Ambiguity, Monetary Policy and Trend Inflation

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Discussion
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Inflation: Drivers and Dynamics Conference
Federal Reserve Bank of Cleveland
September 28-29, 2016

Discussion outline

- Brief summary
  - What the paper does
  - How it does it
- Relation to the literature
  - Trend inflation and ambiguity in macro models
- Review of main results
- Comments and suggestions

What the paper does

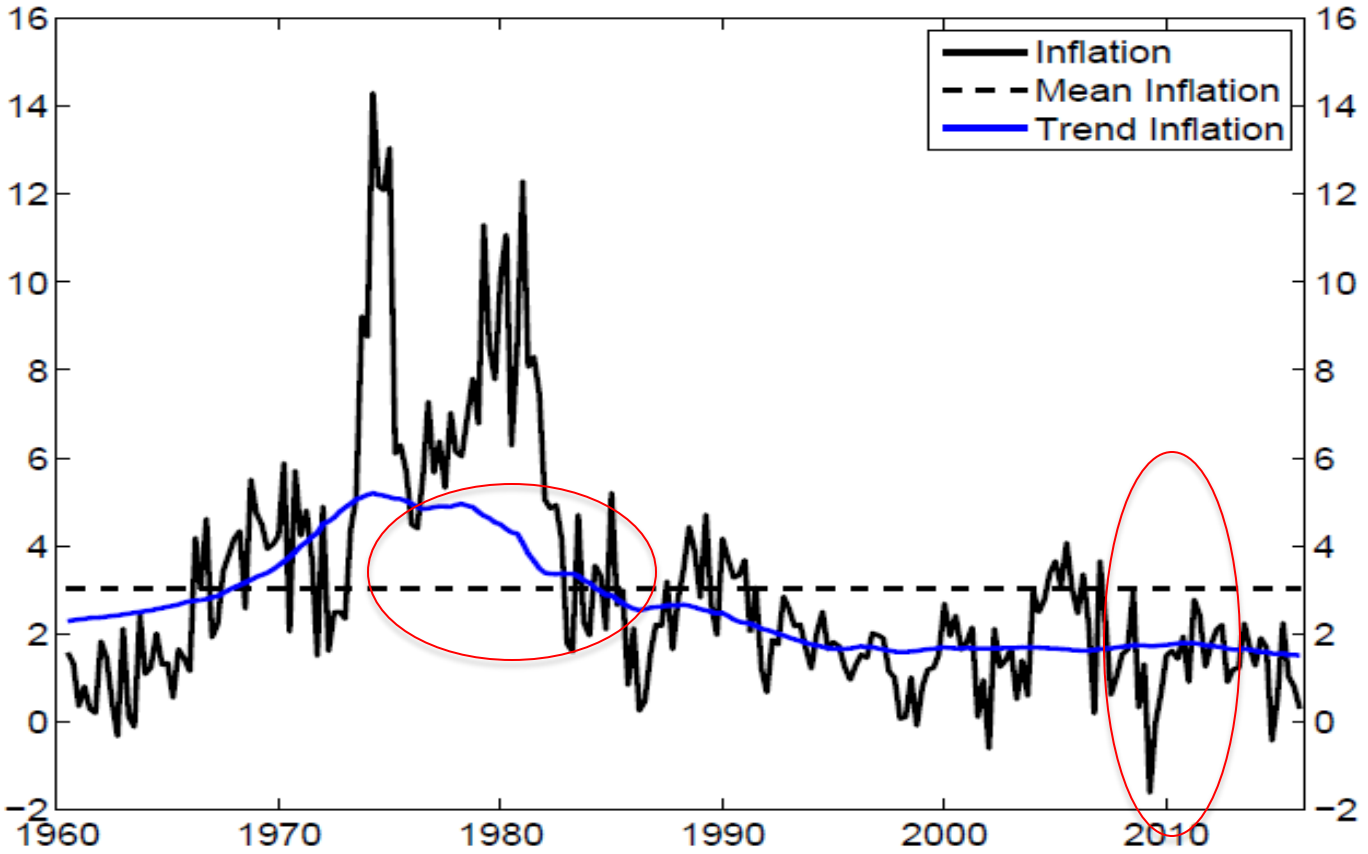
- Asks the following question:
  - Why does trend inflation change over time?
  - More specifically:
    - Inflation target often proxied by a time-varying persistent exogenous trend process
    - Can this process be endogeneized?

