The Market for Inflation Risk

Bahaj, Czech, Ding, and Reis

Discussion – SoFiE Seminar – October 2023

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Plan

1 Summary

2 Identification

3 Looking at outcomes

This Paper

Understand the market for inflation risk

- Who are the market participants?
- What drives prices?
- How do prices respond to shocks: fundamentals (inflation) or others (market structure)?

Are markets for inflation risk a reliable measure of inflation?

- Use the market structure of UK inflation swaps to isolate fundamental shocks
- Fundamentals are mostly present on long term expectations (LT swaps)

The Next Generation

Using high-frequency finance data

- Using high-frequency data to identify key macroeconomic shocks: *monetary policy*
  - Kuttner, Nakamura-Steinsson
- This paper: the next generation of data for macroeconomic models ...
- ... beyond monetary policy shocks
- Identify inflation expectations at high frequency using the structure of the swap market

Useful for academics and policy

- Clean measures of inflation expectations ...
- ... but also clean responses of expectations to shocks

The role of inflation expectations

Measuring inflation expectations is at the core of monetary policy

- The importance of anchoring for monetary policy
- Forward guidance (short and long run expectations)
- New-Keynesian models (e.g. three equation) lean on expectations of inflation

Two Sides of the Problem

The easy case of small idiosyncratic prediction markets

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Attendees listening to a talk at Manifest, a conference about prediction markets last month in Berkeley, Calif. Jason Henry for The New York Times

THE SHIFT

The Wager That Betting Can Change the World

A coterie of tech insiders believe that "prediction markets" can fix social ills. Are they right?

The basic idea behind Manifold Markets and similar platforms, such as Kalshi and Polymarket, goes like this: Markets aggregate information. The more information they aggregate, the more accurate they tend to be. And if enough people make enough bets, with enough information behind them, markets can tell you something useful about the future.

Most of us accept this principle when it comes to investing. If the price of Apple stock rises 10 percent one day, or falls 20 percent the next, we assume that it's because smart investors with access to good information have changed their minds about the company's prospects, and that it's not just a random blip.

Research has also shown that betting markets on election outcomes can be more accurate than polls. (Although their recent record has been more mixed.)

But how would markets do at predicting other things? Could you, say, figure out whether Taylor Swift's next tour will sell more tickets than her last one not by

Two Sides of the Problem

The easy case of small idiosyncratic prediction markets

- Idiosyncratic bets on smaller markets
- Prediction markets are "clean"
  - Less likely to be affected by liquidity or hedging motives

Two Sides of the Problem

The complicated case of "Ready-to-Eat Cereal Industry"

- How we interpret movements in prices depend on the market structure
- Prices of cereals go up
  - Taste shock (cereals taste better): shock on demand, increase in p and q
  - Grain prices go up: shock on supply, increase in p and decrease in q
- Changes in quantities and prices depend on both structure of demand (substitution) and the supply (competition)

Two Sides of the Problem

This paper

- Market for inflation swap is driven by fundamentals (inflation expectations) ...
- ... and participants own preferences through hedging motives, liquidity etc.
- Structure of the market makes it closer to cereals than pure prediction markets

How do we sort fundamentals from other trading motives

- Use the structure of the market across short and long run swaps
- Impose some structural restrictions on the shocks that affect market participants

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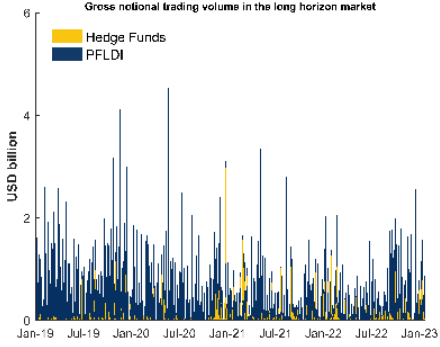
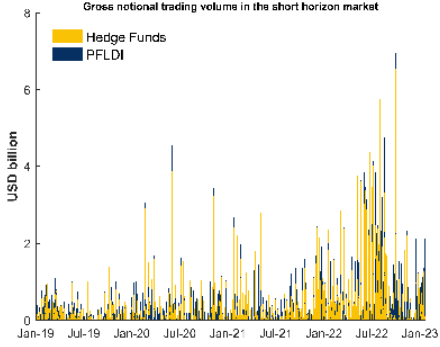
The structure of ST and LT inflation swap market

