THE PEOPLE VS. THE MARKETS:
A PARSIMONIOUS MODEL OF INFLATION EXPECTATIONS

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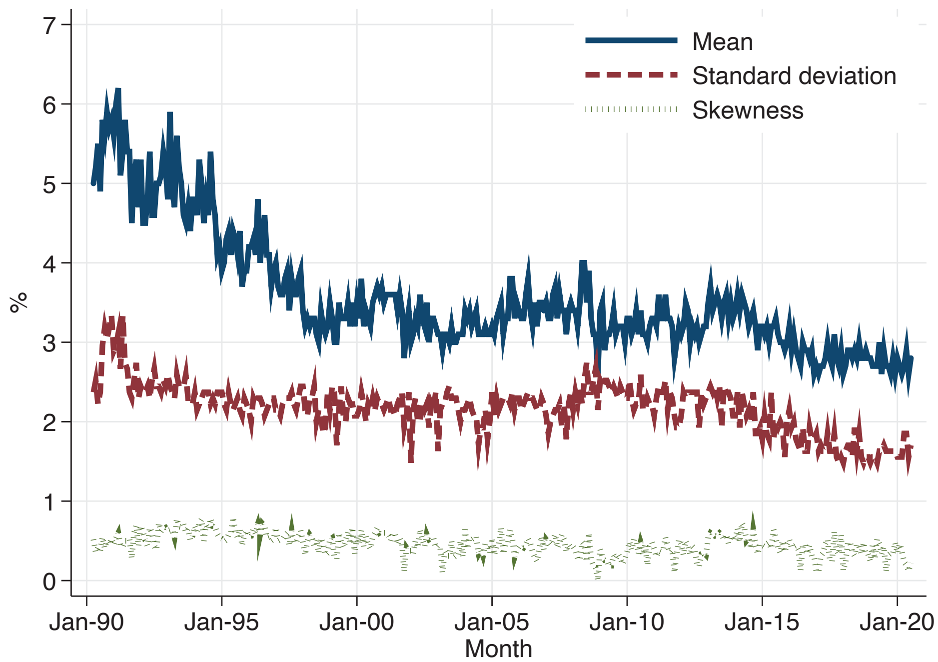
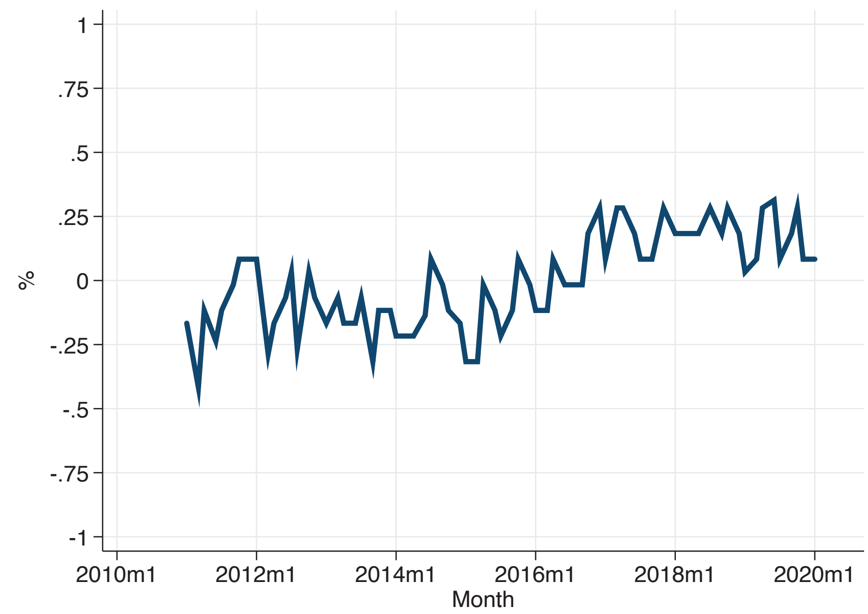
People disagree about long-run inflation

Within people (Michigan)

