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

Ricardo Reis
LSE

26th of March, 2021
San Francisco Fed conference on macro and monetary policy
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 $\mathbf{v}^h$ of inflation: $\boldsymbol{\pi} = \boldsymbol{\pi}_{t,T}$, fundamental RE is $\boldsymbol{\pi}^e$, prior with mean $\boldsymbol{\pi}^*$

1. Idiosyncratic noisy signal, match dispersion, average under-reaction (normal)
   \[
   \mathbb{E}^h(\pi^e + e^h | \pi^e) = \pi^e \quad \text{and} \quad \text{Var}(e^h | \pi^e) = \sigma^2
   \]

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 \((\pi^*, \pi^e)\),

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
   \[ \mu_t \equiv \text{Mean}_t - \text{StDev}_t (0.5 \text{Skew}_t)^{1/3} \]
   \[ \lim_{T \to \infty} \frac{\sum_t \mu_t}{T} = \pi^* \]

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 $y(\pi^e) = E(m(\pi)e^{-\pi} | \pi^e)$, 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 $v^*$ is a sufficient statistic for $(\pi^e, \omega)$. 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 $(\pi^e, \omega)$ spans real line, so can fit data.
- Parameters: $\pi^*$ shifts $q$ 1-to-1, $\beta$ informativeness of market prices
- Model justifies a decomposition of the discrepancy

$$\phi_t = \underbrace{\mathbb{E}^b_t(\pi_{t,T}) - \mathbb{E}^p_t(\pi_{t,T})}_{\text{disagreement across}} + \underbrace{\mathbb{E}^m_t(\pi_{t,T}) - \mathbb{E}^b_t(\pi_{t,T})}_{\text{disagreement within}} + \underbrace{\mathbb{E}^*_{t}(\pi_{t,T}) - \mathbb{E}^m_{t}(\pi_{t,T})}_{\text{risk compensation}}$$
Model’s mechanics

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

Inputs: Five series in introduction.

Outputs: fundamental $\pi^e_t$, 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

\[ \frac{dp_t}{p_t} = \pi_e^t dt + \alpha' dZ_t \]

\[ \phi_t = -\alpha' \alpha + \chi \pi (\pi_e^t - \pi^*) + \chi \omega \hat{\omega}_t \]

• Transmission mechanism on natural rate

\[ g_t = \ln(\zeta) + i_t^{CB} - \pi_e^t - \delta \phi_t \]

• Monetary policy response

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

• Natural rate and financial shocks both OU processes.
Predictions

1. Inflation is determinate as long as:

\[ \frac{\eta}{\rho} > 1 + \delta \chi_\pi \]

- 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

[Graphs showing expected long-run inflation for the Euro-area from 2010q1 to 2019q1. The x-axis represents quarters from 2010q1 to 2019q1, and the y-axis represents inflation rates in percentage. Two lines are plotted: one for People and another for Markets.]

[Graph showing density distribution with three different SPF densities labeled as 2004 SPF Density, 2014 SPF Density, and 2018 SPF Density. The x-axis represents inflation rates ranging from 1% to 2.5%, and the y-axis represents density.]