- Provides a theoretical micro-foundation for the evolution of trend inflation based on ambiguity aversion
  - Trend inflation evolves in response to changes in the private sector's 'confidence' in the conduct of monetary policy

- Assesses the ability of the model to account for a number of facts

A measure of trend inflation

- Trend inflation changed over time: two notable changes addressed in the paper:



Note: Trend inflation estimate over 1960Q3-2016Q1, based on Cogley-Sbordone (2008)

Related literature

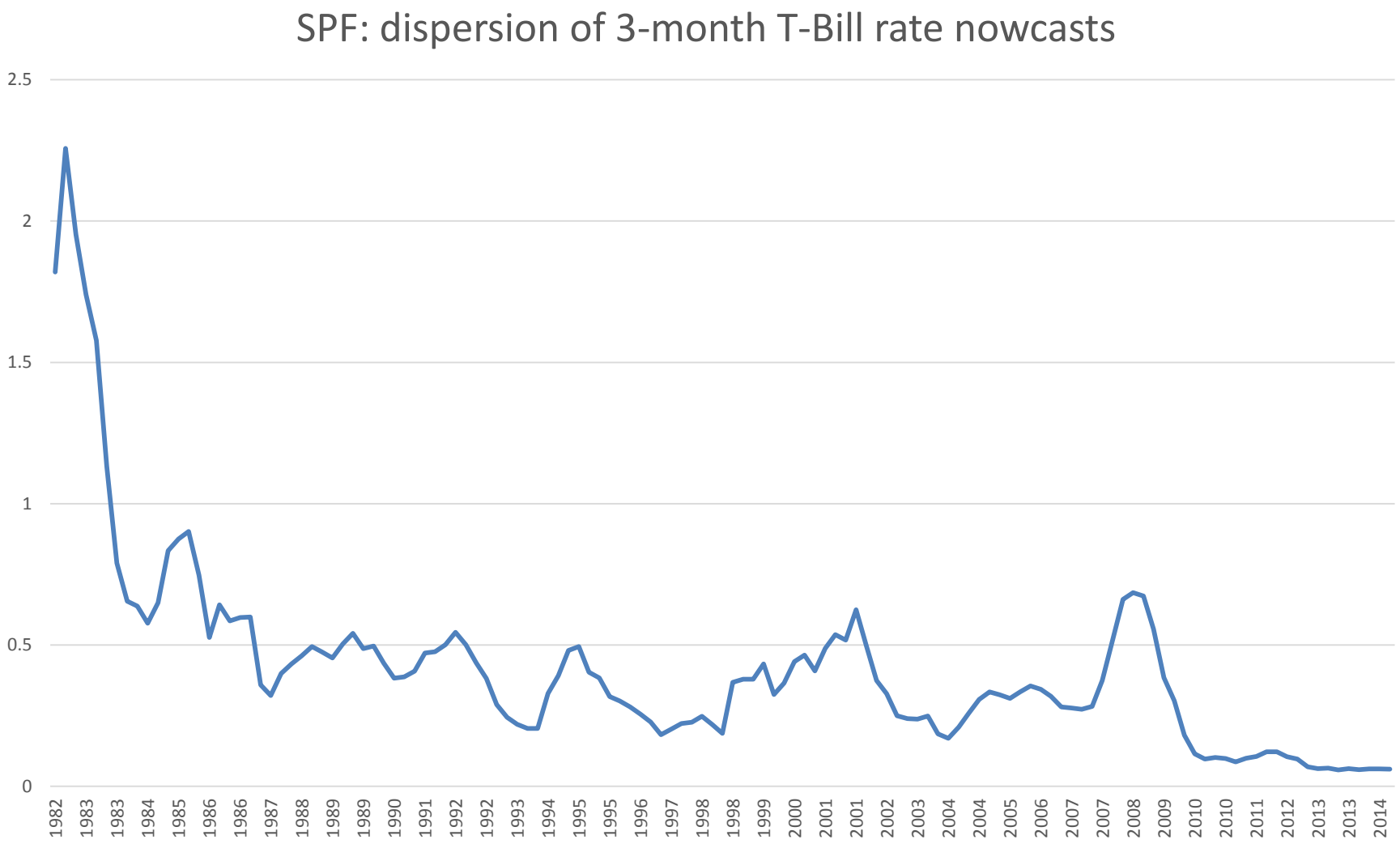
- Trend inflation literature
  - Cogley-Sbordone 2008, Ascari-Ropele 2007, Coibion-Gorodnichenko 2011, Coibion-Gorodnichenko-Wieland 2012, ….
- Ambiguity literature
  - Ilut-Schneider 2014, Drechsler 2013, ….
- Expectations and learning literature
  - Closely related to Carvalho et al paper on this Conference program
    - Both papers aim at endogeneizing the underlying dynamics of inflation (trend)
      - Carvalho et al. paper identifies this trend with survey measures of long-run inflation expectations
      - This paper measures trend inflation by multivariate VAR estimates of infinite horizon inflation expectations
    - In both papers the underlying inflation process may have a ‘break’
      - In the Carvalho et al. paper this occurs when expectations become unanchored, as forecasts deviate too much from model-consistent forecasts
      - In this paper a break occurs, under ambiguity aversion, when there is a change in the distribution of beliefs about the policy rate