Figure 7 MARKET SEGMENTATION AT HIGHER FREQUENCIES





Using market segmentation to infer the fundamental shock

Segmented markets

- Hedge funds (HF) trade on the short end while pension funds (PF) trade the long end
- With only one market, two agents (buyer and seller)
  - Three shocks to estimate (two demand shocks and a fundamental)
  - Two observables (price and quantities)
- With two markets and three agents: four shocks, four observables
  - Identification relies on the differential role played by dealer banks in response to fundamentals
  - Demand (HF) dominates the short end: higher prices and quantities
  - Supply (Banks) dominates the long end: higher prices, lower quantities

Using sign restrictions

$$\mathbf{Y} = \Psi\varepsilon = \begin{pmatrix} q_{ST} \\ p_{ST} \\ q_{LT} \\ p_{LT} \end{pmatrix} = \begin{pmatrix} + & 0 & - & + \\ + & 0 & + & + \\ 0 & + & - & - \\ 0 & + & + & + \end{pmatrix} \begin{pmatrix} \varepsilon_{HF} \\ \varepsilon_{PF} \\ \varepsilon_{Banks} \\ \varepsilon_{\pi} \end{pmatrix}$$

- Use priors the structure of the market
- No structure on the magnitude of the effects
  - How do the demand curves of HF and PF move?
  - Do banks operate with same supply curves on both ST and LT markets?

Using sign restrictions

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Issues with sign restrictions for magnitudes

- Consider unit demand and price on both markets, $Y = [1, 1, 1, 1]^T$
- We consider the two following transmission matrices

$$\Psi_1 = \begin{pmatrix} 1 & 0 & -1 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & -1 & -1 \\ 0 & 1 & 1 & 1 \end{pmatrix}, \qquad \Psi_2 = \begin{pmatrix} 1 & 0 & -1 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & -1 & -1 \\ 0 & 0.5 & 1 & 1 \end{pmatrix},$$

Using sign restrictions

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- Inverting the system

$$\epsilon_1 = \Psi_1^{-1} Y = [1, 1, 0, 0]^T$$
$$\epsilon_2 = \Psi_2^{-1} Y = [2/3, 4/3, 0, 1/3]^T$$

Using sign restrictions

Evidence for the ex-ante sign restrictions

- No leakages: desk separation for the dealer (who are trading in both markets)
- Hedge fund trade *mostly* the short-end
  - No arbitrageurs along the curve
  - If spread between short and long end gets too wide, is there no one to step in?
- Assumptions that hedge funds "front-run" banks on information
  - Banks have access to centrally-cleared market and observe flows from diverse part of market

Using cross-sectional granularity

Controlling for things...

- Extract idiosyncratic shocks on market participants ($\varepsilon_{PF}^{(idio)}, \varepsilon_{HF}^{(idio)}, \varepsilon_{B}^{(idio)}$)
- Control for flexible factors and heterogeneous loadings

$$\tilde{q}_{fi,t} = \omega_{fi,t}^{T} F_t + \tilde{\varepsilon}_{fi,t}$$

- Enough instruments to identify simultaneous equation model ($N-1$)

- What are the factors?
  - Does it match the interpretation of the model into liquidity and fundamental?
  - Future research to link heterogeneity in loadings to fund characteristics.

The problem with GIV

- Idiosyncratic shocks to large participants show up as aggregate for others?
- If shocks of Barclays large enough to be relevant, how can we exclude them from other participants response.