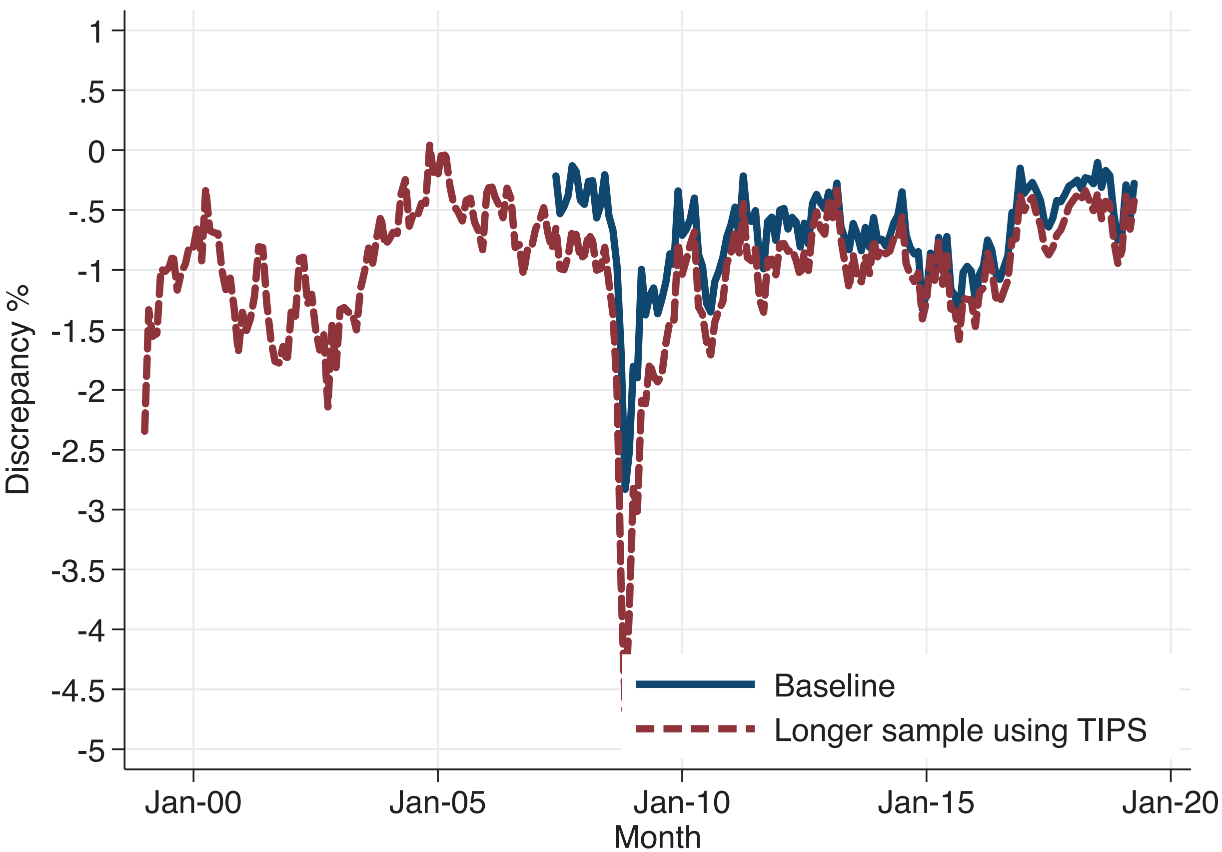


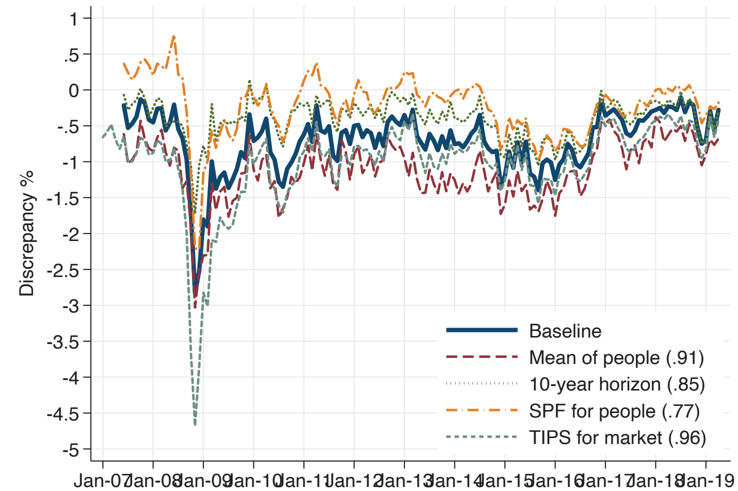
Across people (Households - Dealers)

