Inflation Disagreement Weakens the Power of Monetary Policy

Ding Dong (HKBU), Zheng Liu (FRBSF), Pengfei Wang (PHBS) and Min Wei (BOG) [1]

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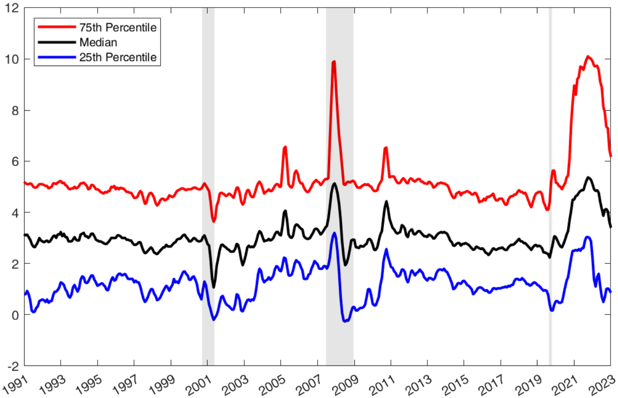
[1] The views expressed herein are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of San Francisco, of the Federal Reserve Board or of the Federal Reserve System.

Motivation

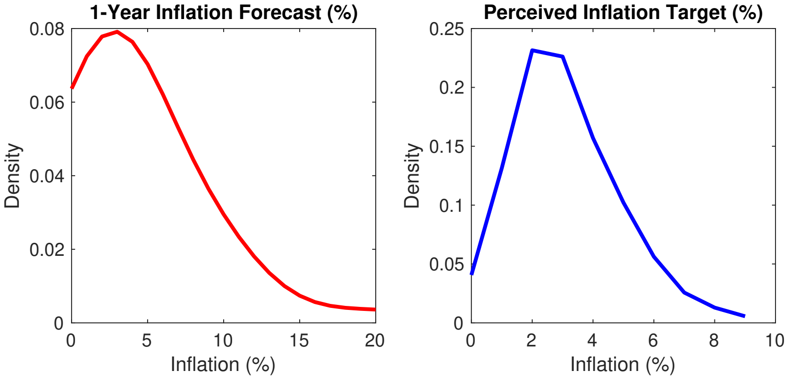
- The importance of consensus inflation expectations for monetary policy transmission has been extensively studied
- Less is known about the role of dispersion of inflation expectations across forecasters (i.e., inflation disagreement)
- This is true despite evidence of pervasive inflation disagreement (e.g., Mankiw,et al, 2003; Weber et al, 2022; Fofana, et al. 2024)

Consumers often disagree on inflation outlooks



Note: One-year ahead inflation expectations from the Michigan Survey of Consumers.

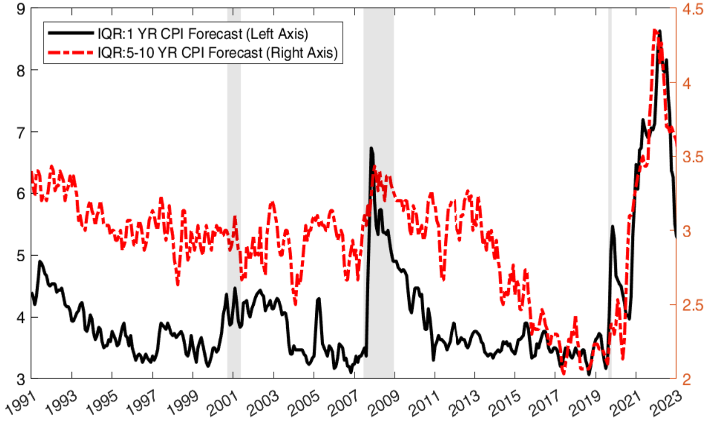
Inflation disagreement can be large...



Source: Michigan Survey (left) and NY Fed Survey of Consumer Expectation (right), June 2023.

Back

...and also time-varying



Source: Michigan Survey of Consumers, 1991:m7-2023:m12.

