

# Whose Inflation Expectations Best Predict Inflation?

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\*The views expressed herein are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of Cleveland or the Federal Reserve System

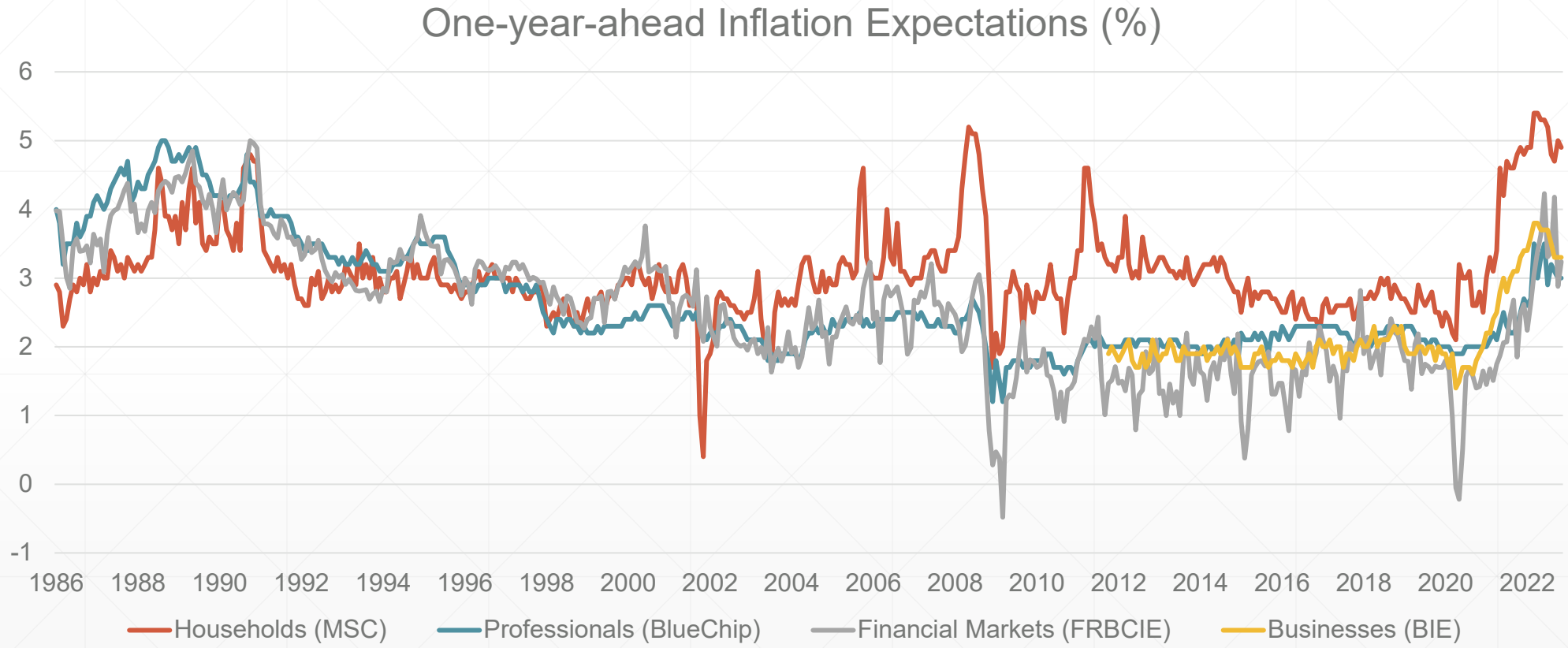
# Motivation

- As the economic recovery began following the COVID-19 pandemic, inflation rebounded quite sharply
  - By June 2021, CPI inflation had increased 5.4% over the previous 12 months
  - Key question at that time: **was this transitory?** Many experts said, yes.
  - Question is still relevant today! (Our research\* suggests that, without a recession, inflation will be well above target at end of 2025)
- Obvious place to search for clues: inflation expectations.
  - Perhaps expectations summarize lots of dispersed, but important, information.
  - Also, people's expectations about future inflation influence their behavior, and hence might shape inflation.
- But there are several measures of expectations, and they don't always agree – and there is no consensus on whose inflation expectations are most important.
- Which one(s) perform the best? (Please don't say, "It depends"!)