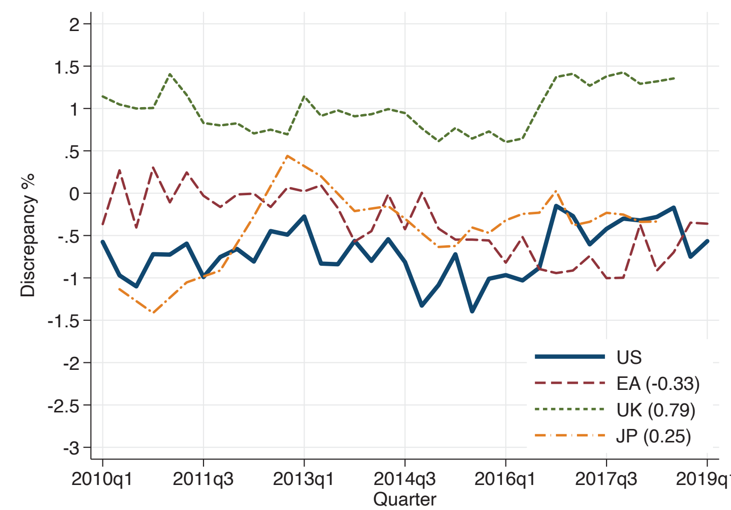


The people versus the markets

Subjective long-run expected inflation risk premium







Parsimonious model of the people

Have forecast v^h of inflation: $\pi = \pi_{t,T}$, fundamental RE is π^e, prior with mean π^*

1. Idiosyncratic noisy signal, match dispersion, average under-reaction (normal)

$$\mathbb{E}^h(\pi^e + e^h|\pi^e) = \pi^e \quad \text{and} \quad Var(e^h|\pi^e) = \sigma^2$$