Research questions

1. How does inflation disagreement affect monetary policy transmission in the data?
   - conventional monetary policy (fed funds rate shock)
   - unconventional policy (forward guidance or FG)

2. Through what channels could inflation disagreement affect monetary policy transmission?

Main findings

- Empirical evidence: inflation disagreement significantly weakens the power of monetary policy (both FG and FFR)

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- Theoretical channels:
  1. Heterogeneous beliefs among consumers about Fed's inflation target
  2. Occasionally binding borrowing constraints

Main findings

- Empirical evidence: inflation disagreement significantly weakens the power of monetary policy (both FG and FFR)
- Theoretical channels:
  1. Heterogeneous beliefs among consumers about Fed's inflation target
  2. Occasionally binding borrowing constraints
- How does the mechanism work?
  1. Agents with higher perceived inflation target have lower perceived real rate and higher MPC
  2. High-MPC agents borrow to consume, subject to borrowing constraints
  3. More dispersed inflation beliefs $\rightarrow$ more constrained agents $\rightarrow$ aggregate C less sensitive to changes in interest rates $\rightarrow$ weaker power of monetary policy

Related literature

- Inflation disagreement: Mankiw et al. (2003); Andrade et al. (2016); Coibion et al. (2020); Ropele et al. (2024); Ahn and Farmer (2024); Fohana et al. (2024); Falck et al. (2021); Barbera et al. (2023)

  Our contribution: How inflation disagreement affects transmission of FG and conventional policy, both empirically and theoretically

- Forward guidance puzzle: Del Negro et al. (2023)
  Previous studies: information frictions (Carlstrom et al 2015; Angeletos and Lian 2018); bounded rationality (Farhi and Werning 2019; Gabaix 2020); imperfect CB communication/credibility (Campbell et al. 2019; Bernanke 2020); precautionary savings in HANK (McKay, et al 2016; Werning 2015)

  Our paper highlights role of belief heterogeneity and borrowing constraints

- Inflation expectations and consumption: Bachmann et al. (2015); D'Acunto et al. (2021); Coibion et al. (2022); Vellekoop and Wiederholt (2019)

  Our model's mechanism consistent with these empirical studies

Empirical evidence

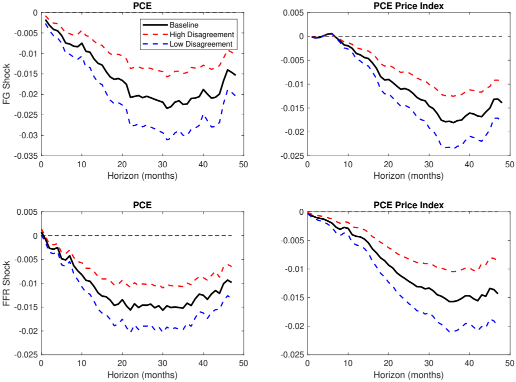
Inflation disagreement and FG transmission

- We estimate a Jorda (2005) LP specification

$$\log(y_{t+h}) - \log(y_{t-1}) = \alpha_0^h + \alpha_1^h MP_t + \alpha_2^h IQR_{t-1}^{\pi} + \alpha_3^h IQR_{t-1}^{\pi} \times MP_t + \alpha_4^h \Gamma_{t-1} + \varepsilon_{t+h}$$

  - Dependent variable: real PCE or PCEPI from t to $t+h$
  - MP_t dnotes FG shock or FFR shock from Swanson (2021) based on high-frequency identification
  - IQR_{t-i}^{π}: IQR of one-year ahead inflation expectations, scaled by the median expectation
  - Γ_{t-1}: macro controls (PCE and IP growth, U3, inflation, and shadow FFR)
- If $sign(\alpha_1) \neq sign(\alpha_3) \rightarrow$ disagreement attenuates effect of MP

Inflation disagreement weakens monetary policy



- At 2-year horizon, one std increase in disagreement (IQR^{π}) reduces impact of FG and FFR on PCE and PCEPI by about 1/3.
- Attenuation effects are statistically significant

Results are robust

- Long-term inflation disagreement (5-10 years expectations)
- Alt measures of real activity (IP or U3) or inflation (CPI)
- Alt measures of inflation disagreement (std/mean of expectations)
- Results not hinged upon specific sources of disagreement (individual experiences or aggregate shocks)
- Additional controls (one at a time, and its interaction with MP):
    1. mean inflation expectations
    2. income growth expectations
    3. Consumer sentiment
    4. Consumption uncertainty
    5. inflation uncertainty
    6. income uncertainty

[See paper for details.]

