THE THIRTIETH DUBROVNIK ECONOMIC CONFERENCE

Organized by the Croatian National Bank

Yuriy Gorodnichenko

# What Do We Know About the Formation of Inflationary Expectations: Surveys and RCTs?

Hotel " Sun Gardens Dubrovnik "

Dubrovnik

June 13 – 15, 2024

Draft version

Please do not quote

CROATIAN NATIONAL BANK

EUROSYSTEM

# WHAT DO WE KNOW ABOUT THE FORMATION OF INFLATIONARY EXPECTATIONS: SURVEYS AND RCTS?

Yuriy Gorodnichenko
UC Berkeley and 

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- Inflation expectations play a central role in almost all key economic decisions
  - Prices and wages (Phillips curve): $\pi_t = E_t\pi_{t+1} + \gamma \times gap_t$
  - Consumption decisions (Euler eqtn): $c_t = E_t c_{t+1} - \sigma[i_t - E_t\pi_{t+1}]$
  - Investment decisions (Tobin's $Q$): $Q_t = MP_K/[i_t - E_t\pi_{t+1} + \delta]$
  - Asset prices: $P_t^{stock} = E_t D_{t+1}/(i_t - E_t\pi_{t+1}) + E_t P_{t+1}^{stock}$
  - Central bank decisions (Taylor rule): $i_t = \varphi_\pi E_t\pi_{t+h} + \varphi_x E_t x_{t+h}$

# HOW DO AGENTS FORM THEIR EXPECTATIONS?

- Frameworks:

- Non-rational expectations (adaptive)

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  - Full-information rational expectations (FIRE)
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# How do agents form their expectations?

- Frameworks:
  - Full-information rational expectations (FIRE)
  - Sticky information
  - Noisy information

  } Rational Expectations models subject to frictions/costs.

  - Bounded rationality
  - Learning

  } Rationality but no knowledge of the economy structure.

  - Non-rational expectations (adaptive)

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- Muth (1961): expectations should be model consistent.
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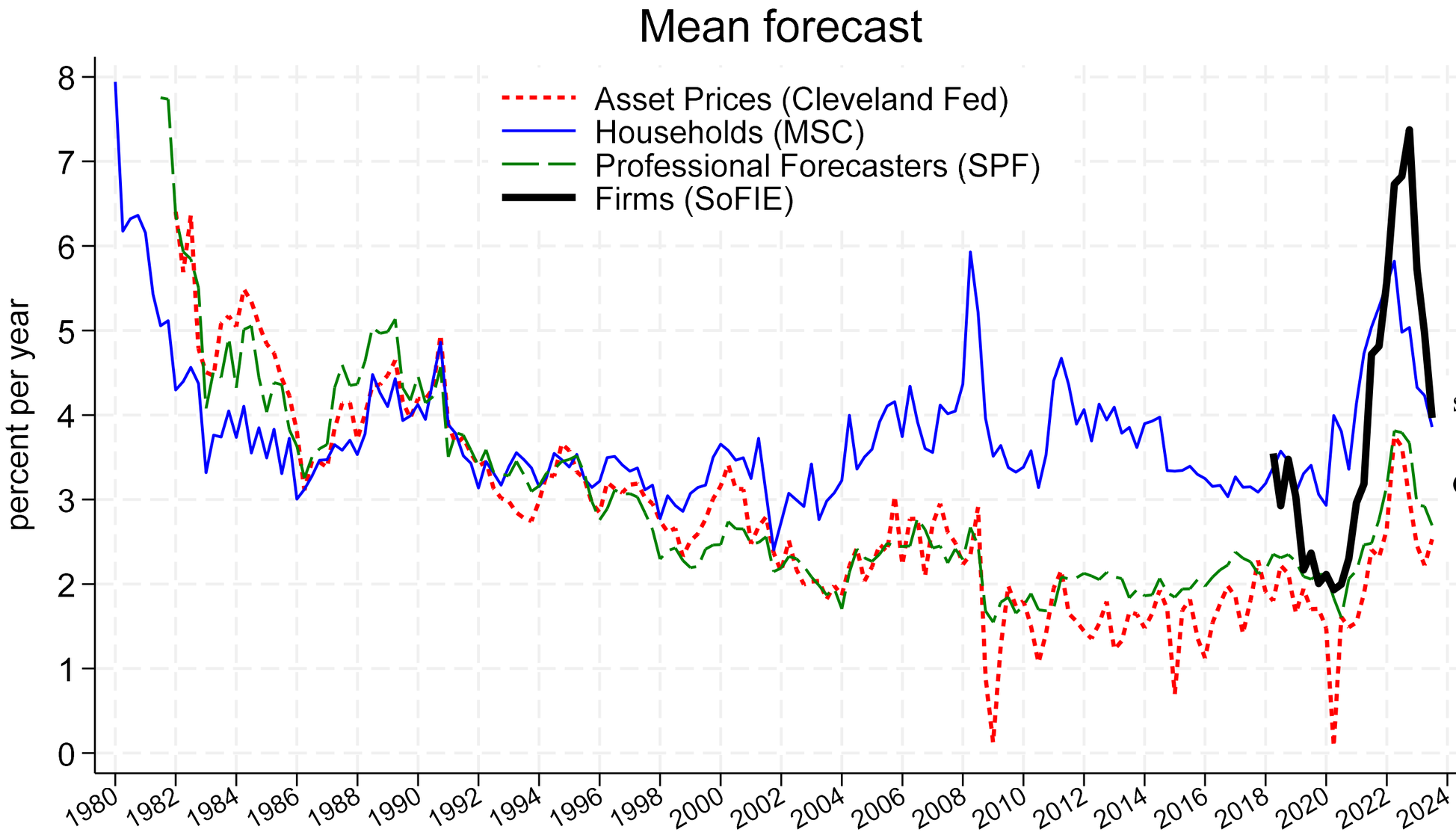
  - Pervasive deviations from FIRE in survey data
  - Enormous heterogeneity in beliefs and interpretations
  - FIRE may be a good proxy in the long run