2. Overconfidence, match over-reaction to news in the cross-section (linear)

$$\partial v^h / \partial(\pi^e + e^h) = \theta$$

3. Type-specific systematic bias, learning from experience, (linear in group)

$$z_c = c\pi^z$$

4. Infrequent updating across cohorts, endogenous disagreement, exponential

$$\lambda(1 - \lambda)^c$$

Parsimonious model of expectations

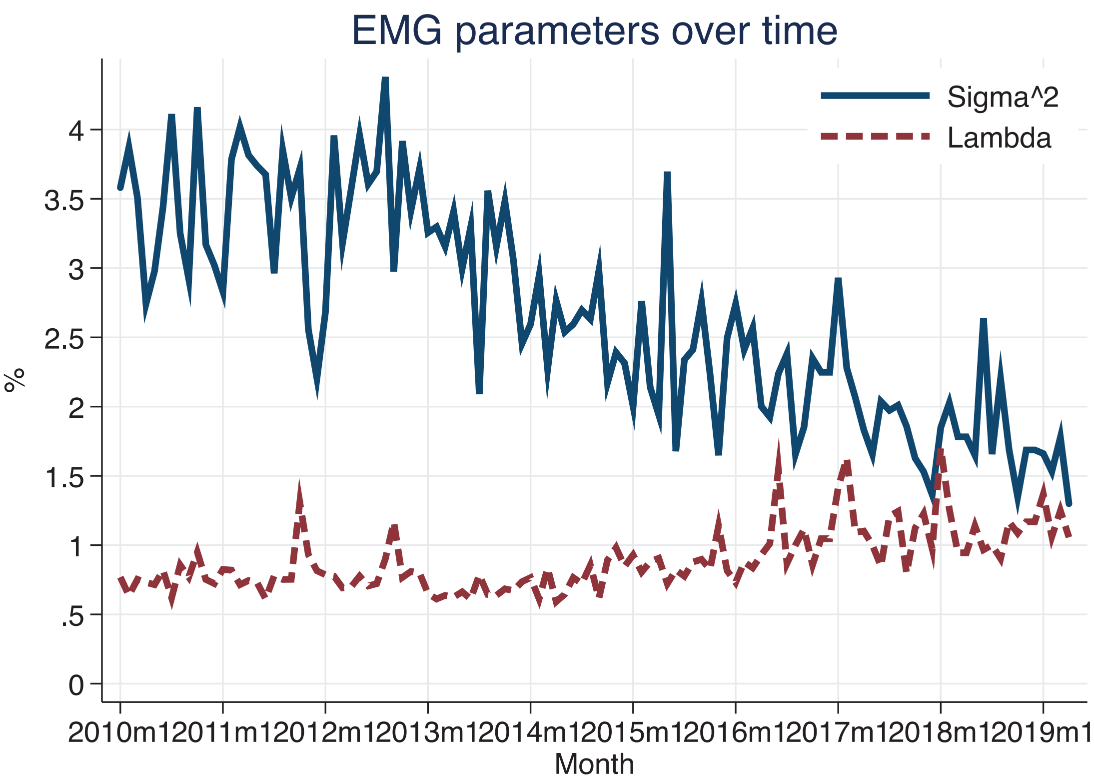
- Full model, conditional on (π*, π^e),

follow an EMG distribution ***F_t(.)***

- 3 identified parameters, 3 non-zero moments

$$\theta, \sigma^2, \lambda/\pi^z$$

Identification and over-identification



Checks on the model:

1. Both positive always
2. Kurtosis and higher-order moments are zero
3. Adjusted mean

$$\mu_t \equiv Mean_t - StDev_t(0.5Skew_t)^{1/3}$$

$$\lim_{T\to\infty} \frac{\sum_t \mu_t}{T} = \pi^*$$

2.3% full sample 1.9% since 2010

Traders expectations and actions

- Indexed by ***i***, draw prior v^i from ***F(.)***, trade bond that pays 1 and costs ***q*** today

$$p(\pi^e|v^i,q) \propto g(q|\pi^e)f(\pi^e|v^i)$$

- Goal is to choose $b^i \in [0,w_i]$ given an sdf ***m(.)***

$$\max \int \left[m(\pi)e^{-\pi} - q\right] b^i p(\pi^e|v^i,q)d\pi^e$$

- Payoff $y(\pi^e)=E(m(\pi)e^{-\pi} \mid \pi^e)$, MLRP of $F_t(.)$, marginal trader signal v^* indifferent:

$$\int y(\pi^e)p(\pi^e|v^*,q)d\pi^e = q$$

- Market clearing since only those with low signal buy, ***B*** shocks with Beta dist.

$$F(v^*|\pi^e) = B/w \equiv \omega$$

Market prices and the discrepancy

- Property: the threshold $\boldsymbol{v}^*$ is a sufficient statistic for $(\boldsymbol{\pi}^e, \boldsymbol{\omega})$. Equilibrium price:

$$q(\pi^e, \omega) = Q(v^*) = \frac{\int y(\pi^e) g(v^* - \pi^e) f(v^* - \pi^e) d\pi^e}{\int g(v^* - \pi^e) f(v^* - \pi^e) d\pi^e}$$

- Monotonic in $(\boldsymbol{\pi}^e, \boldsymbol{\omega})$ spans real line, so can fit data.
- Parameters: $\boldsymbol{\pi}^*$ shifts $\boldsymbol{q}$ 1-to-1, $\boldsymbol{\beta}$ informativeness of market prices