Theoretical model

A large family framework of heterogeneous beliefs

- Representative family has continuum of ex ante identical members, with ex post idiosyncratic beliefs about inflation target
- In the morning, each member gets lump-sum transfer from family's pooled labor and capital income
- Then, members each draws idiosyncratic belief e_{jt} before dispersing to decentralized markets
- In decentralized markets, members make consumption-saving decisions conditional on their beliefs, subject to borrowing constraints
- At night, all members return to family, pooling consumption risks
- Remark: model structure shares spirit of day-night markets of Lagos and Wright (2005), allowing analytical aggregation

Heterogeneous beliefs about Fed's inflation target

- Monetary policy follows Taylor rule

$$R_{ft} = R_0 \Pi_t^* \left(\frac{\Pi_t}{\Pi_t^*} \right)^{\varphi} \exp(\xi_t), \qquad \varphi > 1,$$

- Inflation target Π_t^* follows random walk process

$$\Pi_{t+1}^* = \Pi_t^* \exp(\varepsilon_{t+1}),$$

where ε_{t+1} is i.i.d. (constant target: $\varepsilon = 0$)

- Consumers have heterogeneous beliefs about ε_{t+1}

$$E_t^j \frac{\Pi_{t+1}^*}{\Pi_t^*} = e_{jt}, \quad j \in [0, 1]$$

where e is i.i.d. with CDF $G(e)$ [helps aggregation]

- Model feature captures inflation disagreement in reality

Household family

- The family utility function

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\int_0^1 \log C_{jt} dj - \psi \frac{N_t^{1+\gamma}}{1+\gamma} \right]$$

- Family budget constraint

$$A_t \leq \frac{\int_0^1 B_{jt} dj}{P_t} + \frac{W_t}{P_t} N_t + D_t,$$

where net worth A_t is transferred to all members

- Flow-of-funds constraint for member j in decentralized markets

$$C_{jt} + \frac{B_{jt+1} / R_{ft}}{P_t} \leq A_t$$

- Borrowing constraint for member j in decentralized markets

$$\frac{B_{jt+1} / R_{ft}}{P_t} \geq -\bar{B}$$

Euler equations

- Intertemporal Euler equation for agent with belief e_{jt}

$$\Lambda_{jt} = \beta R_{ft} \mathbb{E}_t^j \frac{\Lambda_{t+1}}{\Pi_{t+1}} + \Omega_{jt},$$

where $\Omega_{jt} > 0$ iff borrowing constraint is binding $\rightarrow$ constrained agents have high MPC

- Integrating out i.i.d. beliefs to obtain

$$\Lambda_{jt} = \beta r_{ft} \mathbb{E}_t^j \left[\frac{\Lambda_{t+1}}{\pi_{t+1}} \frac{\Pi_t^*}{\Pi_{t+1}^*} \right] + \Omega_{jt} \equiv \beta r_{ft} \frac{1}{e_{jt}} \mathbb{E}_t \left[\frac{\Lambda_{t+1}}{\pi_{t+1}} \right] + \Omega_{jt},$$

where $r_{ft} \equiv R_{ft}/\Pi_t^*$ and $\pi_t \equiv \Pi_t/\Pi_t^*$ denote nominal interest rate and inflation, both normalized by inflation target

Decentralized consumption-saving decisions

- Agents expecting high inflation borrow to consume; others save
- $\exists$ marginal agent with e_t^*, indiff b/n borrowing or saving $(\Omega(e_t^*) = 0)$
- Euler equation for marginal agent with belief e^*

$$\frac{1}{\bar{C}_t} = \beta r_{ft} \frac{1}{e_t^*} \mathbb{E}_t \left[\frac{\Lambda_{t+1}}{\pi_{t+1}} \right],$$

where $\bar{C}_t = A_t + \bar{B}$ is max attainable consumption

- Consumption decision rule

$$C_{jt} = \begin{cases} \bar{C}_t, & \text{for } e_{jt} > e_t^* \\ \frac{e_{jt}}{e_t^*} \bar{C}_t, & \text{for } e_{jt} \leq e_t^* \end{cases},$$

