Discussion of Nason & Smith’s “Reverse Filtering U.S. Inflation with Sticky Professional Forecasts”

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The results presented here do not necessarily represent the views of the Federal Reserve System or the Federal Open Market Committee

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First impression

• Neat exercise!

• “Survey observations as Kalman Filters? Even when surveys are not perfect RE?”

• Important topic, straightforward application
AGENDA

1. Reverse Filtered Inflation Trend
2. A Filtered Trend (Mertens 2012)
3. Further Comments
Builds on two strands of the literature:

- Inflation: Stock & Watson’s UC
- Surveys: Coibion & Gorodnichenko (Mankiw & Reis)

“Can we get estimates without filtering?”

“Are the two models consistent?”
Builds on two strands of the literature:

- Inflation: Stock & Watson’s UC
- Surveys: Coibion & Gorodnichenko (Mankiw & Reis)

“Can we get estimates without filtering?”
(KIND OF YES)

“Are the two models consistent?”
(SEEMS NOT)
UC model of inflation

\[ \pi_t = \tau_t + \epsilon_t \]

\[ E_t \pi_{t+\infty} = \tau_t = \tau_{t-1} + \eta_t \]

\[ \Rightarrow E_t \pi_{t+h} = \tau_t \]
INFLATION AND SURVEY DYNAMICS

UC model of inflation

\[ \pi_t = \tau_t + \epsilon_t \]

\[ E_t \pi_{t+\infty} = \tau_t = \tau_{t-1} + \eta_t \]

\[ \epsilon_t = \rho \epsilon_{t-1} + \nu_t \]

\[ \Rightarrow E_t \pi_{t+h} = \tau_t + \rho^h \epsilon_t \]
UC model of inflation

\[ \pi_t = \tau_t + \epsilon_t \]

\[ E_t \pi_{t+\infty} = \tau_t = \tau_{t-1} + \eta_t \]

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\[ \Rightarrow E_t \pi_{t+h} = \tau_t + \rho^h \epsilon_t \]

Sticky Survey Forecasts

\[ F_t \pi_{t+h} = (1 - \lambda) E_t \pi_{t+h} + \lambda F_{t-1} \pi_{t+h} \]

“Reverse Filtering”:

Use observed \( F_t \pi_{t+h} \) to back out \( \tau_t \)?

(or at least \( E_t \pi_{t+h} \)?)
INFLATION AND SURVEY DYNAMICS
RE and no persistence in inflation gap

**UC model of inflation** \((\rho = 0)\)

\[
\pi_t = \tau_t + \epsilon_t \\
\tau_t = \tau_{t-1} + \eta_t \\
\epsilon_t, \eta_t \text{ unpredictable} \\
\Rightarrow E_t \pi_{t+h} = \tau_t
\]

**Rational Survey Forecasts** \((\lambda = 0)\)

\[
F_t \pi_{t+h} = E_t \pi_{t+h}
\]

• Little or no serial correlation in \(\hat{\eta}_t\) and \(\hat{\epsilon}_t\)

• Gap volatility higher since 2000, . . .

• Longer-term forecasts more sensible for \(\tau_t = E_t \pi_t + \infty\)
REVERSE FILTERED TRENDS

blue: CPI, red: $\tau_{1t} = F_t \pi_{t+1}$, black: $\tau_{2t} = \sum_{j=1}^{4} F_t \pi_{t+j}/4$

$\rho = 0, \lambda = 0$
INFLATION AND SURVEY DYNAMICS
RE and no persistence in inflation gap

**UC model of inflation** \((\rho = 0)\)

\[
\pi_t = \tau_t + \epsilon_t \\
\tau_t = \tau_{t-1} + \eta_t \\
\Rightarrow E_t\pi_{t+h} = \tau_t
\]

\(\epsilon_t, \eta_t\) unpredictable

**Rational Survey Forecasts** \((\lambda = 0)\)

\[
F_t\pi_{t+h} = E_t\pi_{t+h}
\]

\(\hat{\tau}_t = F_t\pi_{t+1} \text{ or } \hat{\tau}_t = \frac{1}{4} \sum_{j=1}^{4} F_t\pi_{t+j}\)

- Little or no serial correlation in \(\hat{\eta}_t\) and \(\hat{\epsilon}_t\)
- Gap volatility higher since 2000, . . .
- Longer-term forecasts more sensible for \(\tau_t = E_t\pi_{t+\infty}\)
AGENDA