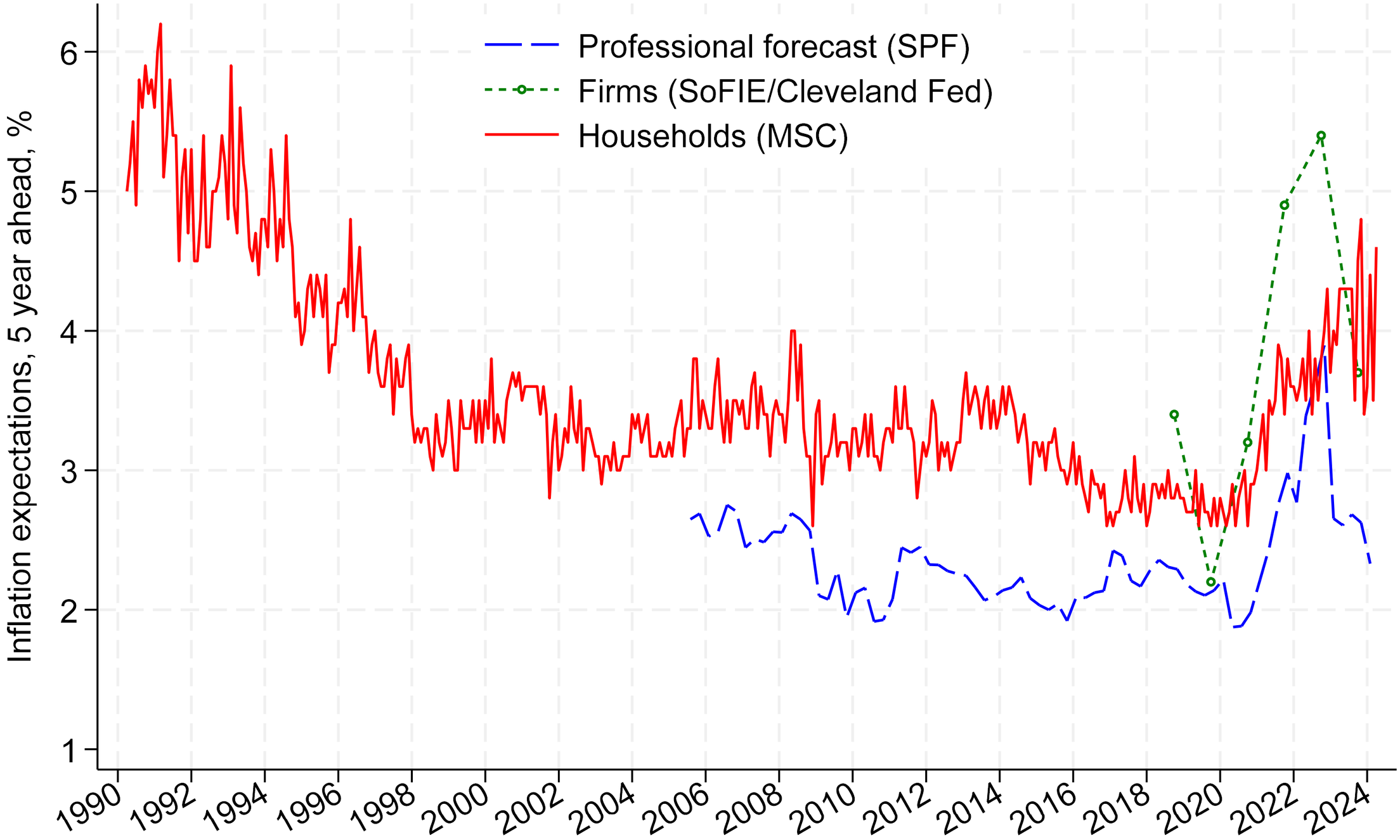
# WHAT DOES THE PUBLIC PREDICT FOR INFLATION?




source: Candia, Coibion, and Gorodnichenko (2021)

Divergence in expectations.

# LONG-TERM INFLATION EXPECTATIONS: TRUST BUT VERIFY



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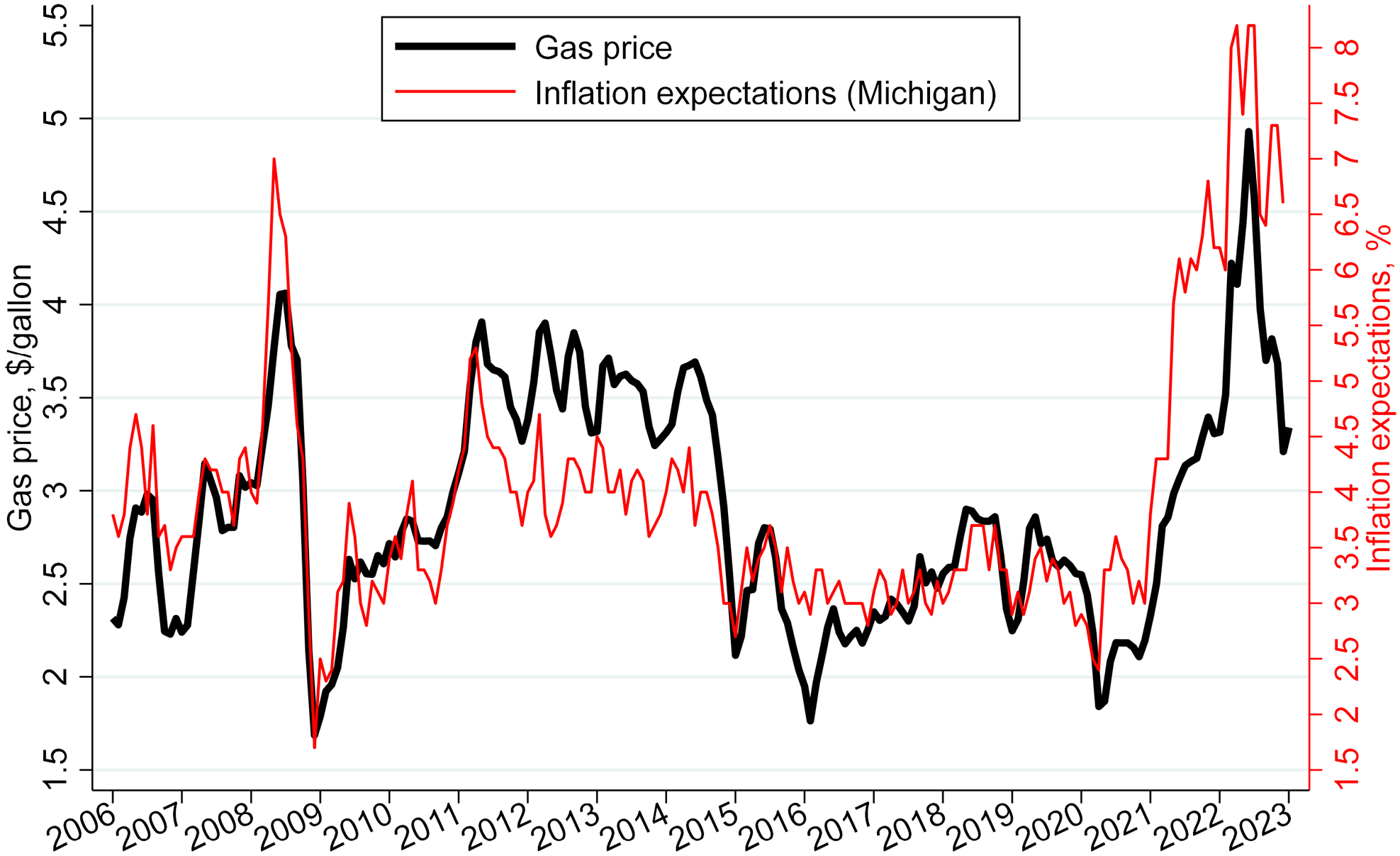
- Pushback to Prescott (Zarnowitz, Lovell, Manski, etc.): one should not discount data even if it's inconsistent with a beautiful theory.