*\*Verbrugge and Zaman (2022), The Hard Road to a Soft Landing*

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# Inflation Expectations Measures



Source: Mitchell and Zaman (2022); Blue Chip Economic Indicators data; FRB Atlanta business inflation expectations survey; FRB Cleveland Inflation Expectations; University of Michigan, Surveys of Consumers.

# Four measures of inflation expectations

- Inflation expectations of **households** (MSC)
  - University of Michigan Surveys of Consumers one-year-ahead (median) inflation expectations
- Inflation expectations of **professional economists** (Blue Chip)
  - Blue Chip Economic Indicators one-year-ahead (mean) CPI inflation expectations
- Inflation expectations of **firms** (BIE)
  - Atlanta Fed's business inflation expectations survey: captures expected growth in the production costs of the firm over the next year
- Inflation expectations of **financial markets** (FRBCIE)
  - As captured by the model behind the one-year-ahead Cleveland Fed's inflation expectations series, which uses data on nominal yields from US Treasury securities, survey forecasts, and inflation swap rates

# What we do?

- We examine the predictive relationship of each of these four inflation expectations measures to several measures of inflation
  - CPI and core CPI (as well as median CPI and trimmed-mean CPI)
- In the paper, we consider cross-correlations, in-sample predictive relationship, and out-of-sample forecasting
  - Two sample periods: **1986**-2021, and **2011**-2021
  - Monthly data; 12-month inflation rates
- Today, we'll show in-sample predictive ability, and out-of-sample, and as a bonus, also examine the recent period (2021-2022).
- Preview of results: Professionals and Business Expectations are best, and consumer expectations are worst (*except...*)

# Examining Predictive Relationships (In-Sample)

- Focus on the ability of each inflation expectations measure to predict one-year-ahead inflation, taking sample as a whole
- Specifically, estimate the following regression for various measures of expectations

$$\pi_{t,t+12} = \beta S_t + \delta \pi_{t-12,t} + e_t$$

$\pi_{t,t+12}$  is the year-over-year inflation rate, based on CPI, median CPI, trimmed mean CPI, or core CPI, between time  $t$  and time  $t + 12$

$\pi_{t,t-12}$  is the trailing year-over-year inflation rate, and

$S_t$  represents the inflation expectations measure at time  $t$   
(either the Michigan survey, the Cleveland Fed model, the Atlanta Fed business survey, or Blue Chip)

- If  $S_t$  is a good predictor, then  $\beta$  estimate should be close to +1  
(and  $R^2$  should improve notably)

# In-Sample Predictive Relationships

$$\pi_{t,t+12} = \beta S_t + \delta \pi_{t-12,t} + e_t$$

CPI (+12 months)			Core CPI (+12 months)		
	1986-2021	2011-2021		1986-2021	2011-2021
	Beta	Beta		Beta	Beta
None	--	--	None	--	--
MSC	0.60	0.48	MSC	0.15	0.50
FRBCIE	1.08	0.55	FRBCIE	0.33	-0.01
Blue Chip	1.07	0.77	Blue Chip	0.82	1.55
BIE	--	0.83	BIE	--	1.20

Red box: Notable improvement in R<sup>2</sup>. Highlighted: best R<sup>2</sup> (by a wide margin)

# Out of Sample Forecast Evaluation (“S” alone): CPI and Core CPI

Evaluation Sample: January 1987 – April 2021

<b>RMSE</b>	<b>MSC</b>	<b>FRBCIE</b>	<b>Blue Chip</b>	<b>BIE</b>
CPI	1.48	1.17	1.10	--
Core CPI	1.05	0.61	0.45	--