Belief heterogeneity attenuates power of FG

- Log-linearized Euler equation

$$\hat{C}_t = \underbrace{\frac{\mu + (1-\theta)\kappa}{\mu+\kappa}}_{\equiv \beta_1} \mathbb{E}_t \hat{C}_{t+1} - \underbrace{\frac{(1+\kappa)\mu}{\mu+\kappa}}_{\equiv \beta_2} \left(\hat{r}_{ft} - \mathbf{E}_t \hat{\pi}_{t+1}\right),$$

where $\theta \in [0,1)$ and $\mu \in (0,1]$ are functions of belief distribution and SS e^*; $\kappa \equiv \frac{\bar{B}}{C} \in (0,1)$ is SS leverage

- RE special case: no disagreement $\Rightarrow \theta = 0$ and $\mu = 1 \Rightarrow$ $\beta_1 = \beta_2 = 1$
- In general, with disagreement, $\theta > 0$ and $\mu < 1 \Rightarrow \beta_1 < 1, \beta_2 < 1$

Proposition 1

Belief heterogeneity implies $\theta > 0$ and $\mu < 1$, such that $\beta_1 < 1$, attenuating effects of FG on C_t relative to standard NK model

Belief heterogeneity attenuates power of FFR

$$\hat{C}_t = \underbrace{\frac{\mu + (1-\theta)\kappa}{\mu + \kappa}}_{\equiv \beta_1} \mathbb{E}_t \hat{C}_{t+1} - \underbrace{\frac{(1+\kappa)\mu}{\mu + \kappa}}_{\equiv \beta_2} (\hat{r}_{ft} - \mathbf{E}_t \hat{\pi}_{t+1}),$$

Proposition 2

Belief heterogeneity implies $\mu < 1$, such that $\beta_2 < 1$, attenuating effects of FFR shock on C_t relative to standard NK model

More dispersed beliefs lead to greater attenuation

- Consider Pareto distribution of beliefs

$$G(e) = \begin{cases} 1 - \left(\frac{e_{min}}{e}\right)^{\alpha} & \text{if } e \geq e_{min} \\ 0 & \text{if } e < e_{min} \end{cases}$$

where $e_{min} = \frac{\alpha-1}{\alpha}$ such that $E(e) = 1$

- Smaller α means greater dispersion of beliefs

Proposition 3

Under Pareto distribution, β_1 and β_2 both increase with α and thus decrease with belief dispersion

Belief heter. also attenuates effects of policy on inflation

Proposition 4

Belief heterogeneity attenuates effects of monetary policy on inflation

Intuition:

- Belief heterogeneity reduce sensitivity of output gap to policy shocks $\rightarrow$ inflation also less responsive through Phillips curve

Intuition

- Agents with higher belief e_{jt} expect higher future inflation, resulting in lower perceived real interest rate and higher MPC
- High MPC agents borrow to consume, subject to binding borrowing constraints
- More dispersed inflation beliefs lead to larger share of constrained agents, muting effects of FG or MP on aggregate C_t
- *Remark:* more dispersed beliefs also lead to larger share of low-MPC agents (savers), but that won't hamper aggregate C adjustment because savers are unconstrained
- Since disagreement lowers sensitivity of C to policy shocks, it also lowers sensitivity of inflation through Phillips curve
- Model implications are in line with empirical evidence

Supporting Evidence

Model mechanism supported by empirical evidence

- Model mechanism implies consumers with higher inflation expectations are more willing to spend
- This implication is supported by empirical studies
    1. D'Acunto, Hoang, Webber (2021): pre-announced German VAT increases raised consumers' inflation expectations $\rightarrow$ immediate increase in consumers' readiness to buy durable goods.
    2. Coibion, Gorodnichenko, Weber (2022): higher π^e from randomized information treatment on US households leads to more spending on non-durables over next 6 months
    3. Vellekoop and Wiederholt (2019): Dutch households with higher inflation expectations more likely to buy durables

Model mechanism supported by empirical evidence

- Model implies consumers with higher inflation expectations are also more likely to face binding borrowing constraints
- Supporting evidence from Survey of Consumer Expectations:

Dep. Var.	(1) Willing to Increase Spending	(2) Harder Credit Access Current period	(3) Harder Credit Access Next 12 months
Exp_Inflation	0.084***	0.003***	0.006***
	(0.017)	(0.001)	(0.001)
Income	-0.081	-0.011***	-0.014***
	(0.137)	(0.004)	(0.004)
Exp_IncomeGrowth	0.245***	-0.003***	-0.004***
	(0.059)	(0.001)	(0.001)
Employed	2.679***	-0.047	-0.011
	(0.850)	(0.030)	(0.028)
Individual Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Observations	104,626	104,643	104,639
No. of Unique I.D.	15,497	15,501	15,501