# WHAT FORCES INFLUENCE INFLATION EXPECTATIONS?

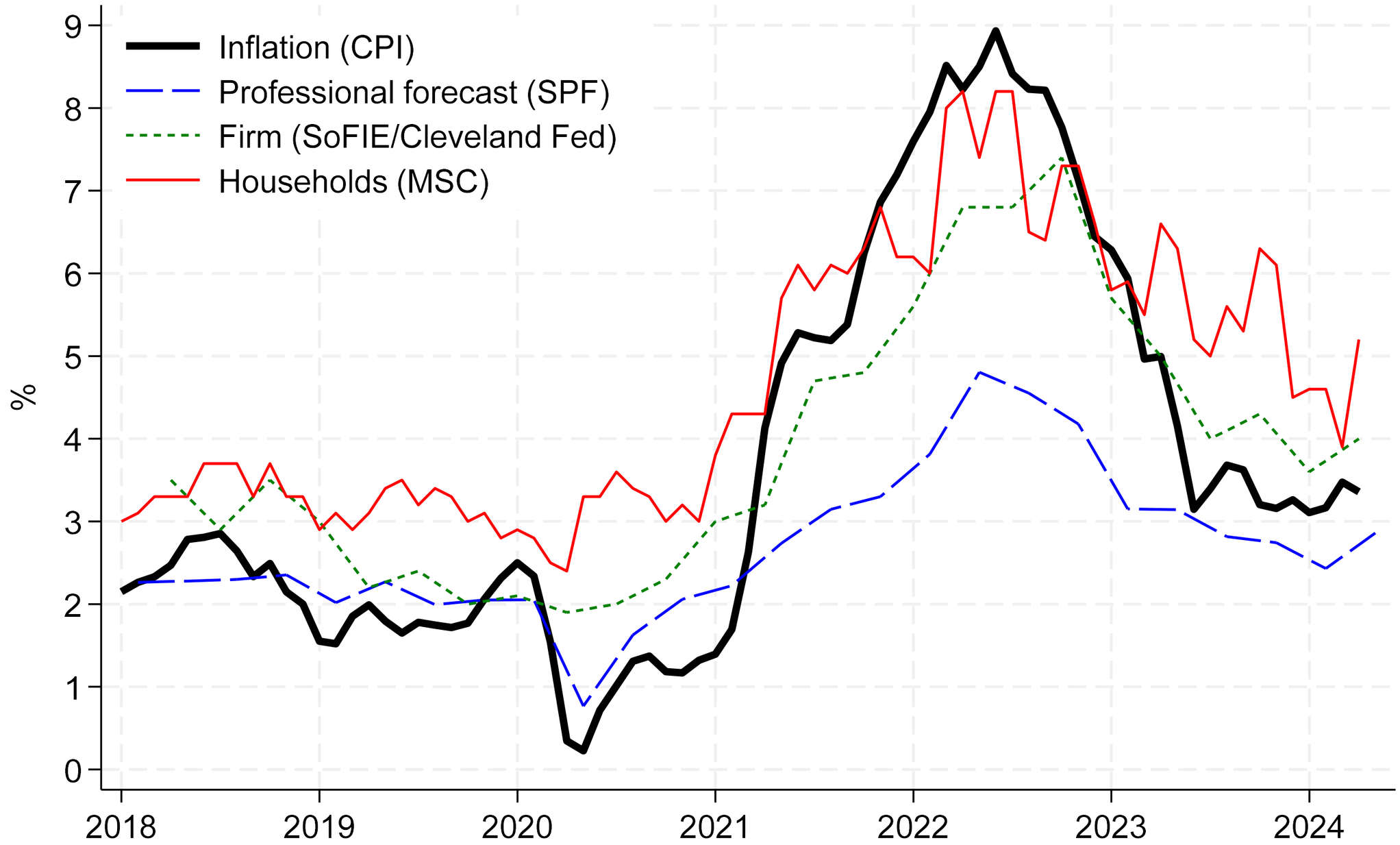
Predictors of inflation expectations in low inflation economies.

- Perceptions of recent inflation (strong)
- Shopping (strong)
- Media (intermediate)
- Policy (weak)
- Incentives (strong)

# Inflation expectations of US households



# POST-COVID INFLATION EXPECTATIONS




Professional forecasts are too anchored

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If expectations are not FIRE, why should central banks care?

