Structured Beliefs and Fund Performance: An LLM-Based Approach

By Zhenyu Gao, Wei Xiong, and Jian Yuan

Discussion by Zhen Huo
Yale University

ABFER Webinar Series

Jan 15, 2025

Summary: An Intriguing Paper!

- Methodology: text as data, convert financial reports to beliefs via LLM
  - beliefs on asset prices: directly payoff relevant
  - beliefs on policy style: whether expect countercyclical policy (CCP)
- Applied findings: investors expecting CCP or not matters
  - CCP investors associated with higher fund return
  - CCP investors' expected asset prices more correlated with actual prices
- Potential implications
  - evidence for role of state intervention in financial market
  - evidence for government-centric attention channel (Brunnermeier et al, 2022; Sockin and Xiong, 2024)

LLM-Approach and Belief Measurement

- Traditional belief inference
  - imposed model structure + observed outcomes: RE, AL
  - imply fully structured beliefs, but lack indirect evidence

- New generation
  - survey evidence: direct and numeric measurement, but panel often unavailable
  - text: based on word frequency, useful to measure attention or sentiment
  - difficult to infer structured beliefs for both

- This paper: text + LLM
  - repeated panel + structured beliefs
  - allow analysis of investors' micro strategy and potential GE propagation channel
  - open doors for further structure modeling of expectation formation

How do CCP Funds Outperform Non-CCP Funds?

1. Higher information quality

- Both 1 and 2 can lead to better expectations

2. More accurate mapping from the states to prices given the same info

3. More sophisticated investment strategy given the same expectations

Comment 1: Improved Forecasts or Distorted Forecasts?

- Key idea: CCP investors make more accurate forecasts
  - ideal test: compare the forecast errors with non-CCP investors

- Without numeric forecasts, instead considering the following regression

$$RI\_equity_{i,t} = \alpha_i + \beta_t + \beta expect\_equity\_market_{i,t} \times CCP\_fund_i + \gamma expect\_equity\_market_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}$$

- Preferred interpretation
  - positive γ: positive association between predicted and realized prices
  - positive β: stronger association for CCP investors

- Caveat: not necessarily imply more accurate expectations

A Simple Model

- Investor i forecast return r_t based on signal x_{it}

$$x_{it} = r_t + \epsilon_{it}$$

  - ϵ_{it}: noise with variance σ_i^2
  - information quality may depend on whether investor is CCP

- Linear forecast

$$\mathbb{E}_{it}[r_t] = \boldsymbol{\kappa}_i \boldsymbol{g}_i x_{it}$$

  - $g_i = \frac{\sigma_r^2}{\sigma_r^2 + \sigma_i^2}$: optimal forecast rule under RE
  - κ_i: potential behavioral distortion, e.g., $\kappa_i > 1$, over-confidence

Regression Coefficient

- Regression coefficient can be expressed as

$$\gamma = \frac{\mathsf{Cov}(r_t, \mathbb{E}_{it}[r_t])}{\mathbb{V}(\mathbb{E}_{it}[r_t])} = \frac{\sigma_r^2}{\sqrt{\sigma_r^2 + \sigma_i^2}} \frac{1}{\sqrt{\mathbb{V}(\kappa_i g_i x_{it})}}$$

- Interpretation 1: common information quality σ_i^2 but heterogeneous κ_i
  - higher γ implies smaller forecast volatility or smaller κ_i
  - behavioral distortion: under-confidence, level-k thinking, cognitive discounting
- Interpretation 2: common κ_i but heterogeneous information quality σ_i^2
  - γ is constant: variations in σ_i^2 and g_i cancel out each other
  - regression may not be able to capture variations in info quality
- Alternative: regress expectations against realizations
  - regression coefficient directly corresponds to the responsiveness $\kappa_i g_i$

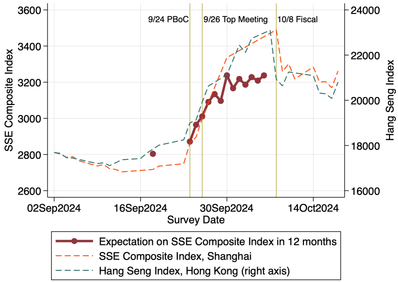
Comment 2: Structured Beliefs and Mapping from Policy to Price

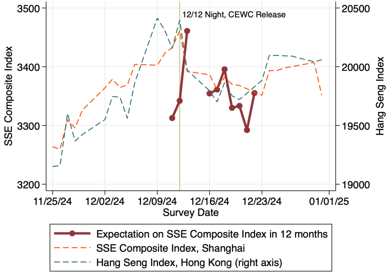
- Challenges for investors given they hold CCP belief
  - demanding to forecast the magnitude of the policy intervention
  - demanding to evaluate the impact of the policy intervention
  - the mapping from policy and states to prices can be complicated

- To overcome the challenges requires knowledge about other participants
  - implication of GE and structured beliefs
  - outcomes depend on beliefs of CCP fund, non-CCP fund, consumers, firms
  - effective government-centric channel needs sufficient belief synchronization
  - empirical question on the degree of belief dispersion

- A case study to shed light on these aspects

Recent Intervention Cases

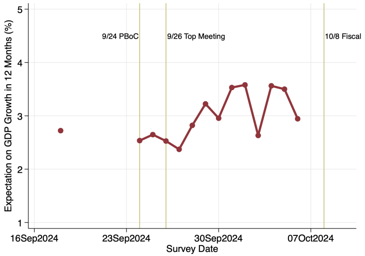


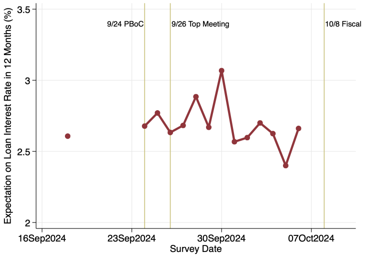


- Two stimulating policy announcements achieved very different outcomes
- May not be easy to establish the mapping from policy to price

Evidence from Online Survey on Micro-and-Small Enterprises

- Based on preliminary work (Huo, Song, Yang, and Zhang, 2024)





- Impact of policy: improved beliefs on GDP but less clear on interest rate
- Response of firms' beliefs may differ from textbooks and fund investors
- To which extent do CCP investors internalize these when forming beliefs?

Comment 3: Investment Strategy of CCP Investors

- To explain CCP funds' performance, paper focuses on improved expectations
- What about CCP investors' investment strategies?
  - e.g., do their portfolios concentrate more on policy-sensitive industries?
  - e.g., do their excess returns mostly materialize during business downturns?
  - bottom line: whether strategies are consistent with government-centric beliefs
- Useful to consider some event studies
  - do CCP investors perform better around the government intervention window?
  - do non-CCP investors switch to CCP investors after salient intervention?