Evaluation Sample: October 2012 – April 2021

<b>RMSE</b>	<b>MSC</b>	<b>FRBCIE</b>	<b>Blue Chip</b>	<b>BIE</b>
CPI	1.60	0.96	0.93	0.89
Core CPI	1.02	0.61	0.34	0.32



## Out of Sample Forecast Evaluation (“S” alone): Median and Trimmed CPI

Evaluation Sample: January 1987 – April 2021

<b>RMSE</b>	<b>MSC</b>	<b>FRBCIE</b>	<b>Blue Chip</b>	<b>BIE</b>
Median CPI	0.83	0.64	0.49	--
Trimmed CPI	0.96	0.61	0.48	--

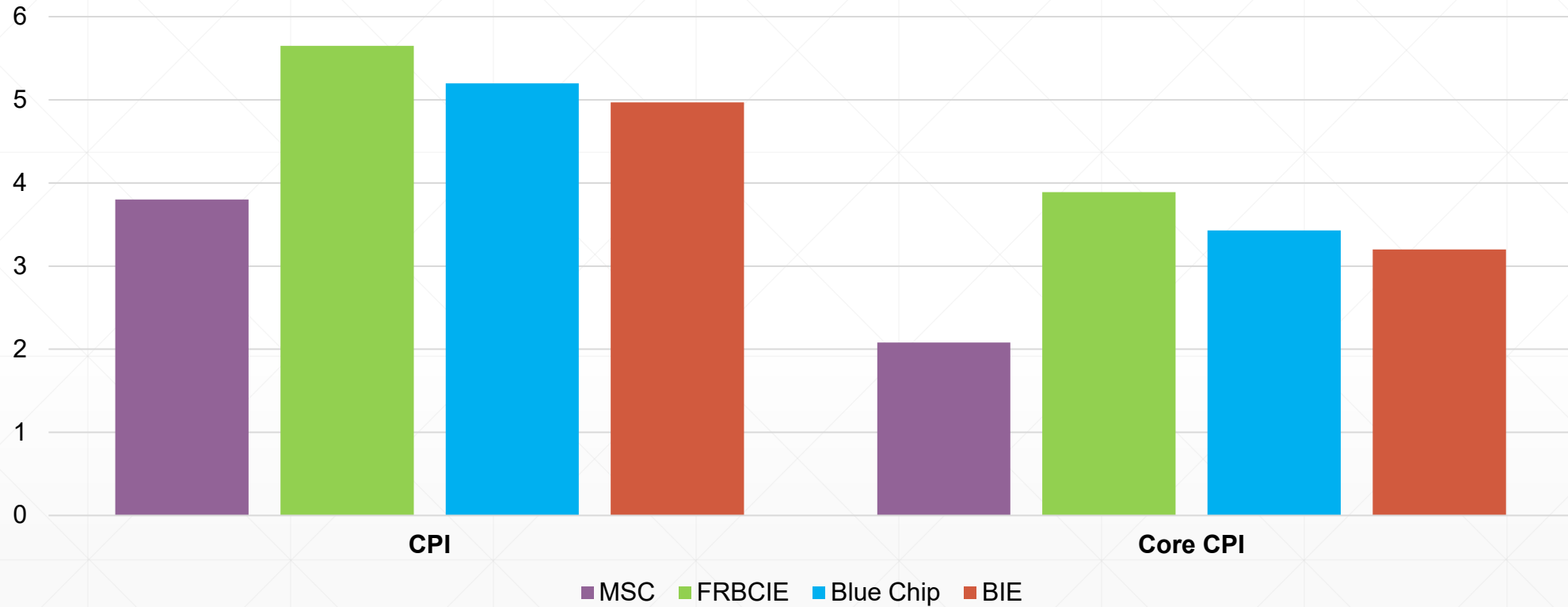
Evaluation Sample: October 2012 – April 2021

<b>RMSE</b>	<b>MSC</b>	<b>FRBCIE</b>	<b>Blue Chip</b>	<b>BIE</b>
Median CPI	0.64	0.88	0.38	0.89
Trimmed CPI	0.97	0.58	0.26	0.27

## However...

- Expectations of consumers are not always worse!
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# RMSE: May 2021 – October 2022



Household expectations of inflation **more** accurate than others over this period!!