# INFLATION EXPECTATIONS ↑ ⟹ STIMULUS

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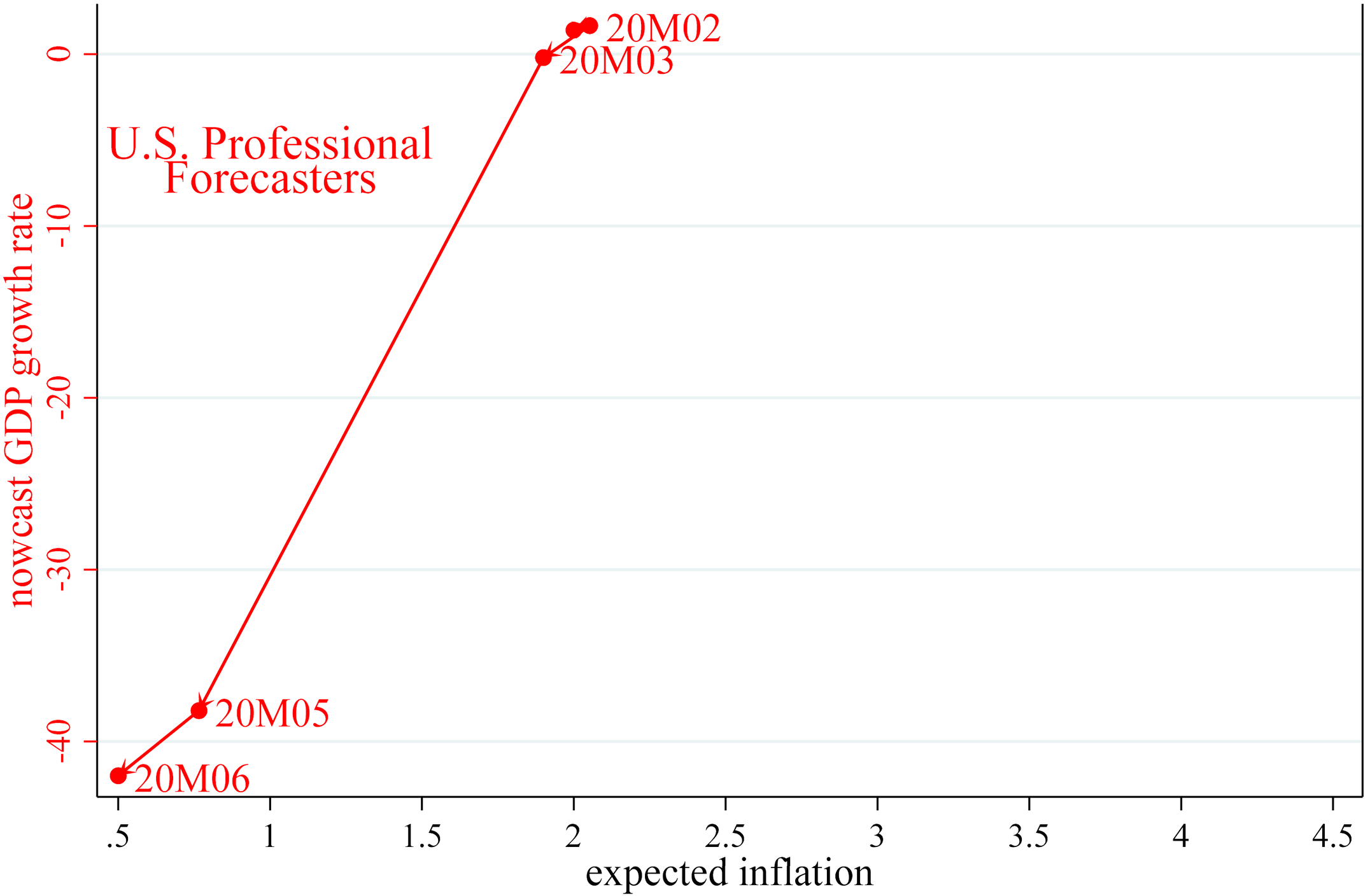
Is this how it works in the data?

Should we raise inflation expectations of households and firms?

Does the public think that inflation is desirable?


20M02
20M03
U.S. Professional
Forecasters
20M05
20M06
0
-10
-20
-30
-40
nowcast GDP growth rate
.5
1
1.5
2
2.5
3
3.5
4
4.5
expected inflation

U.S. Professional Forecasters

U.S. Households

20M02
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0
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current business conditions
.5
0
-.5
-1

