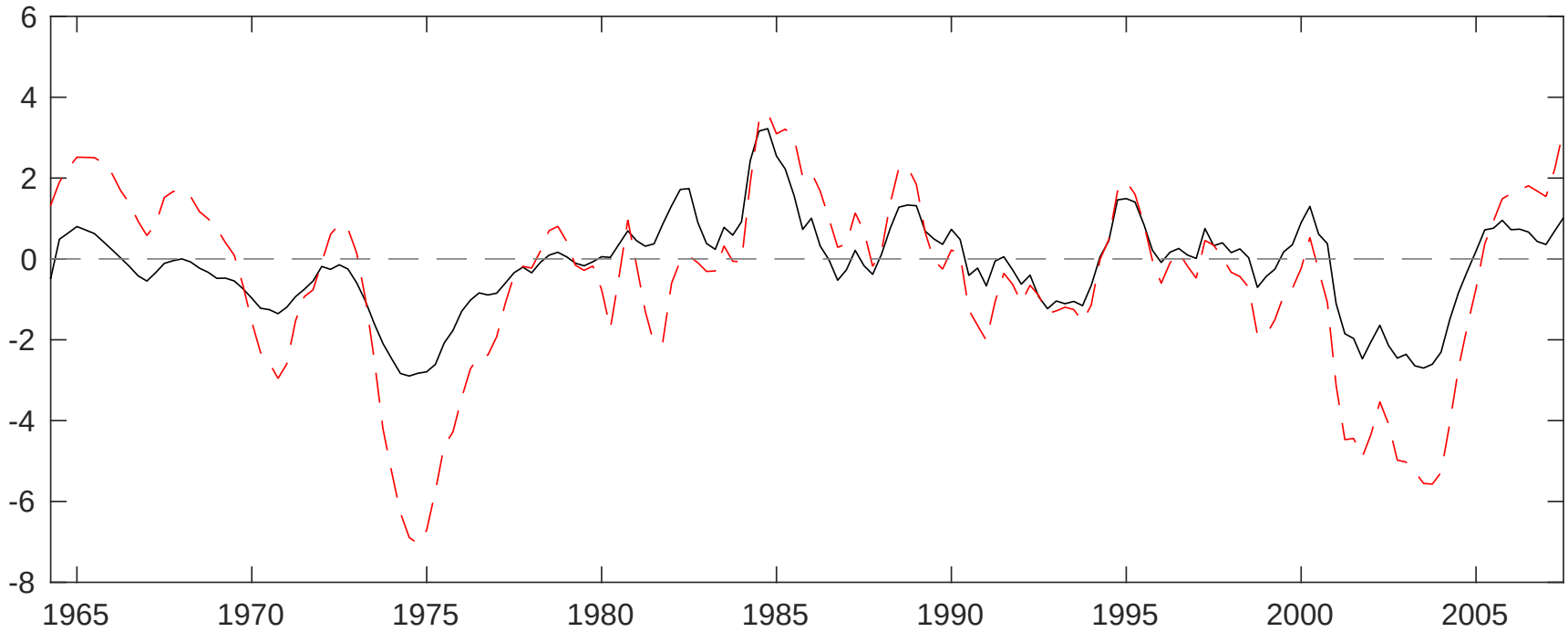

FIGURE: Output gap counterfactuals with no markup shocks, rational expectations: Baseline (dashed red); optimal policy (solid black)

- Complete stabilization of demand shocks infeasible
- Shallower recessions; consistent with inflation outcomes