Conclusion and policy implications

- Evidence suggests that inflation disagreement weakens the effects of monetary policy on consumption and inflation
- Those observed attenuation effects can be rationalized in a simple theoretical model with belief heterogeneity and borrowing constraints
- Policy implications:
  1. Elevated inflation disagreement in recent years may explain why, despite aggressive tightening, consumption remains resilient and inflation remains stubborn
  2. If inflation disagreement stays elevated, more aggressive easing may be needed to cushion slowdowns in economic activity

Extra Slides

Lemma 1

- Average MU:

$$\Lambda_t \equiv \int_0^1 \Lambda_{jt} dj = \int_{e_t^*} \frac{1}{\bar{C}_t} dG(e) + \int^{e_t^*} \frac{e_t^*}{e} \frac{1}{\bar{C}_t} dG(e)$$

$$= \frac{1}{\bar{C}_t}[1 - G(e_t^*) + \int_{e_{min}}^{e_t^*} \frac{e_t^*}{e} dG(e)] \quad (1)$$

- Relative MU

$$\frac{\Lambda_t}{\Lambda_{jt}^*} \equiv e_t^* F(e_t^*)$$

- Define the (inverse) elasticity of $F()$ w.r.t. e^* as

$$\theta \equiv -\frac{F'(e^*)e^*}{F(e^*)} = \frac{1 - G(e^*)}{1 - G(e^*) + e^* \int_{e_{\min}}^{e^*} \frac{1}{e} dG(e)} \in [0, 1), \quad (2)$$

Lemma 5

Under Pareto distribution of $G(e)$, $\theta \in [0, 1)$ increases with inflation disagreement. $\theta = 0$ if and only if inflation expectation is homogeneous.

back

Lemma 2

- Market clearing condition:

$$Y_t = C_t \equiv \bar{C}_t[1 - G(e_t^*)] + \bar{C}_t \int_{e_{\min}}^{e_t^*} \frac{e}{e_t^*} dG(e)$$

- Relative consumption:

$$\Phi(e_t^*) \equiv \frac{C_t}{\bar{C}_t} \equiv \left[1 - G(e_t^*) + \frac{\int_{e_{\min}}^{e_t^*} edG(e)}{e_t^*} \right]. \quad (3)$$

- Define the (inverse) elasticity of $\Phi()$ to e^* as

$$\mu \equiv -\frac{\Phi'(e^*)e^*}{\Phi(e^*)} = \frac{\int_{e_{\min}}^{e^*} edG(e)}{[1 - G(e^*)]e^* + \int_{e_{\min}}^{e^*} edG(e)} \in (0, 1]. \quad (4)$$

Lemma 6

Under Pareto distribution of $G(e)$, $\mu \in (0, 1]$ decreases with inflation disagreement. $\mu = 1$ if and only if inflation expectation is homogeneous.

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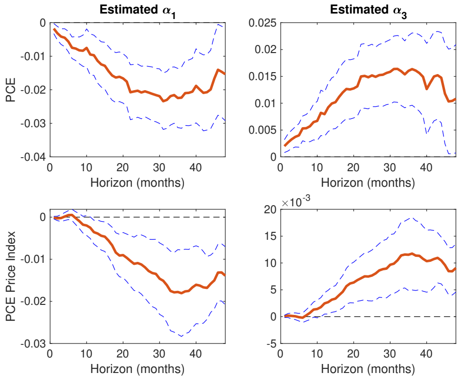
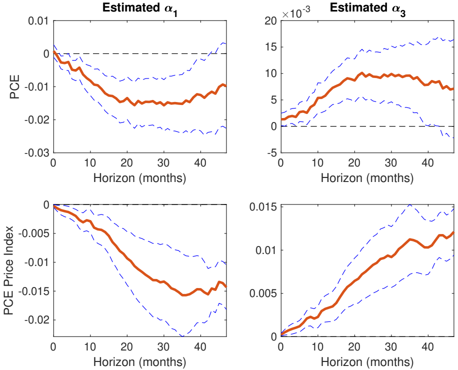
Inflation disagreement weakens forward guidance