.5
1
1.5
2
2.5
3
3.5
4
4.5
expected inflation

U.S. households

Saving rate

Expected inflation

Expected inflation, percent

Increased personal savings, share, %

10
8
6
4
2

50
45
40
35

10/3
24/3
07/4
21/4
05/5
19/5
02/6
16/6
30/6
14/7

Source: Cleveland Fed

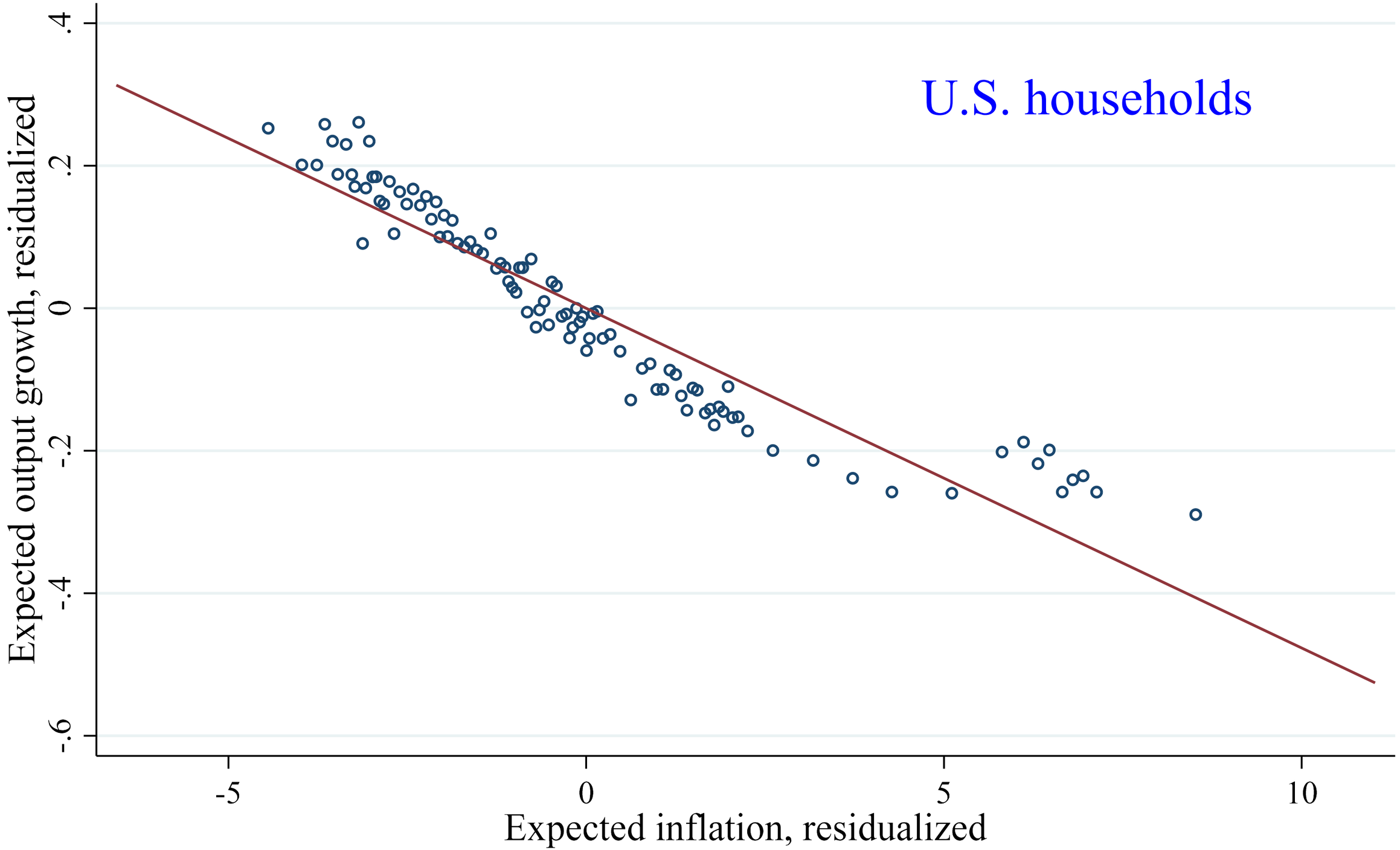
U.S. professional forecasters

Expected output growth, residualized

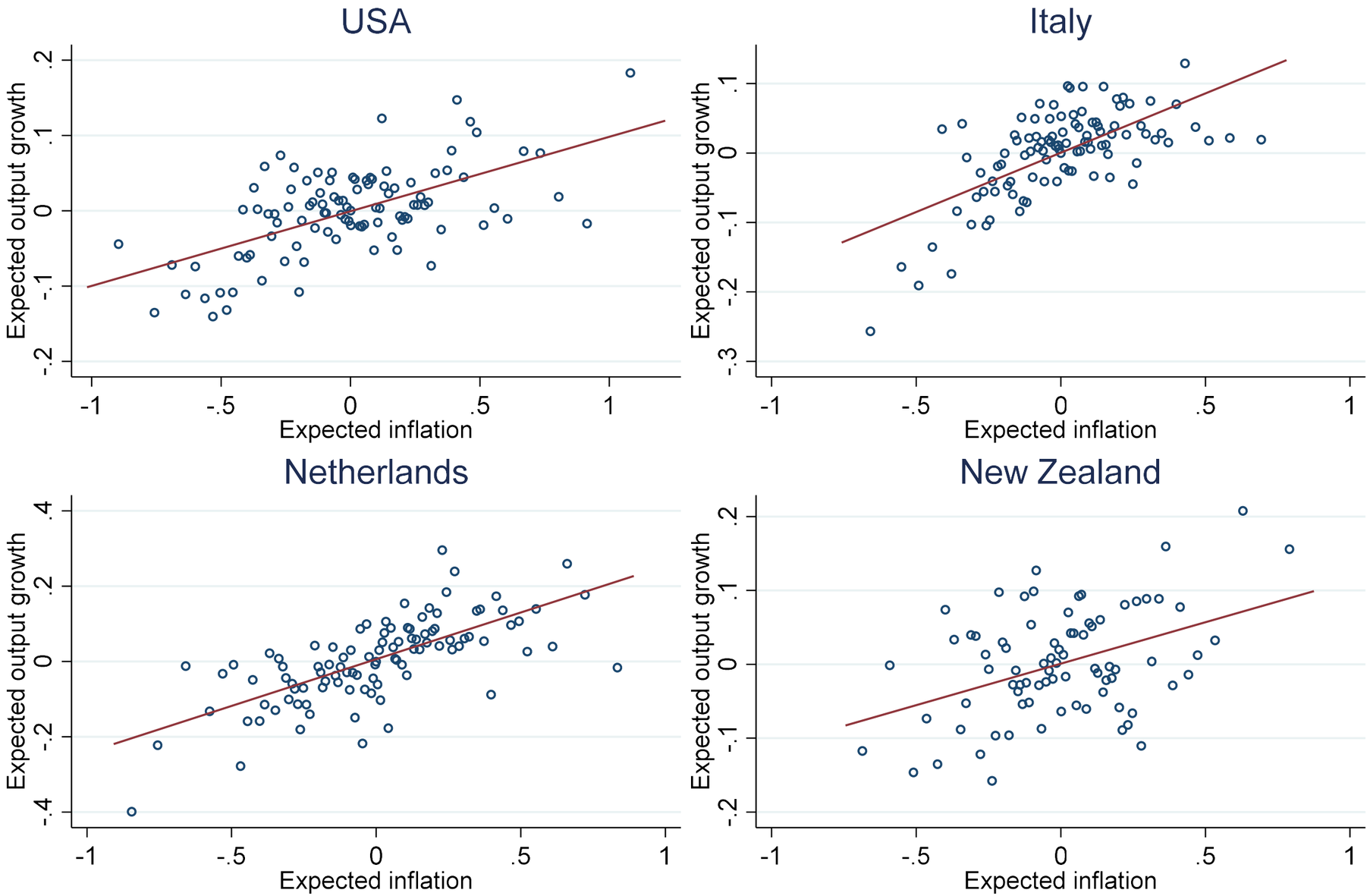
.2
.1
0
-.1
-.2

-1
-.5
0
.5
1

Expected inflation, residualized

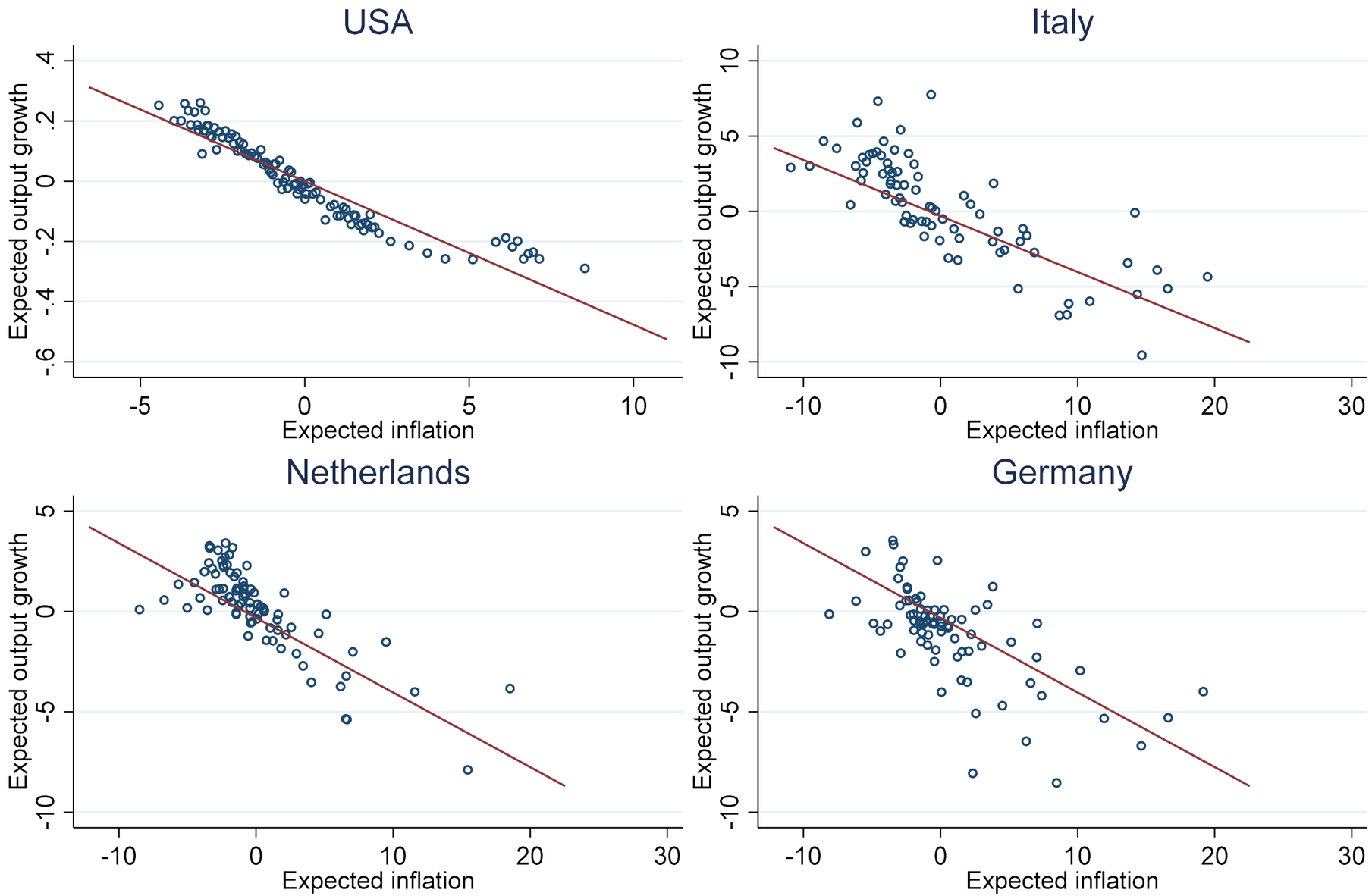

U.S. households
Expected output growth, residualized
.4
.2
0
-.2
-.4
-.6
-5
0
5
10
Expected inflation, residualized

# EXPECTED INFLATION AND OUTPUT: PROF. FORECASTERS




Demand-driven business cycles and a Phillips curve

# EXPECTED INFLATION AND OUTPUT: HOUSEHOLDS




Inflation is driven by supply-side ("stagflation") shocks