The model: stylized NK with ambiguity-averse agents

- Features Calvo price-setting, a Taylor rule for monetary policy, standard preferences but ambiguity averse households
- Ambiguity modeled as in Ilut and Schneider 2014
  - Agents are uncertain about the probability distribution over states of the world
    - Have a set of beliefs but are unable to assign probabilities to them
    - The belief set is represented by an interval of means
    - A loss of confidence is an increase in the interval width
  - Aversion to ambiguity implies that agents evaluate plans based on the worst-case probability drawn from a set of multiple beliefs
  - Model can be solved with standard linear methods

- Ambiguity manifests itself here in distorted beliefs about the policy rate
- In the empirical application, these beliefs are calibrated using the SPF nowcasts of 3-month T-bill rate
  - Important feature: these beliefs became asymmetric at the start of ZLB

Motivation: evolution of public sector's confidence



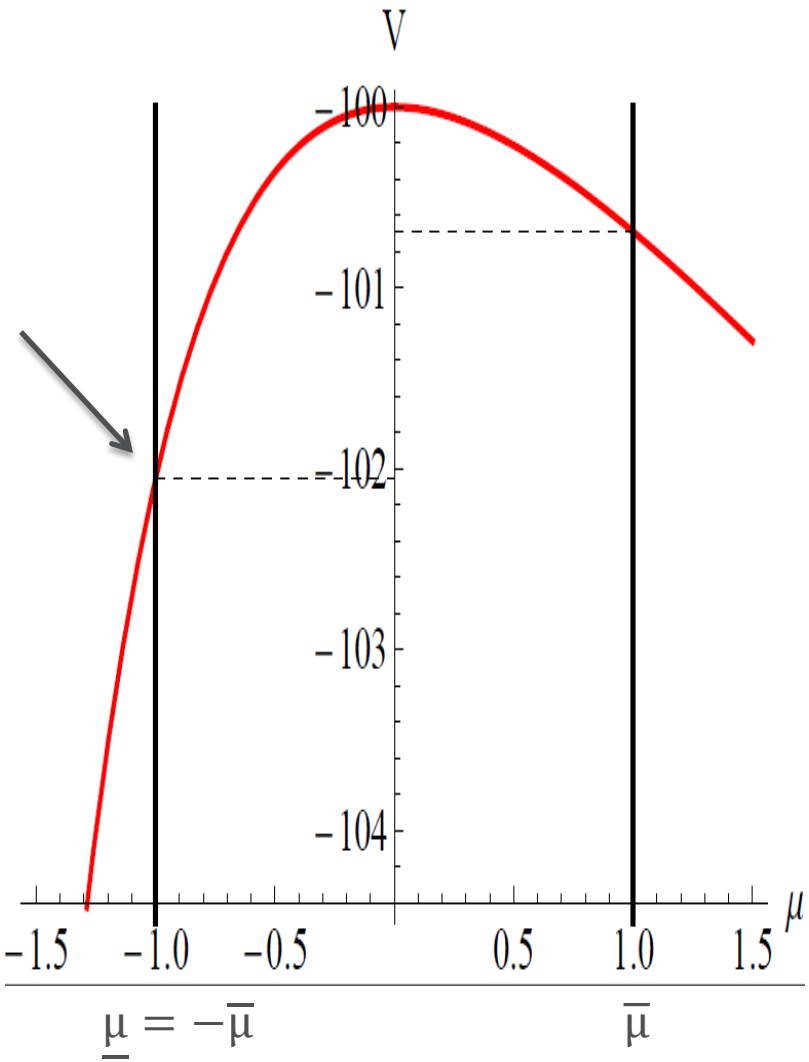
Implications of ambiguity-aversion

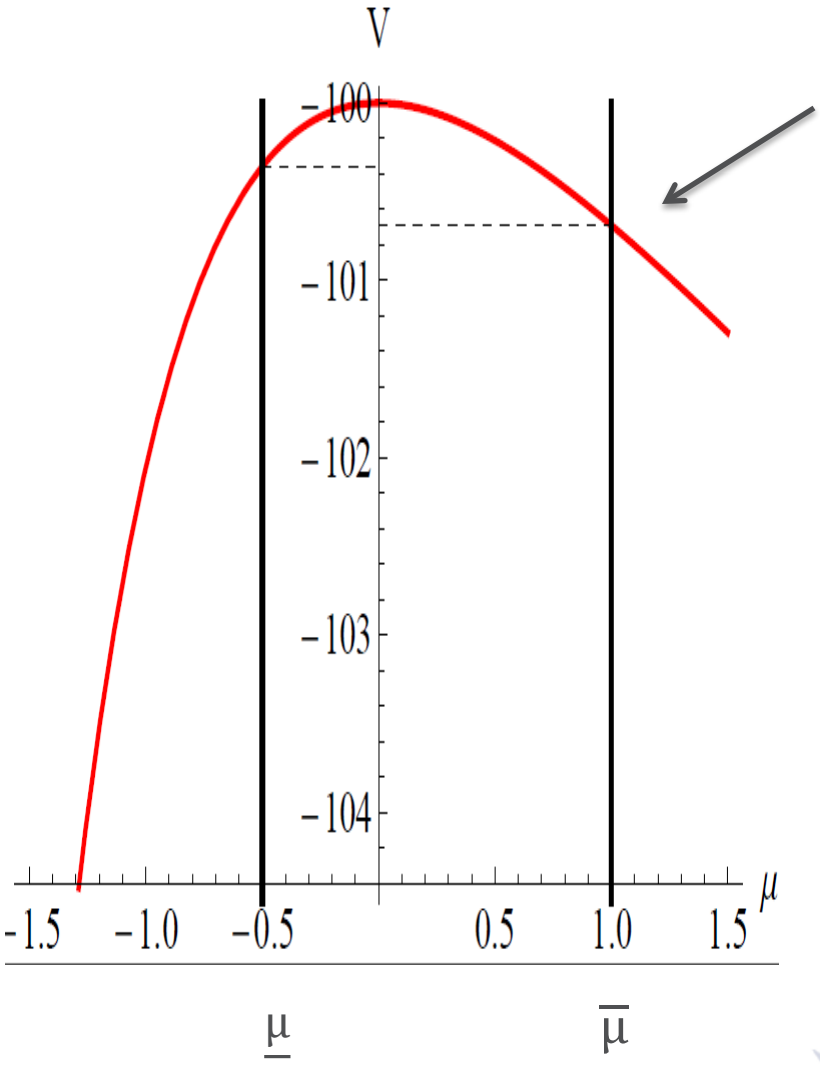
- The dynamics of trend inflation arises endogenously as a function of 3 components
  - The inflation target, π^*
  - The strength of monetary policy response to inflation, ϕ
  - The degree of (Knightian) uncertainty about the monetary policy rule, μ
    - Specifically, μ represents uncertainty about the policy rate, taking as given all other policy parameters
- Ambiguity creates a wedge between inflation target and trend inflation
- The analysis focuses on changes in μ, keeping constant ϕ and π^*

Methodology

- Model is approximated around the worst-case steady state
- Features of the steady state
  - Inflation and interest rate depend *negatively* on the ambiguity bias (if ϕ>1)
    - If bias is positive, inflation and policy rate are lower than absent ambiguity
  - When range of ambiguity is *symmetric* the welfare function is lowest at the range lower bound
    - A narrower range reduces steady state inflation and increases welfare
    - Underestimating the interest rate is *worse* than overestimating it (welfare asymmetric w.r.t. μ)
    - Intuition: effect of ambiguity bias on inflation is symmetric, but effect of inflation on welfare is asymmetric