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# Why might consumers be more correct recently?

- In the recent past (i.e., the period of significantly elevated inflation), household inflation expectations have consistently outperformed other expectations measures

- This is consistent with the theory of rational inattention:

“When inflation is persistently high, households and businesses must pay close attention and incorporate inflation into their economic decisions. When inflation is low and stable, they are freer to focus their attention elsewhere” - Federal Reserve Chair Jerome Powell (2022 speech at Jackson Hole)

- So higher household attention to inflation is associated with higher ability of household expectations to predict future inflation, and vice versa

- O’Trakoun (2022), Braitsch & Mitchell (2022) provide empirical evidence consumers are attentive now

# Work in progress

Mitchell, James and Saeed Zaman (2022), *The Predictive Content of Inflation Expectations Measures*, Cleveland Fed manuscript in preparation

- Examines the predictive relationship between the **full distribution of future inflation** and various inflation expectations measures
  - Model the full distribution of future inflation as a function of inflation expectations measures (and current inflation)
  - Quantile regression methods (as in Adrian, Boyarchenko, & Giannone, 2019; Lopez-Salido & Loria, 2020; Mitchell, Poon, & Zhou, 2022) that allow for nonlinearities in the predictive relationship

Recall from earlier, the linear regression model:

$$\pi_{t,t+12} = \beta S_t + \delta \pi_{t-12,t} + e_t$$

The quantile regression model:

$$Q_\tau(\pi_{t,t+12} | S_t, \pi_{t-12,t}) = \beta_\tau S_t + \delta_\tau \pi_{t-12,t} + \varepsilon_t$$

- Assess whether the predictive content of expectations measures varies across the inflation distribution
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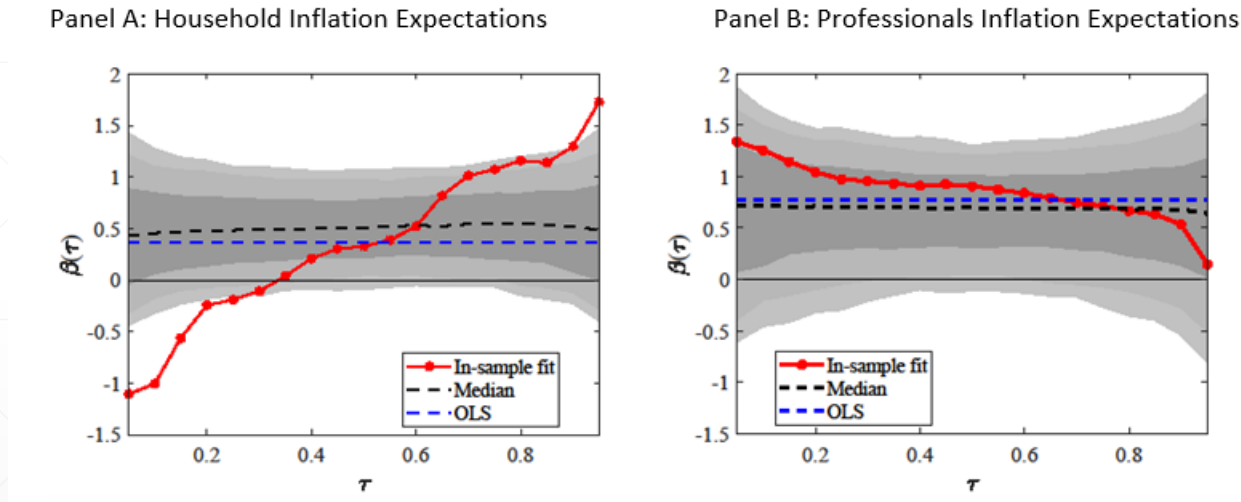
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Mitchell, James and Saeed Zaman (2022), *The Predictive Content of Inflation Expectations Measures*, Cleveland Fed manuscript in preparation