# USE PHILLIPS CURVE TO UNDERSTAND INFLATION

$$\pi_t = E_t\pi_{t+1} - \kappa(U_t - U_t^*) + shock_t$$

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$$\pi_t = E_t\pi_{t+1} - \kappa(U_t - U_t^*) + shock_t$$

$$\underbrace{\pi_t - E_t\pi_{t+1}}_{\text{Inflation gap}} = \underbrace{-\kappa(U_t - U_t^*)}_{\text{Slack}} + \underbrace{shock_t}_{\text{cost push forces}}$$

$(move\ along\ the\ curve)$ $(vertical\ shifts\ of\ the\ curve)$

# Volcker disinflation

Inflation is rising
Inflation is falling

$\pi - E^{MICH}(\pi)$, %

UE-UE*, %

# Current disinflation

Inflation is rising
Inflation is falling

$\pi - E^{MICH}(\pi)$, %

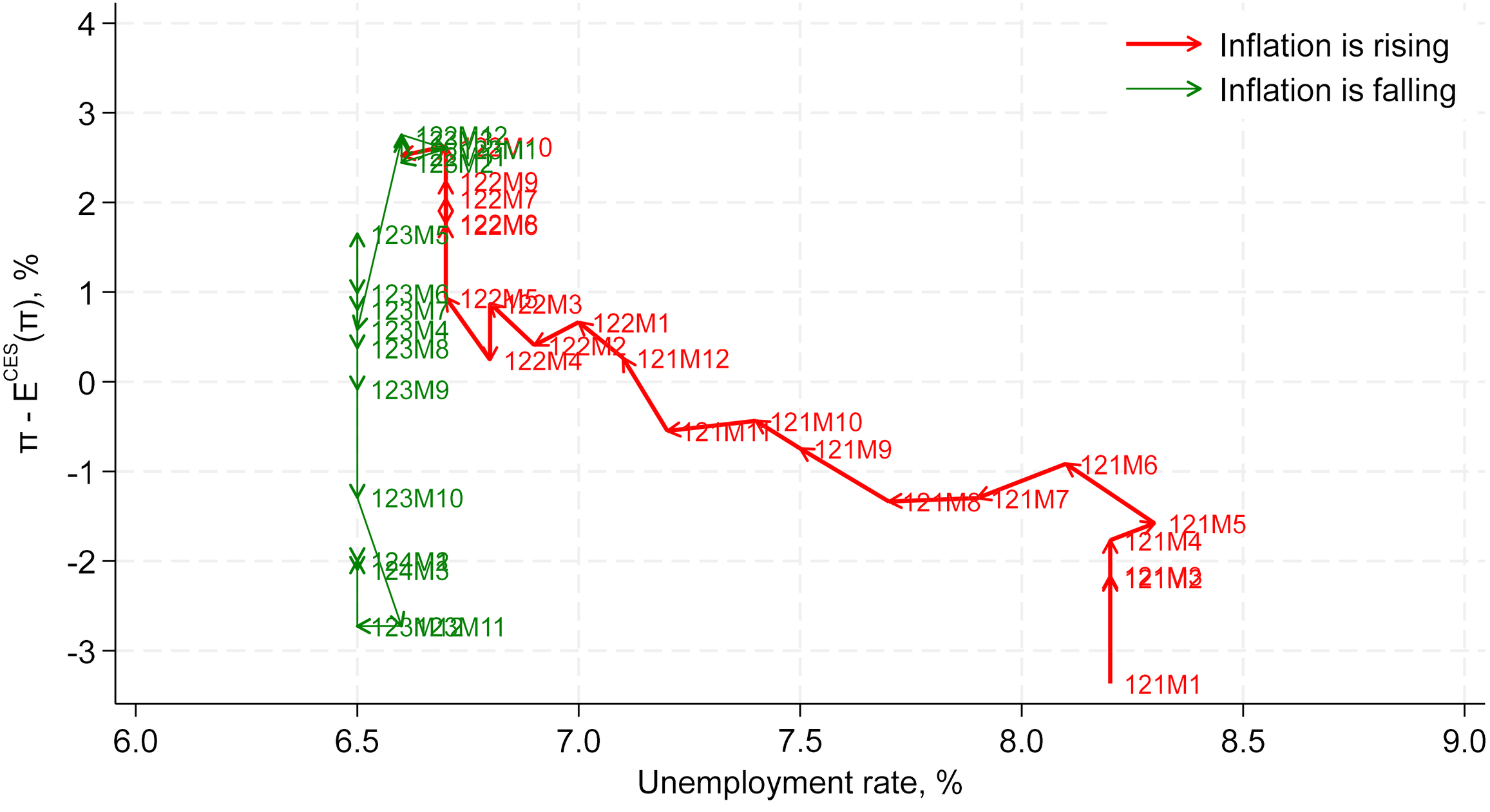
UE-UE*, %

6
5
4
3
2
1
0
-1
-2

-2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

22M7
22M3
22M2
22M1
23M2
21M12
23M3
23M4
21M11
21M10
21M7
21M5
21M6
21M4
23M10
23M5
23M9
23M11
23M12
21M1
20M10
20M11
20M12
20M9