- Model justifies a decomposition of the discrepancy

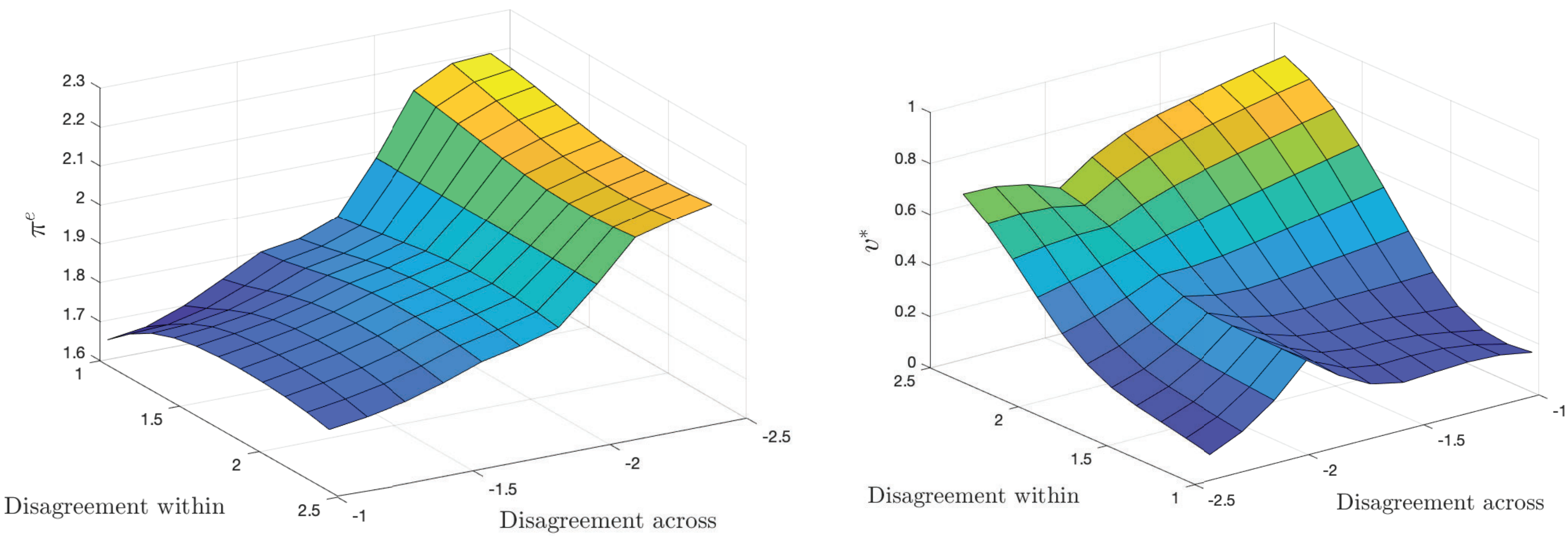
$$\phi_t = \underbrace{\mathbb{E}_t^b(\pi_{t,T}) - \mathbb{E}_t^p(\pi_{t,T})}_{\text{disagreement across}} + \underbrace{\mathbb{E}_t^m(\pi_{t,T}) - \mathbb{E}_t^b(\pi_{t,T})}_{\text{disagreement within}} + \underbrace{\mathbb{E}_t^*(\pi_{t,T}) - \mathbb{E}_t^m(\pi_{t,T})}_{\text{risk compensation}}$$

Model's mechanics

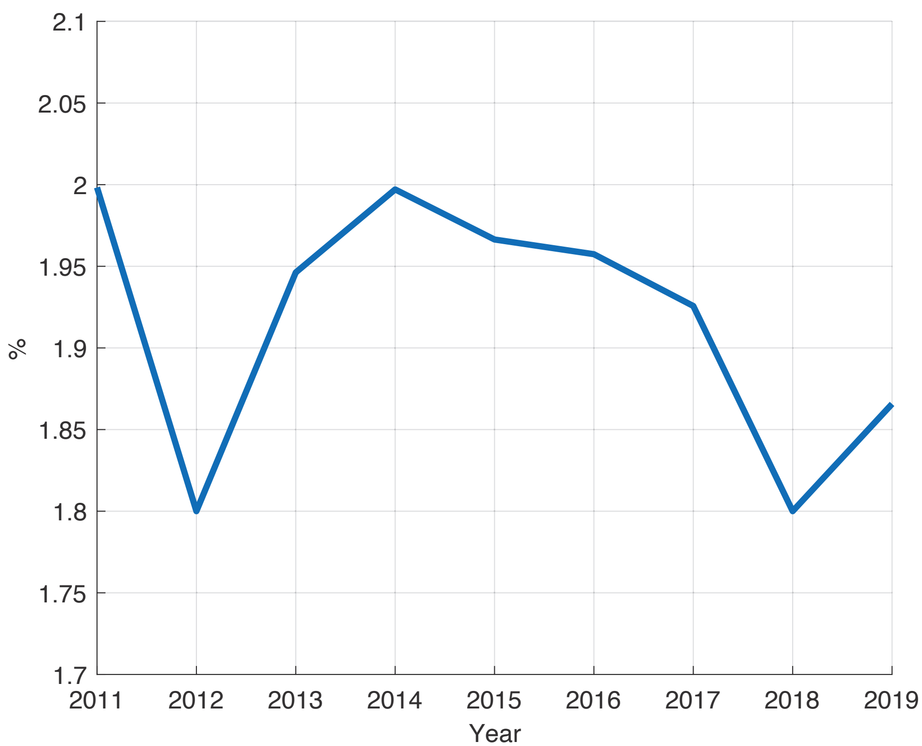
Parameters: only two $\pi^* = 2\%$, and $\beta = 2$