Symmetric and skewed confidence interval





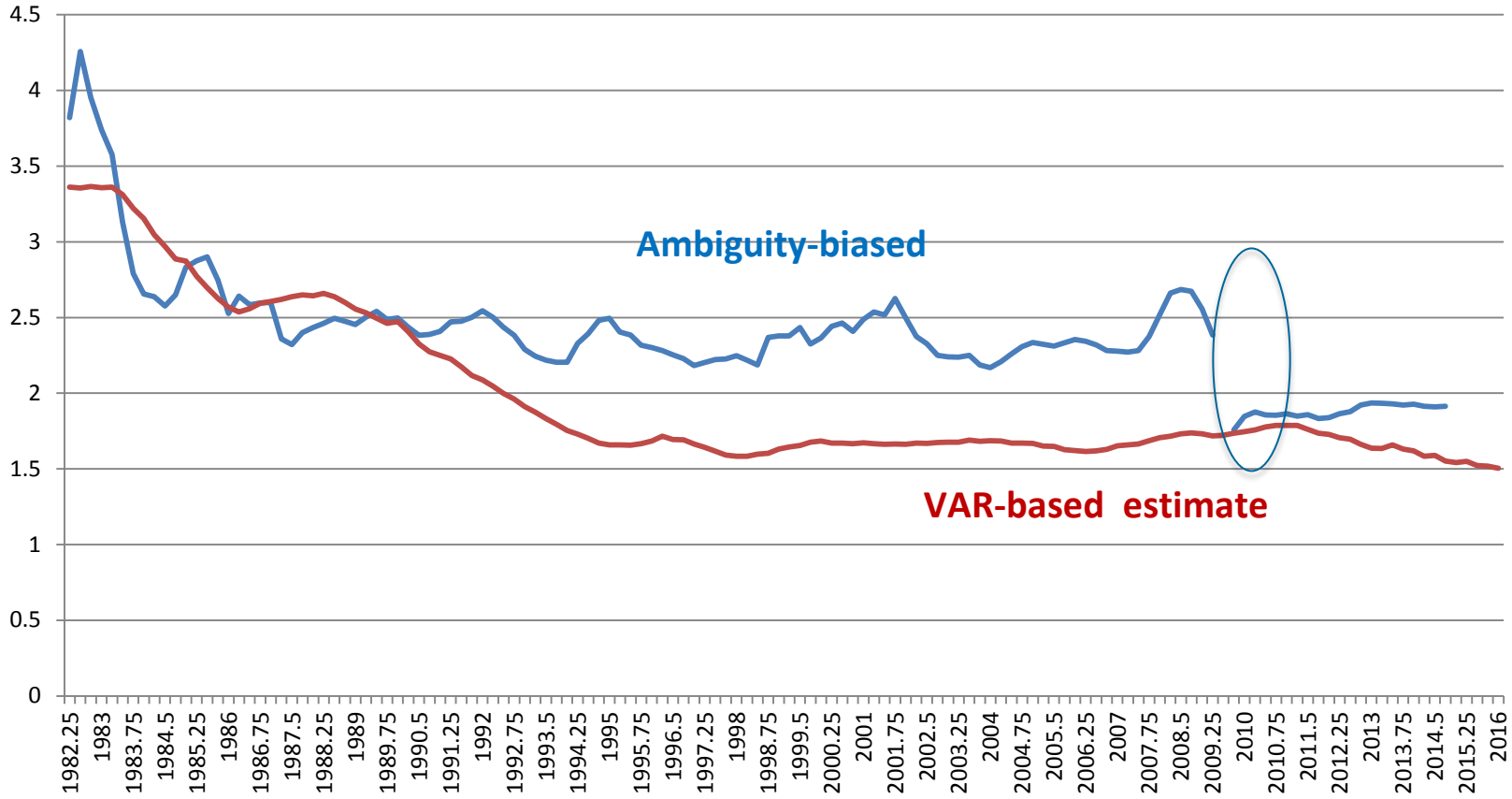
Model validation

- Construct steady state trend inflation
  - Departure from target is function of μ and ϕ

$$\pi = \pi^* - \mu/(\phi - 1)$$

- Measure of μ
  - Dispersion of SPF 3month T-bill rate nowcasts
    - Symmetric distribution up to the ZLB period
      - Confidence width measured by interdecile dispersion (90^{th}-10^{th})
    - Skewed distribution when ZLB binds → rate is overestimated
      - Confidence width measured by (90^{th}-50^{th})
- Main result
  - The ambiguity-based measure of trend inflation captures the decline in the secular component of inflation
    - Explains the disinflation of the 80s and 90s as due to increase in confidence - no change in other parameters (target inflation, reaction function)
    - Because of asymmetric beliefs, also explains the shift of trend inflation from above to below target of 2% (see figure)
  - Explains the switch to indeterminacy to determinacy without a change in the policy coefficient (consistent with Coibion-Gorodnichenko)

Consequence of skewed beliefs distribution



Note: My VAR-based estimate in the figure – the same as in previous slide -- is smoother compared to the trend inflation estimated in the paper.