# Current disinflation in the Euro area



# ARE INFLATION EXPECTATIONS ANCHORED?

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Five metrics:

- Inflation expectations are close to the target.
- There is little disagreement in expectations.
- Revisions in inflation expectations are small.
- Firms/households show confidence in their forecasts.
- Short- and long-term inflation expectations are uncorrelated.

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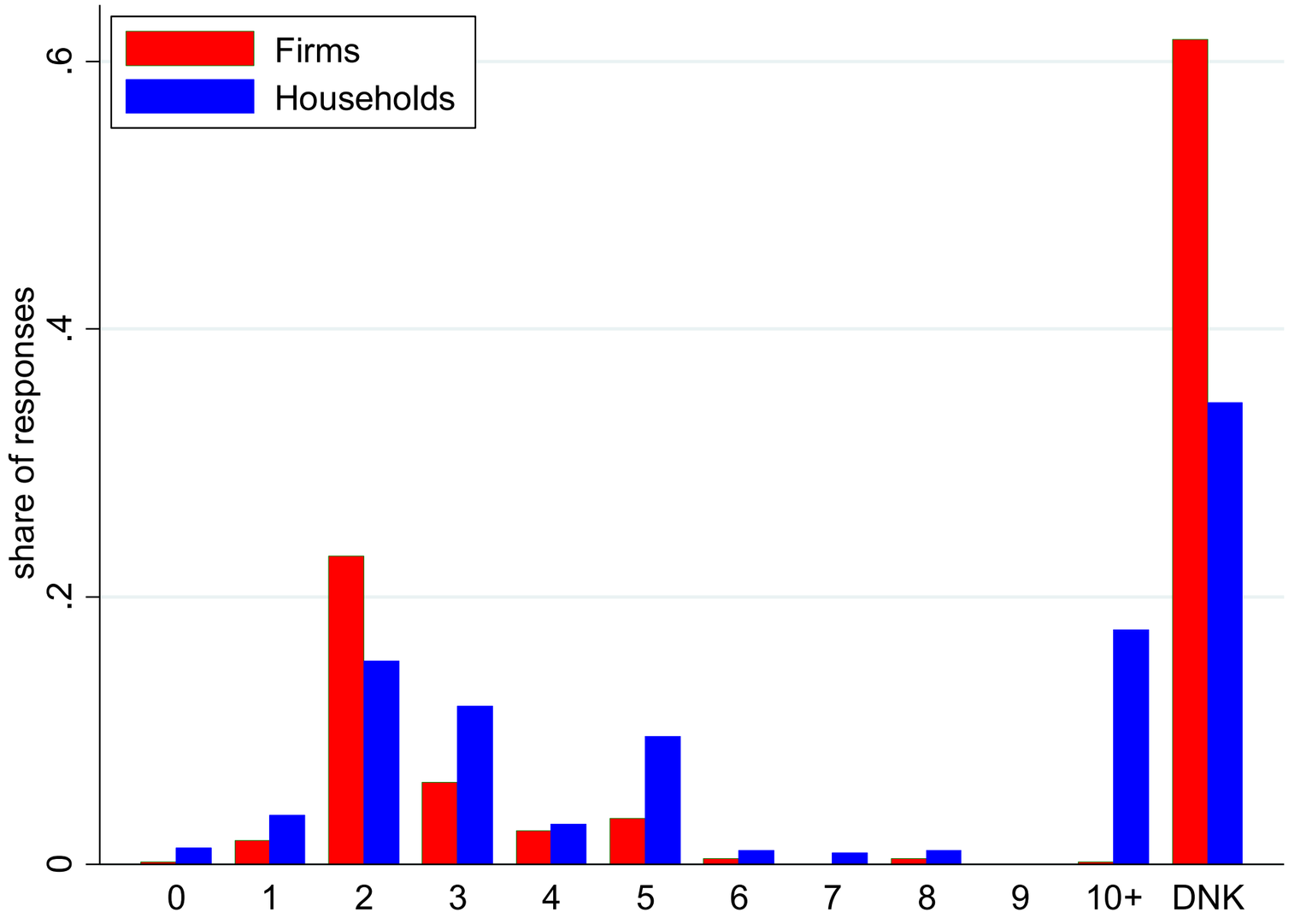
# PERCEPTION OF INFLATION TARGET IN THE U.S. (2018)

Responses to question about Fed's inflation target




DNK: "Don't Know"

Source: Coibion, Gorodnichenko, Kumar and Pedemonte (2020)