- Preview of selective findings
    - The ability of household expectations to predict future inflation, relative to professionals and the market, increases with inflation, i.e., strong evidence of nonlinear relationship between household expectations and future inflation
      - Consistent with “rational (in)attention”: households find it beneficial to invest more in the construction of their forecasts when inflation is high
    - The joint predictive ability of all three inflation expectations measures (households, markets, and professionals) is greater than the marginal predictive content of individual measures
      - Importance of tracking and *differentially* weighting different agents’ expectations of inflation
      - In other words, all expectations are equal, but some are more equal than others
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# Work in progress

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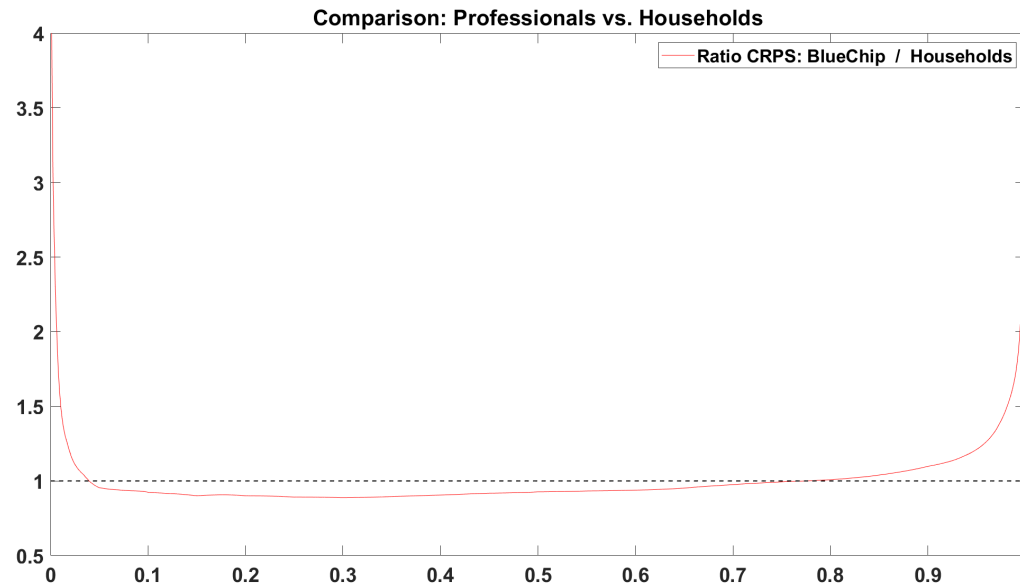


The figure plots the estimated beta coefficients corresponding to quantile regressions of 12-month ahead CPI inflation on current inflation expectations measures (of 12-month ahead inflation).

- Linearity is rejected for household expectations; the regression slopes (i.e., betas) increase dramatically for households as the quantile increases and are statistically different from the OLS slope

# Work in progress

Mitchell, James and Saeed Zaman (2022), *The Predictive Content of Inflation Expectations Measures*, Cleveland Fed manuscript in preparation



- Ratios  $< 1$  indicate that the accuracy of the inflation expectations of professionals are more accurate than households
- For quantiles of inflation below 4% and above 80%, household expectations are more accurate than professionals, but for all other quantiles, professionals are more accurate (evaluation sample: May 2001 through August 2022)



# Summary of the findings

- On average, expectations of professional economists have provided more accurate predictions of CPI inflation one year out compared to households
    - Consistent with Trehan (2015; JMCB), Berge (2018; IJF), and Arouba (2020; JBES)
  - The accuracy of the Atlanta Fed Business survey expectations is comparable to the professional economists
  - However, in the recent period of significantly elevated inflation, household inflation expectations have consistently outperformed other expectations measures
    - In progress work that examines the predictive content of expectations measures across the inflation distribution confirms the superior predictive ability of the household expectations when inflation is very high
    - In assessing the inflationary pressures (probabilistic sense), the preferred approach is to track and combine various agents' expectations but weight them differently; quantile regression is a suitable method for this purpose
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