1. Reverse Filtered Inflation Trend

2. A Filtered Trend (Mertens 2012)

3. Further Comments
- Agnostic about unbiasedness, stickiness etc

\[ E_t \pi_{t+h} \neq F_t \pi_{t+h} \]

- Surveys errors stationary

\[ \pi_{t+h} - F_t \pi_{t+h} \sim I(0) \]

- Surveys and inflation are cointegrated

\[ \tau_t = E_t \pi_{t+\infty} = E_t (F_{t+\infty} \pi_{\infty+h}) + \text{const} \]

- Persistent Gaps: 

\[ A(L) \begin{bmatrix} \pi_t - \tau_t \\ F_t \pi_{t+h} - \tau_t \\ \vdots \end{bmatrix} = e_t \]
INFLATION TRENDS
black: N&S, yellow: COINT w/CPI and SPF, magenta: CPI
INFLATION TRENDS
black: N&S, yellow: COINT w/CPI and SPF, green: COINT w/sur. & inf.
Recap:

- Nason-Smith similar to filtered measures particular when using same data
- Information sets matter: COINT w/long-term surveys is smoother
- Next: COINT using surveys alone is even smoother
INFLATION TRENDS
...green: COINT w/surveys and inflation, red: COINT w/surveys alone
TREND VOLATILITY
“SPF Model” using CPI and SPF Q1-Q4, plus SV in gaps
VOLATILITY OF GAP SHOCKS
clockwise: CPI, SPF Q1, SPF Q3, SPF Q4
GAP PERSISTENCE
posterior distribution of largest eigenvalue
AGENDA

1 Reverse Filtered Inflation Trend

2 A Filtered Trend (Mertens 2012)

3 Further Comments
INFLATION PERSISTENCE

- No significant estimates of persistence ($\rho$)
- Using same data, Jain (2011) finds persistence for individual respondents (but w/o detrending)

Different results due to detrending or averaging across respondents?
**SURVEY STICKINESS**

**Estimated Stickiness \( \lambda \)**
- Estimates differ from CG’s baseline \( \lambda \approx 0.55 \) (GDPD)
- But seem consistent with CG’s CPI results

**Should we reconsider robustness of CG ?**

**Reverse Filters**

\[
\hat{\tau}_t = F_t \pi_{t+h} + \frac{\lambda}{1 - \lambda} (F_t - F_{t-1}) \pi_{t+h}
\]

- Evidence of serial correlation in \( \Delta \hat{\tau}_t \).
  But maybe it measures \( \hat{E}_t \pi_{t+h} \) ?
- \( \hat{\tau}_t = E(\tau | \text{survey respondent’s info}) \) need not be martingale under econometricians info set
• Neat exercise!

• Important topic, straightforward application

• Results

① Surveys observations close to filter estimates

② Need better model/estimates to integrate sticky surveys with inflation dynamics
APPENDIX: MERTENS (2012)
### COMMON TREND MODEL

#### Decomposition

\[ Y_t = \tau_t + \tilde{y}_t \quad \tilde{y}_t \text{ stationary} \]

\[ \lim_{k \to \infty} E_t Y_{t+k} = \tau_t \]

#### Trend $\tau_t$ with Stochastic Volatility

\[ \tau_t = \tau_{t-1} + 1 \exp \left( \frac{h_t}{2} \right) \bar{\epsilon}_t \]

\[ h_t = h_{t-1} + \sigma_h \xi_t \quad \bar{\epsilon}_t, \xi_t \sim N(0, 1) \]

#### Gaps $\tilde{y}_t$

\[ A(L) \tilde{y}_t = \bar{\epsilon}_t + \beta \bar{\epsilon}_t \quad \bar{\epsilon}_t \sim N(0, \bar{\Sigma}) \]
## Inflation Rates
- PCE, Core PCE, CPI(SA)
- GDP Deflator

## Survey Expectations of Inflation
- Michigan: 1-year and 10-year
- Blue Chip, CPI and GDPD: 4-quarter and 5-to-10-year
- SPF, CPI: 4-quarter and 10-year
- Livingston, CPI: 12-month
- “PTR” from FRB Philadelphia and Board of Governors

## In the paper, not shown today: Term Structure
- Nominal Treasury yields: 10-, 30-year
- Nine-to-ten-year forward rate (Svensson yield curve)