Perceived Income Risks

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Outline

Motivation

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What this paper does

1. dddd

Literature

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Definition and notation

Individual moments	Population moments
Mean forecast: $y_{i,t+h\|t}$	Average forecast: $\bar{y}_{t+h\|t}$
Forecast error: $FE_{i,t+h\|t}$	Average forecast error: $\overline{FE}_{t+h\|t}$
Uncertainty: $Var_{i,t+h\|t}$	**Average uncertainty**: $\overline{Var}_{t+h\|t}$
	Disagreement: $\overline{Disg}_{t+h\|t}$

Data

	SCE	SPF
Time period	2013M6-2018M6	2007Q1-2018Q4
Frequency	Monthly	Quarterly
Sample Size	1,300	30-50
Aggregate Var in Density	1-yr-ahead inflation	1-yr and 3-yr core CPI and core PCE
Pannel Structure	stay up to 12 months	average stay for 5 years
Demographic Info	Education, Income, Age	Industry

- density estimation following (**?**)
- exclude top and bottom 5% values for forecast errors and uncertainty

Basic patterns: uncertainty and realized inflation

Basic patterns: uncertainty and the size of forecast errors

- no evidence for positive correlation betwen high ex ante uncertainty and ex post forecast errors.

Basic patterns: uncertainty and disagreement

figuresDraft/CPI_disg_var_SPF_Q.png figuresDraft/PCE_disg_var_SPF_Q.png figuresDraft/Q9_disg_v

- uncertainty are not the same as disagreement for professionals

Basic patterns: summary

- uncertainty varies across time
- uncertainty contains different information from widely proxies such as disagreement and forecast error

AR(1) model of inflation

- **Inflation process**

$$y_t = \rho y_{t-1} + \omega_t$$
$$\omega_t \sim N(0, \sigma^2_\omega)$$

- **Uncertainty**
  - FIRE: time-invariant

$$\overline{Var}^*_{t+h|t} = \sum_{s=1}^{h} \rho^{2s}\sigma^2_\omega$$

  - SE: time-invariant

$$\overline{Var}^{se}_{t+h|t} = \sum_{\tau=0}^{+\infty} \lambda(1-\lambda)^\tau \overline{Var}^*_{t+h|t-\tau}$$

  - NI: time-variant but quantitatively tiny due to highly efficient Kalman gain

$$\overline{Var}^{ni}_{t+h|t} = \rho^{2h}\overline{Var}^{ni}_{t|t} + \overline{Var}^*_{t+h|t}$$

Stocastic volatility (UCSV) inflation process (?)

- **Inflation process**

$$
\begin{aligned}
y_t &= \theta_t + \eta_t, \quad \text{where } \eta_t = \sigma_{\eta,t}\xi_{\eta,t} \\
\theta_t &= \theta_{t-1} + \epsilon_t, \quad \text{where } \epsilon_t = \sigma_{\epsilon,t}\xi_{\epsilon,t} \\
\log \sigma^2_{\eta,t} &= \log \sigma^2_{\eta,t-1} + \mu_{\eta,t} \\
\log \sigma^2_{\epsilon,t} &= \log \sigma^2_{\epsilon,t-1} + \mu_{\epsilon,t}
\end{aligned}
$$

$$
\begin{aligned}
\xi_t &= [\xi_{\eta,t}, \xi_{\epsilon,t}] \sim N(0, I_2) \\
\mu_t &= [\mu_{\eta,t}, \mu_{\epsilon,t}]' \sim N(0, \gamma I_2)
\end{aligned}
$$

UCSV inflation process

- **Uncertainty**
  - FIRE: time-varying

$$\overline{Var}^{*}_{t+h|t} = \sum_{k=1}^{h} exp^{-0.5k\gamma_\eta}\sigma^2_{\eta,t} + exp^{-0.5h\gamma_\epsilon}\sigma^2_{\epsilon,t}$$

  - SE: time-varying

$$\overline{Var}^{se}_{t+h|t} = \sum_{\tau=0}^{\infty}(1-\lambda)^{\tau}\lambda\overline{Var}^{*}_{t+h|t-\tau}$$

  - NI (1-step-ahead): time-varying

$$\overline{Var}^{\theta}_{t|t-1} = \overline{Var}^{\theta}_{t-1|t-1} + Var^{*}_{t|t-1}(y_t)$$

Simulated method of moment estimation

$$\widehat{\Omega} = \underset{\{\Omega \in \Gamma\}}{argmin}(M_{\text{data}} - F^o(\Omega, Y))W(M_{\text{data}} - F^o(\Omega, Y))'$$

- Ω: parameters of the particular $o \in \{fire, se, ni\} \times \{ar, sv\}$
- Γ: constraints for the parameter.
- M_{data}: data moments
- F: simulated model moments according to a particular theory o, a function of parameters Ω as well as the Y, the real-time data (including history) up till each point of the time t.
  - unconditional moments, not specific to time
  - moments selected from average forecast, variance and autocovariance of forecasts, average diagreement, variance and autovariance of disagreement, average uncertainty, etc.
- W: weight matrix, identity matrix for now

Estimation procedure and algorithm

1. for each theory of expectation formation and the inflation process, start with an initial value for the parameter(s) of interest
2. simulate individual forecasts for a large enough ($N = 200$) number of forecasters
3. compute the average forecast errors, disagreement and average uncertainty across all agents
4. compute the time-series moments of the average forecast, disagreement, and uncertainty
5. compute the difference between the simulated moments and the data moments
6. keep searching the parameter value until reaching below a threshold of the loss

Two-step and joint estimation

1. two-step estimation: separately estimate inflation process parameters and then parameters of the inflation process
    - pros: computationally lighter
    - cons: potential misspecification. does not utilize the expectation data to understand inflation process per se.
2. joint estimation: targeting both moments of realized inflation series and moments of forecasts to simultaneously estimate both the inflation process and the parameter of expectation formation
    - pros: additional information gain from expectations data about inflation process itself
    - cons: more computation burden

Outline

SE parameter estimate: professionals

Table: SMM Estimates of SE: professionals

0	1	2	3	4	SE: $\hat{\lambda}_{SPF}$(Q)	SE: $\hat{\lambda}_{SPF}$(Q)	SE: ρ	SE: σ	SE: $\hat{\lambda}_{SCE}$(M)	SE: $\hat{\lambda}_{SCE}$(M)	SE: ρ	SE: σ
FEVar	FEATV				0.47	0.36	1.00	0.08	0.2	0.59	0.99	0.08
FEVar	DisgATV	DisgVar			0.27	0.38	1.00	0.11	0.2	0.56	0.98	0.08
FEVar	FEATV	DisgVar	DisgATV		0.47	0.36	1.00	0.10	0.2	0.59	0.99	0.08
FEVar	FEATV	DisgVar	DisgATV	FE	0.47	0.36	1.00	0.08	0.2	0.59	0.99	0.08

- λ: update rate in SE

Professionals and SEAR

(a) FE

figuresDraft/spf_se_est_diag0.png

(b) Disg

figuresDraft/spf_se_est_diag1.png

(c) FE/Disg

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Conclusion

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