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Outcomes

What to do with the shocks

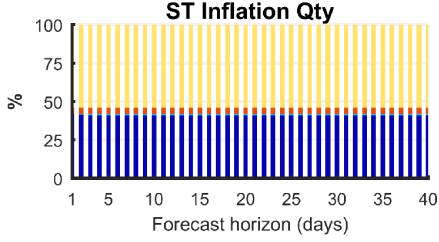
- Expectations
  - See where we could have a clean estimate of inflation expectations
  - Produce a clean estimate of inflation expectation!
- Market structure
  - Estimate the response of market participants to non-fundamental shocks

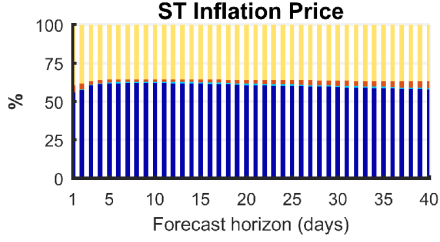
$$\frac{dq}{d\varepsilon_{banks}}, \quad \frac{dq}{d\varepsilon_{HF}}, \quad \frac{dq}{d\varepsilon_{PF}}$$

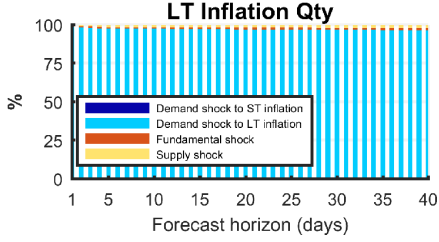
Future work ... monetary policy

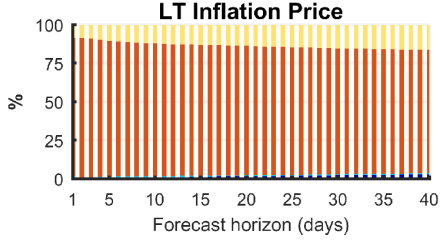
- Response to monetary policy shocks (can also be measured at high frequency!)
- Short and long run response
- Effectiveness of forward guidance