Long-Term Expectations: Optimal Policy

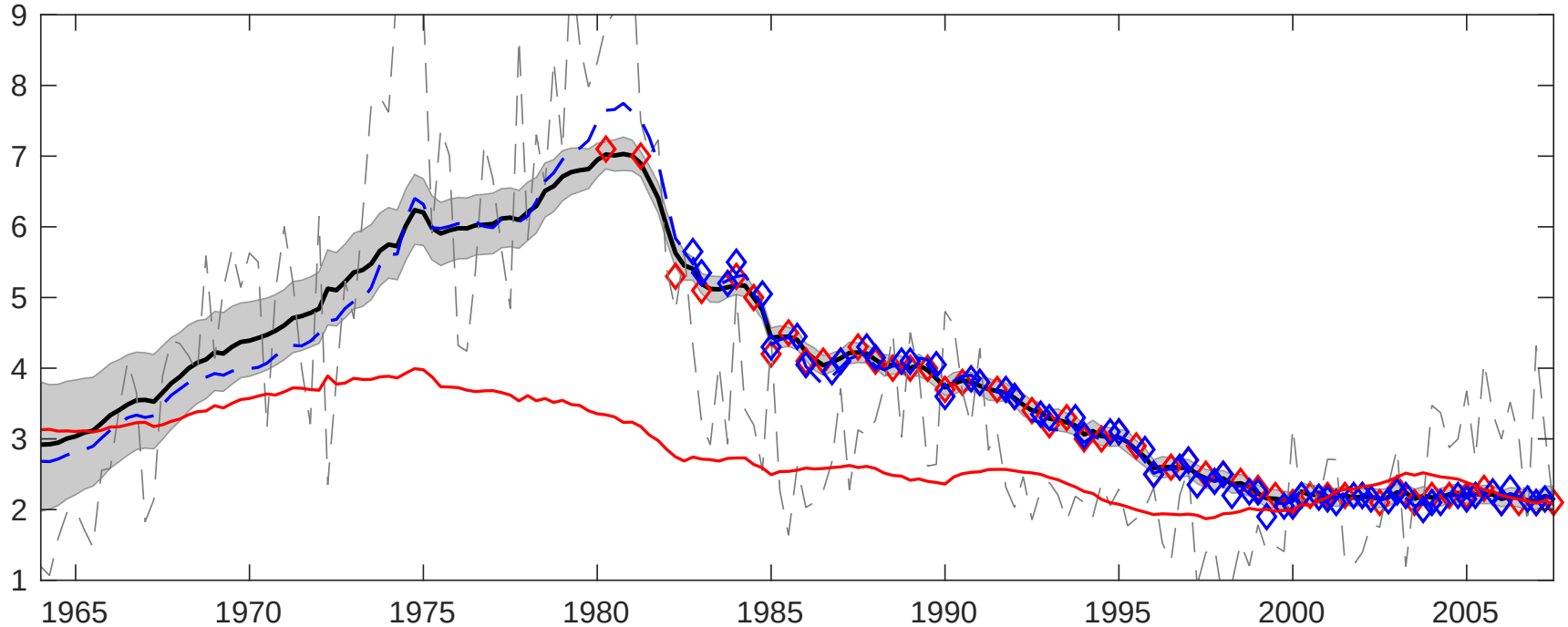

FIGURE: 5-10 yr inflation forecasts (solid black); 1-10 yr forecasts (dashed blue); survey data (diamonds); actual inflation (dashed black); 5-10 yr forecasts under optimal policy (solid red)

- Good policy still provides nominal anchor
- But remain important limits on what can be achieved

LONG-TERM RATES UNDER OPTIMAL POLICY

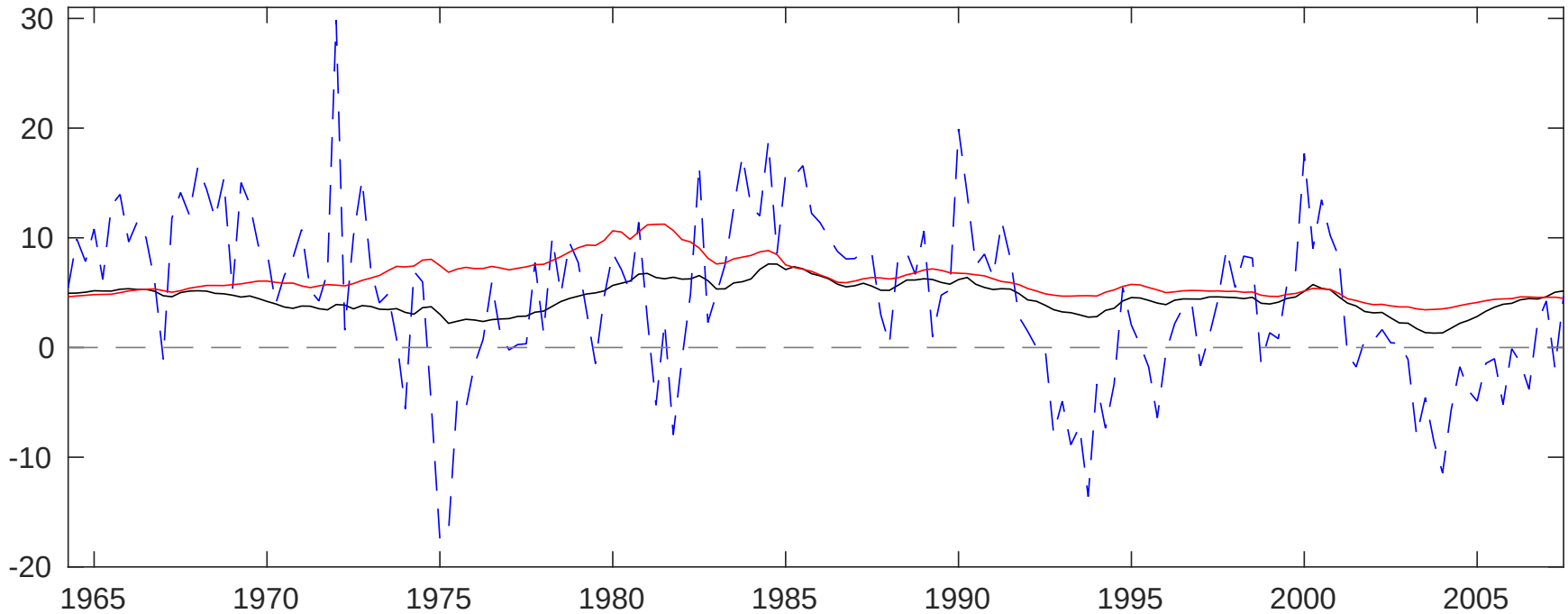

FIGURE: Baseline (solid red); optimal learning policy (solid black); optimal rational expectations policy (dashed blue)

- Interest rates more volatile under rational expectations — optimal policy under learning less aggressive

Conclusion

- Shifting long-term interest-rate expectations constrain what can be achieved by current interest-rate policy
- Aggregate demand a constraint on policy actions — policy less aggressive relative to rational expectations
- Quantitatively important
  - Demand shocks generate non-trivial variation
  - But policy still plays a critical role in proving a nominal anchor