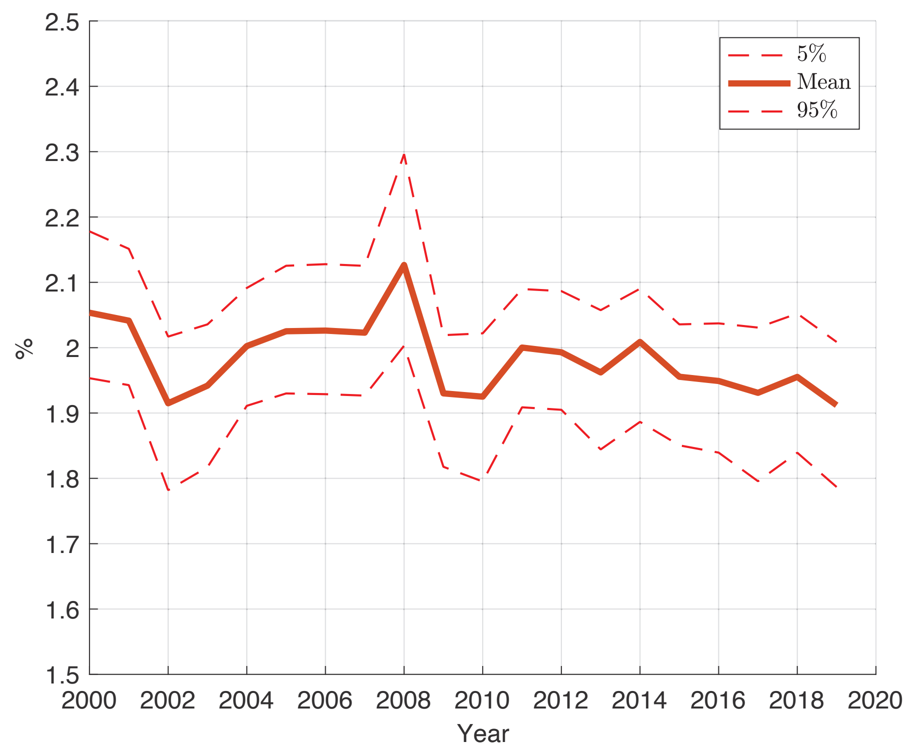
Inputs: Five series in introduction.