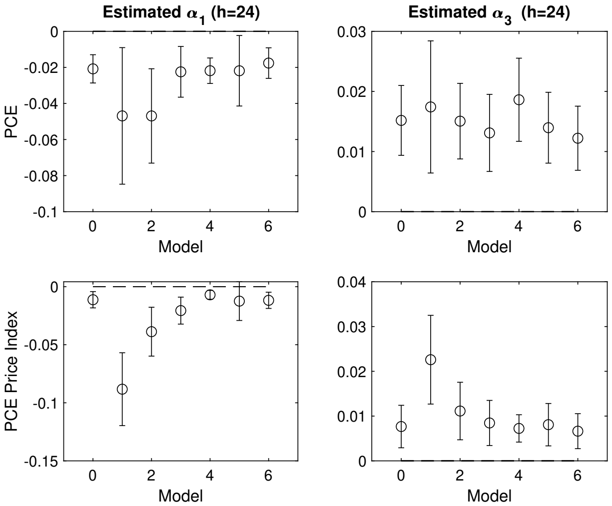
- One std increase in IQR^{π} attenuates responses of both PCE and PCEPI by about 37.5% and 34.4% at 2-year horizon.

Inflation disagreement also weakens conventional policy

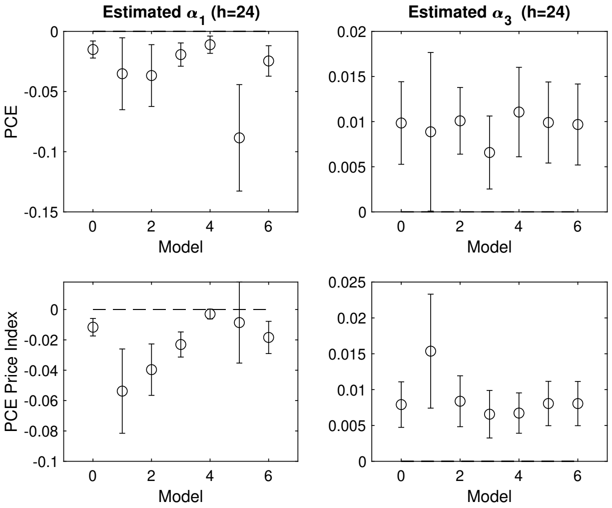


- Estimate similar LP, but with FFR shock (also from Swanson 2021)
- One std increase in IQR^{π} attenuates responses of PCE and PCEPI by 26% and 27%, respectively at 2-year horizon.

Attenuation effects of disagreement on FG shock robust to additional controls



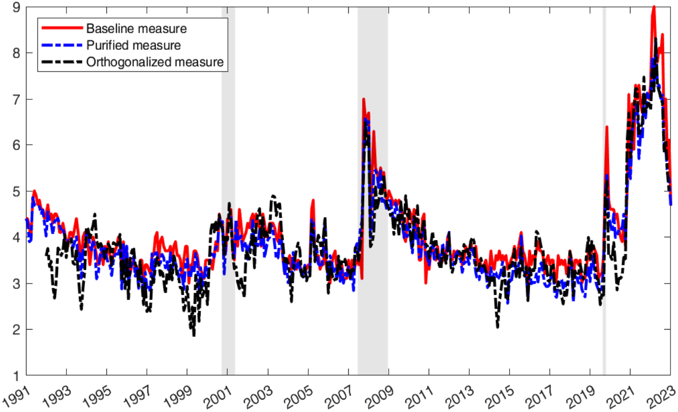
Attenuation effects of disagreement on FFR shock robust to additional controls



Results not hinged upon specific sources of disagreement

- Inflation expectations may be shaped by both individual experiences and aggregate shocks (Malmendier and Nagel, 2016; D'Acunto, et al, 2021)
- Measured disagreement may not reflect exogenous variations in inflation beliefs (Ahn and Farmer, 2024; Fofana, et al 2024)
- We use cross-sectional archives of Michigan Survey to construct an alternative measures of inflation disagreement
  1. Baseline measure: IQR of inflation forecasts
  2. Purified measure: IQR of residuals from regression of inlation forecasts on demographic factors and time fixed effects details
  3. Orthogonalized measure: residuals from regression of purified disagreement on monetary policy shocks and oil supply shocks

Alt measures of inflation disagreement highly correlated



Source: Michigan Survey of Consumers and authors' calculation