Comments

- The model does a good job at explaining the drop in inflation trend after the ZLB
- The model also appears to track the drop in inflation in mid-80s
- But why would there be an increase/decrease in confidence in the conduct of monetary policy with no change in the policy parameters?
  - In proximity of the ZLB, an exogenous shift in beliefs is conceivable
    - beliefs become distorted towards thinking of the rate being too high, which in turn generates low inflation
  - But in the 80s policy parameters were likely changing
- Ideally we would like to model which changes in the conduct of policy would determine a change in confidence and how (transparency? stronger reaction?)
- Absent that explanation, the model has simply substituted the exogenous process of trend inflation that it sought to explain with an equally exogenous change in the private sector confidence

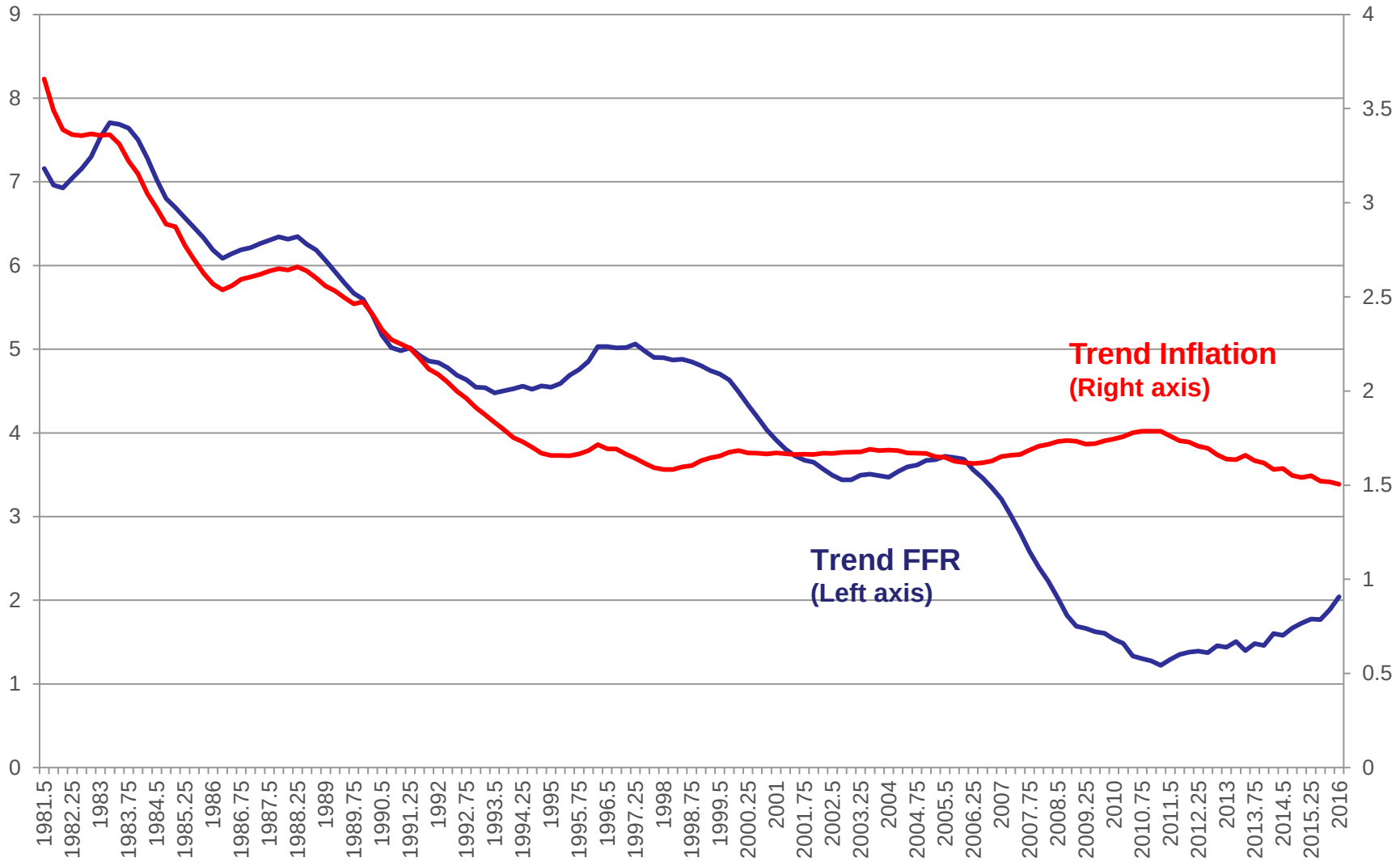
Is constant policy consistent with the data?