Outputs: fundamental π^e_t, marginal trader v^* , decomposition of discrepancy

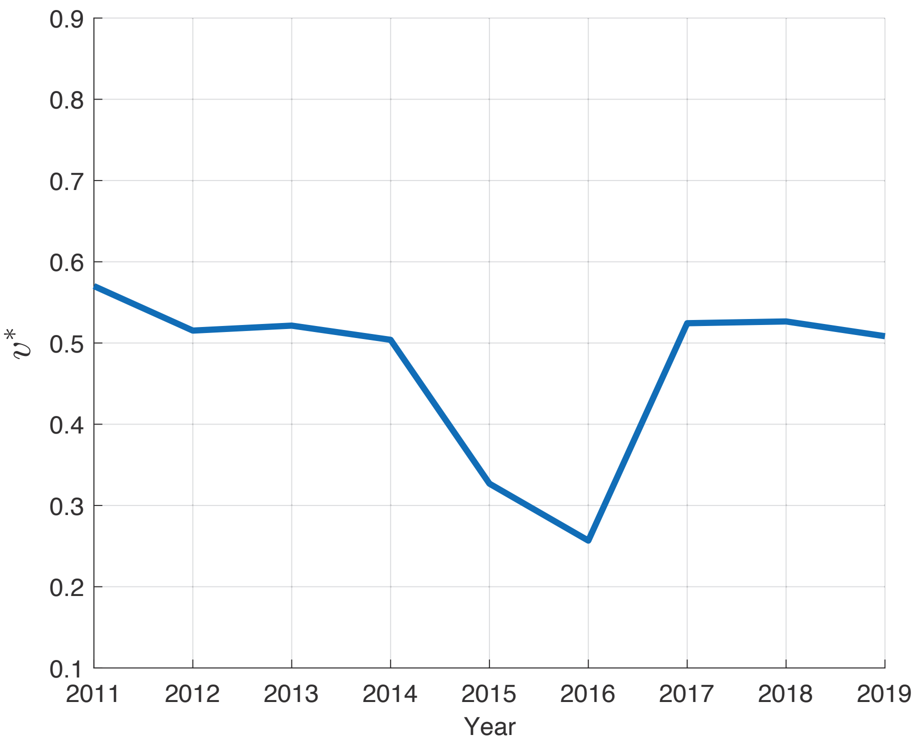


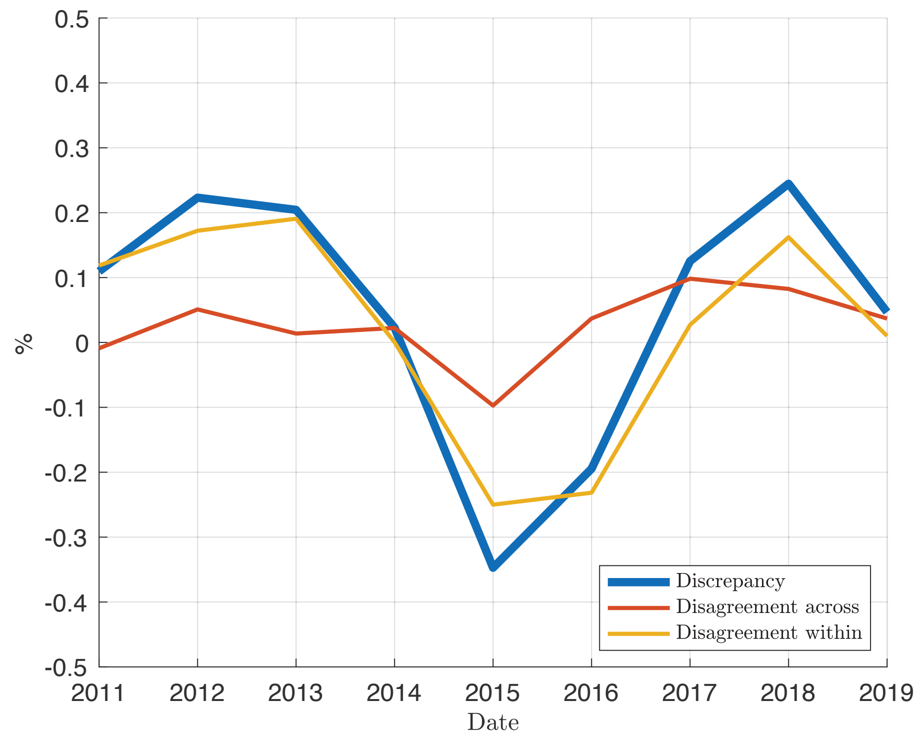
Expected inflation post-2011 and post-2000





Marginal trader and decomposition





Inflation GE: policy, expectations, outcomes

- Solve for expected and actual inflation, given log-linear model

$$\frac{dp_t}{p_t} = \pi_t^e dt + \alpha' dZ_t \qquad \phi_t = -\alpha'\alpha + \chi_\pi(\pi_t^e - \pi^*) + \chi_\omega \hat{\omega}_t$$

- Transmission mechanism on natural rate

$$g_t = \ln(\zeta) + i_t^{CB} - \pi_t^e - \delta\phi_t$$

- Monetary policy response

$$di_t^{CB} = -\rho(i_t^{CB} - i^*)dt + \eta\left(\frac{dp_t}{dt} - \pi^*\right) + \gamma d\phi_t$$

- Natural rate and financial shocks both OU processes.

Predictions

1. Inflation is determinate as long as:

$$\eta/\rho > 1 + \delta\chi_\pi$$

- *Stronger than Taylor condition if higher expectation of inflation lowers discrepancy, lowers real rates, pushes inflation up, need extra tightening for anchoring.*

2. Expected inflation is given by:

$$\pi^e = \pi^* + \frac{(\rho - \kappa_g)(g_t - g^*)}{\eta - \rho(1 + \delta\chi_\pi) + \kappa_g(1 - \chi_\pi(\gamma - \delta))} + \frac{\chi_\omega[\kappa_\omega(\gamma - \delta) + \rho\delta]\hat{\omega}_t}{\eta - \rho(1 + \delta\chi_\pi) + \kappa_\omega(1 - \chi_\pi(\gamma - \delta))}$$

- *Respond more to discrepancy: less volatility from real shocks, more from financial noise*

3. Feedback: if more dovish, more volatile discrepancy, respond more to it

- *May well be that people forecast as well as traders, which is a puzzling fact*

How are expectations of macro variables formed?

1. Parsimonious model of subjective expectations and market prices for business-cycle fluctuations of long-horizon expectations

2. US un-anchoring of inflation expectations, with a drift down 2014-19, revealed by skewness and discrepancy

3. Policy tradeoff in reacting to different measures of expectations, as both financial and fundamental shocks

Application to the Euro-area