Forecasting

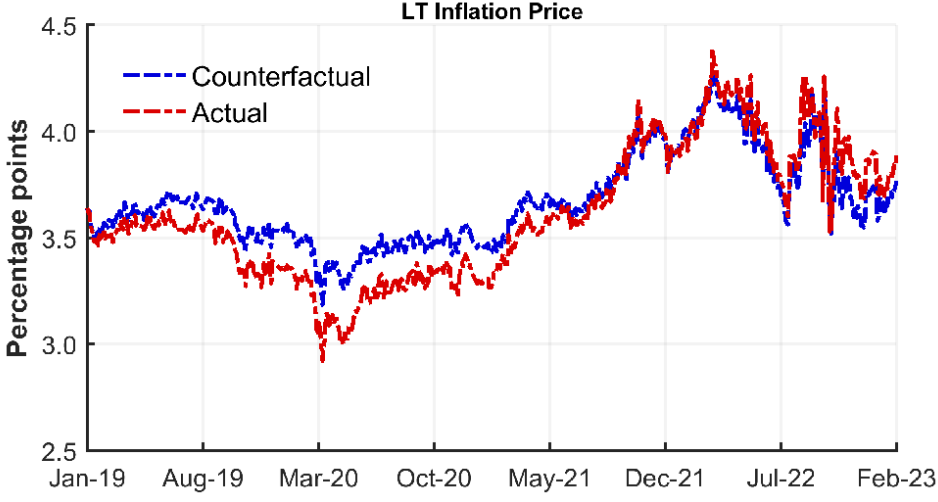






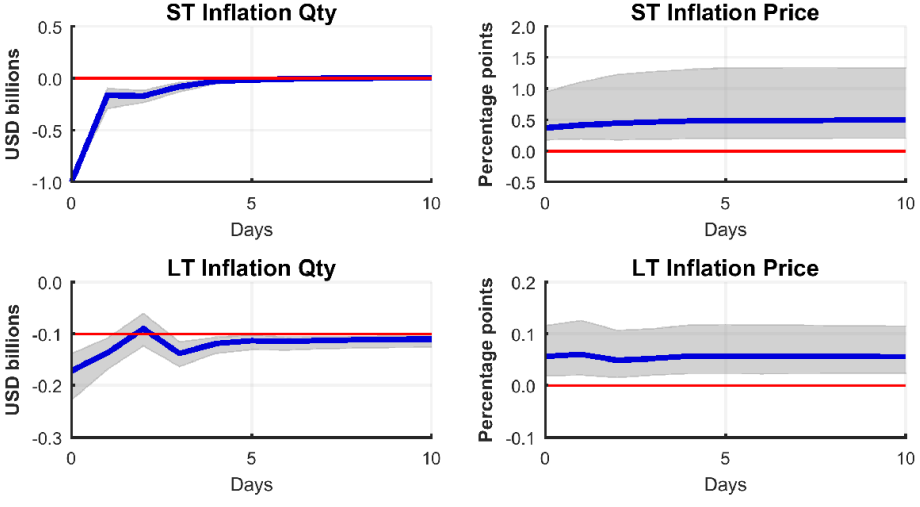


Forecasting



Market structure

(i) Dealer Supply Shock ($\varepsilon_{b,t}$)



Market structure

Why are we interested?

- Illustrate some of the market segmentation assumptions
- Backout demand elasticities on each market

Understand the market structures.

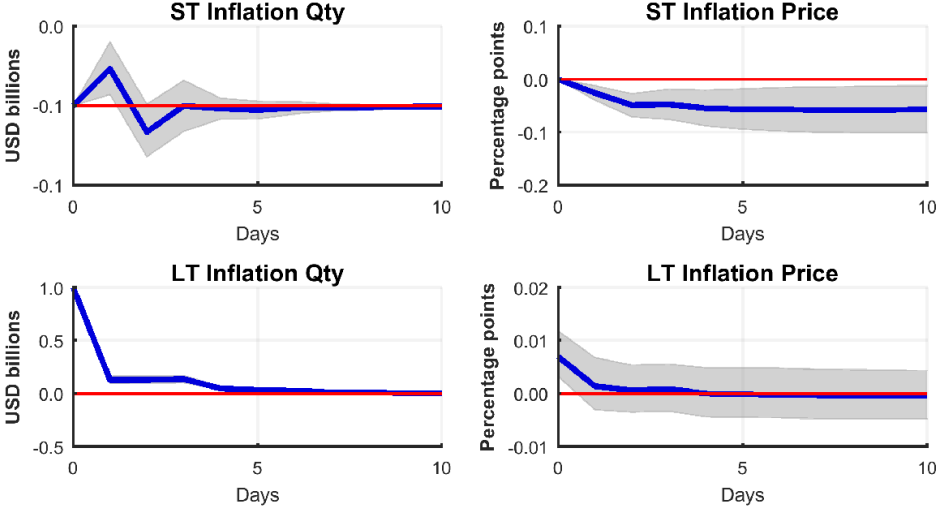
- Response to various shocks highlight some of the frictions
- Who should be arbitraging the curve
- Example: the response to pension funds demand
  - High-frequency response is local, while it spills over to other markets after a few days.

Variance of the response.

- Can we infer the variance of the shock from the heterogeneity in the responses
- Link to previous paper ... and dot/fan Fed plots

Market structure

(ii) PFLDI Demand Shock ($\varepsilon_{f,t}$)



Final Thoughts

Take away

- Liquidity mars the information embedded in ST inflation swaps
- Clean measure of inflation fundamentals in LT swaps
- Market structure of "prediction markets" do matter!

Why it is a great paper

- Neat application of demand estimation for a very useful question
- Striking results of market segmentation!