- Consider the relationship between inflation and the nominal interest rate in 'steady state'
  - Use trend interest rate and trend inflation estimated by the VAR
- And ask whether the data are consistent with no change in monetary policy
  - Or, whether it is plausible for confidence to change without any change in monetary policy, either in ϕ, or in the target
- The model assumes a Taylor rule, which in steady state relates trend interest rate and trend inflation

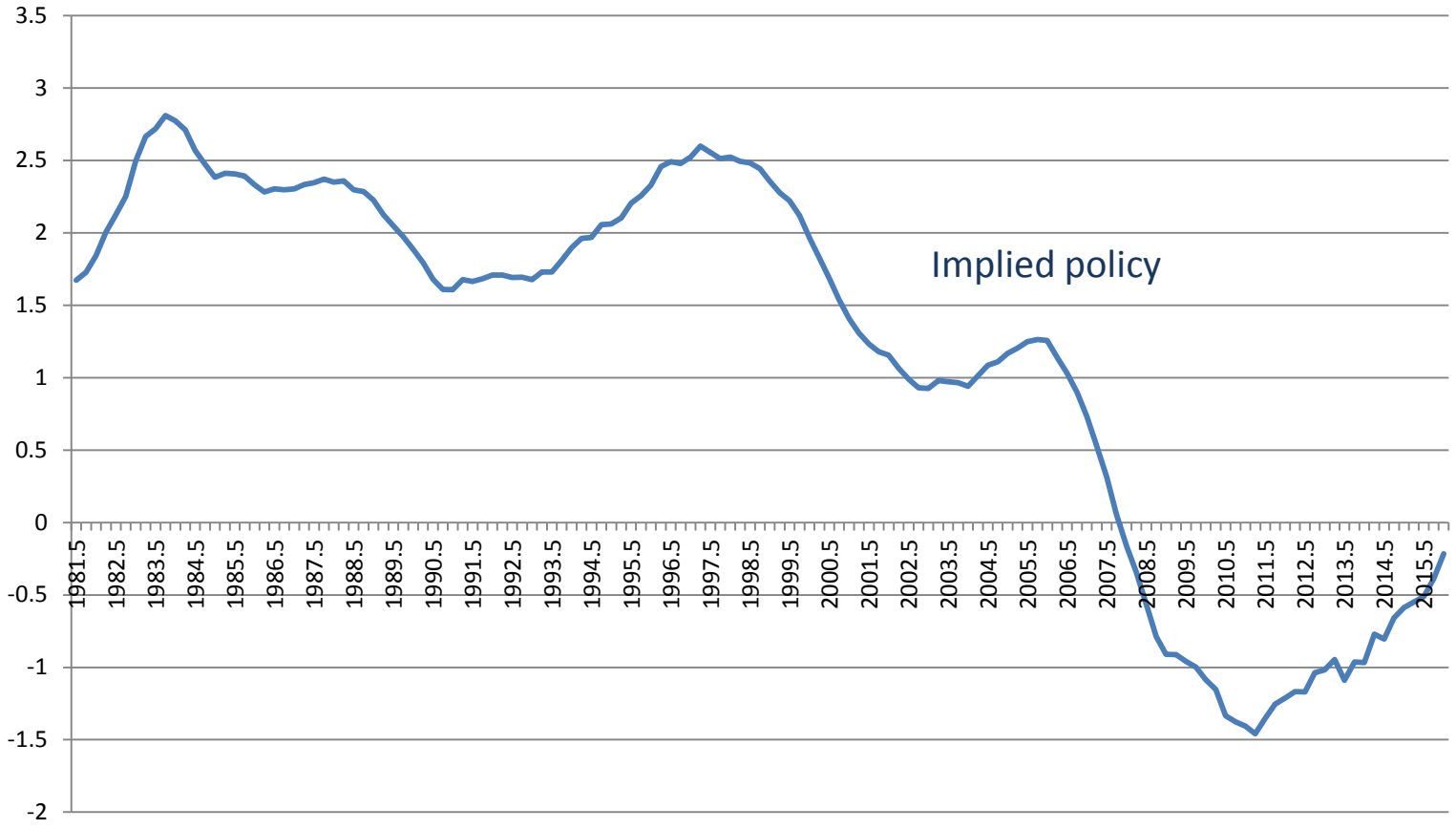
$$i_t = r^n + \pi_t^* + \phi\,(\pi_t - \pi_t^*)$$

- To be consistent with the trends estimated in the data the combination $(r^n + (\phi - 1)\,\pi^*)$ cannot be constant, but must be declining to accommodate the decline in the FFR trend

Trend inflation and trend FFR as estimated by VAR



Is constant policy consistent with trend FFR and trend π ?



An alternative validation of the model

- Consider now implications of the Euler equation
- EE in steady state:

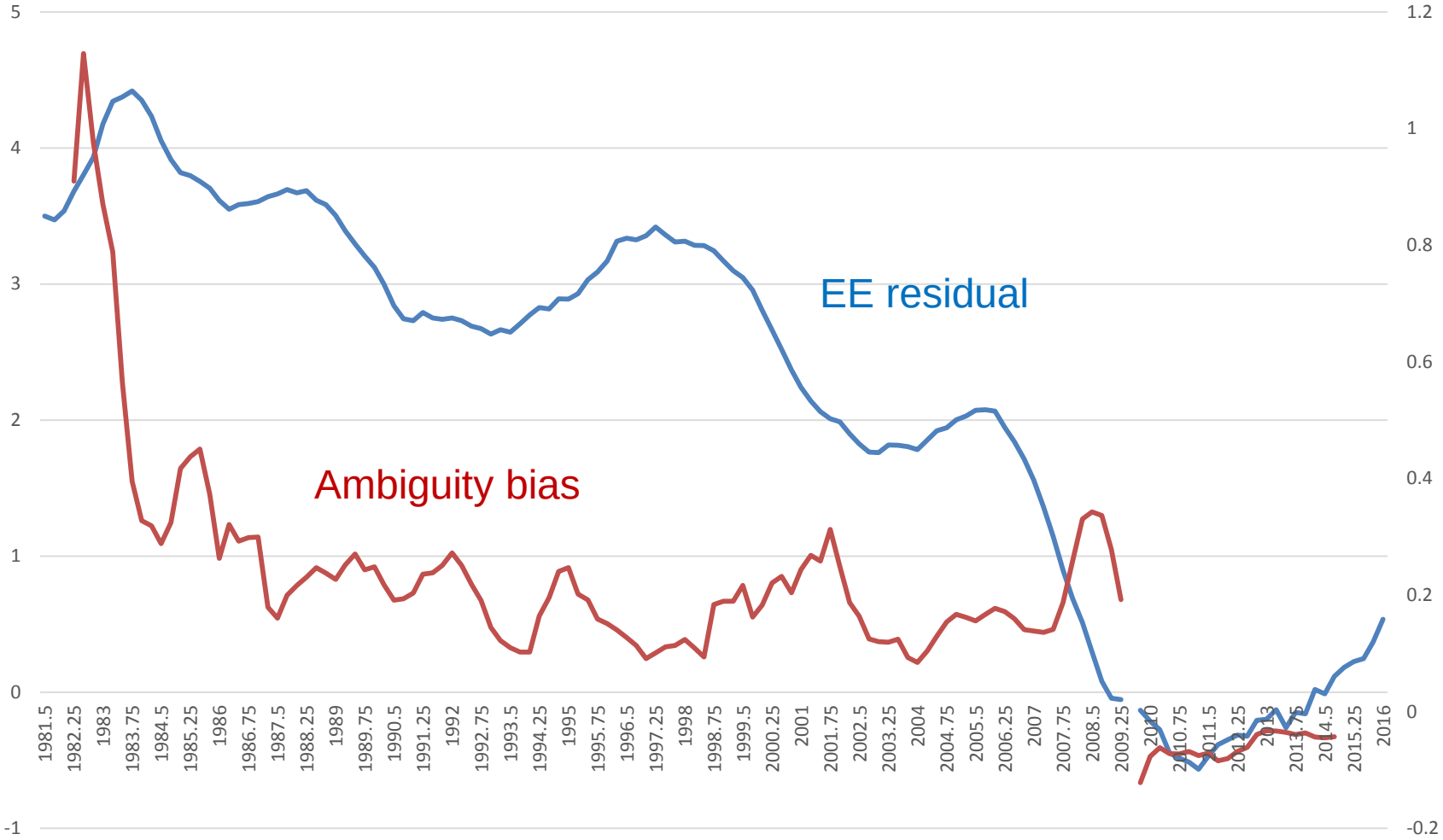
$$1 = \frac{\beta \tilde{R}(\mu, \cdot)}{\Pi(\mu, \cdot)}$$

Where the perceived interest rate is

$$\tilde{R}_t \equiv R_t e^{\mu_t}$$

- In log-linear terms the equation implies that the EE residual should be a measure of μ
  - How does this residual compare with the ambiguity measure in the paper? Not too well, as it's missing some turning points

Does ambiguity explain the EE residual?



Few more comments/questions

- On the measure of ambiguity
  - Complex concept: Knightian uncertainty is about individual inability to assign probabilities
  - Is *dispersion between point forecasts* of different people – the variable chosen in this paper to measure this concept – an appropriate approximation?
- Firms discount their profits with the actual interest rate
  - Is it reasonable that firms' behavior is not affected by ambiguity?
- What features of the model are relevant for delivering asymmetry of the welfare function?