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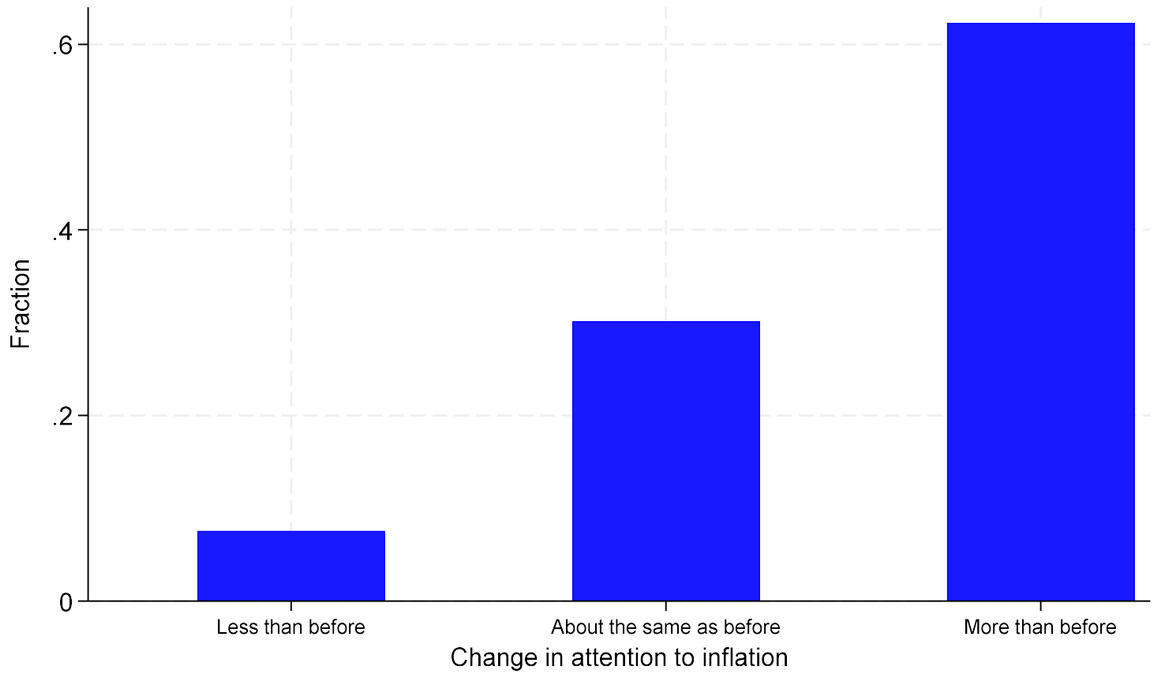
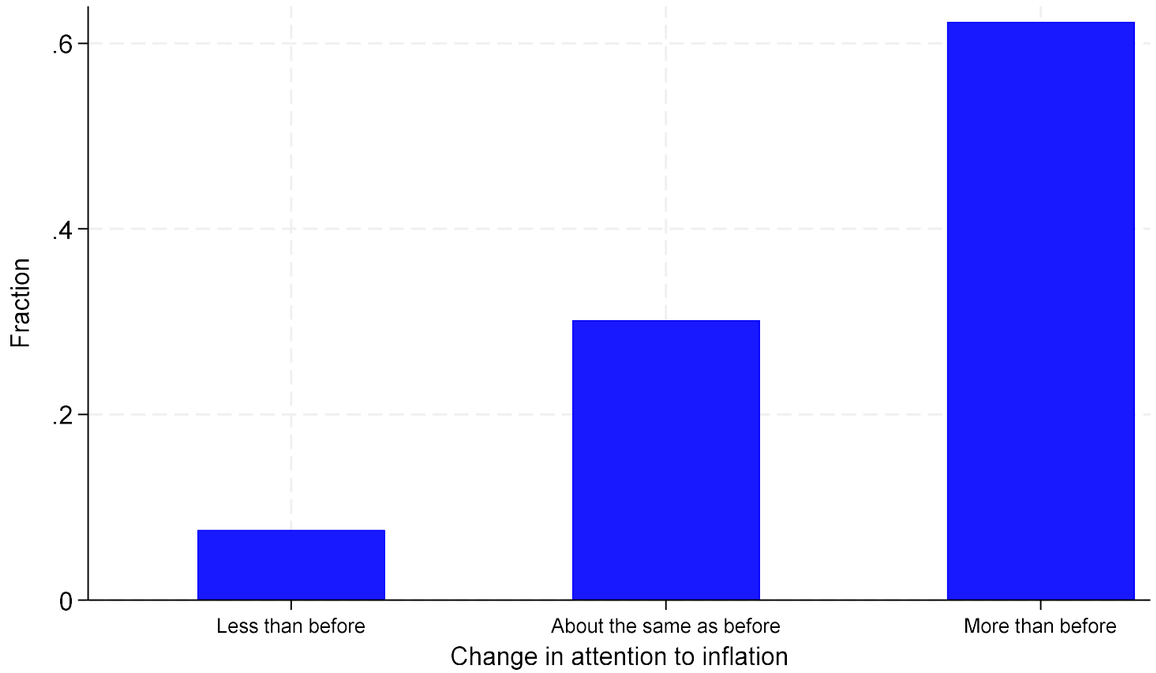
Are survey expectations noise? **NO**

- Incentives matter
- Expectations respond to information
- Expectations translate into actions




# INCENTIVES:
# ECB SURVEY OF HHS (23M1)

Most households in the Euro-area in January 2023 reported that they were paying *more attention to inflation* than they were a year before.

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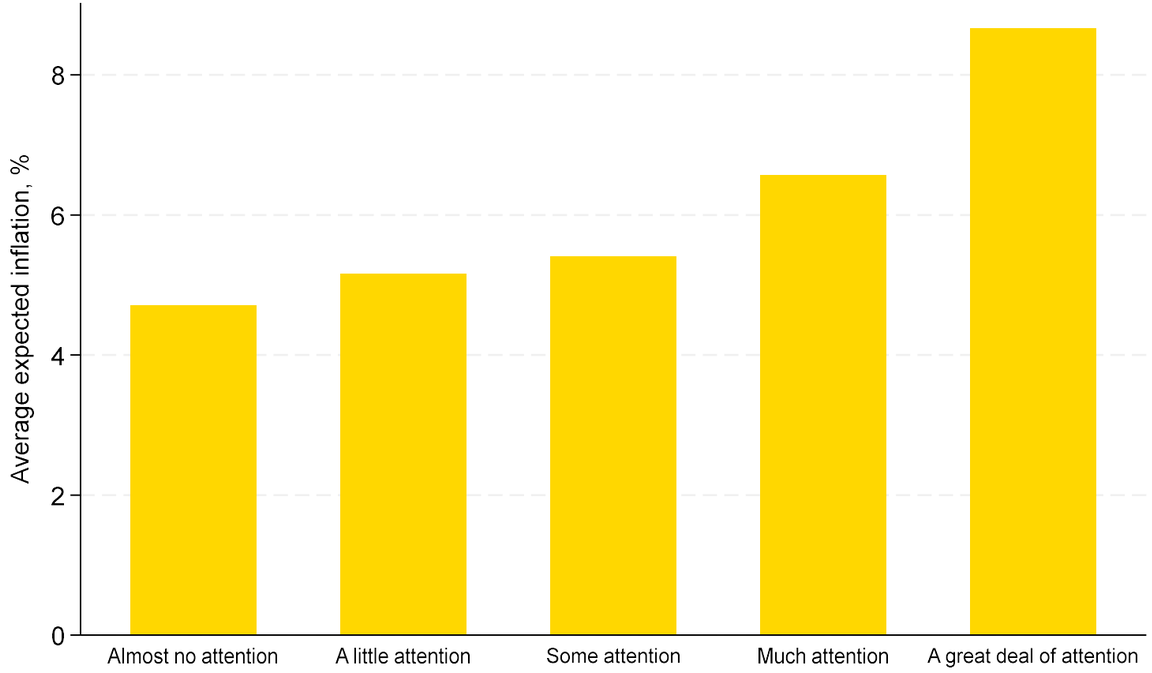
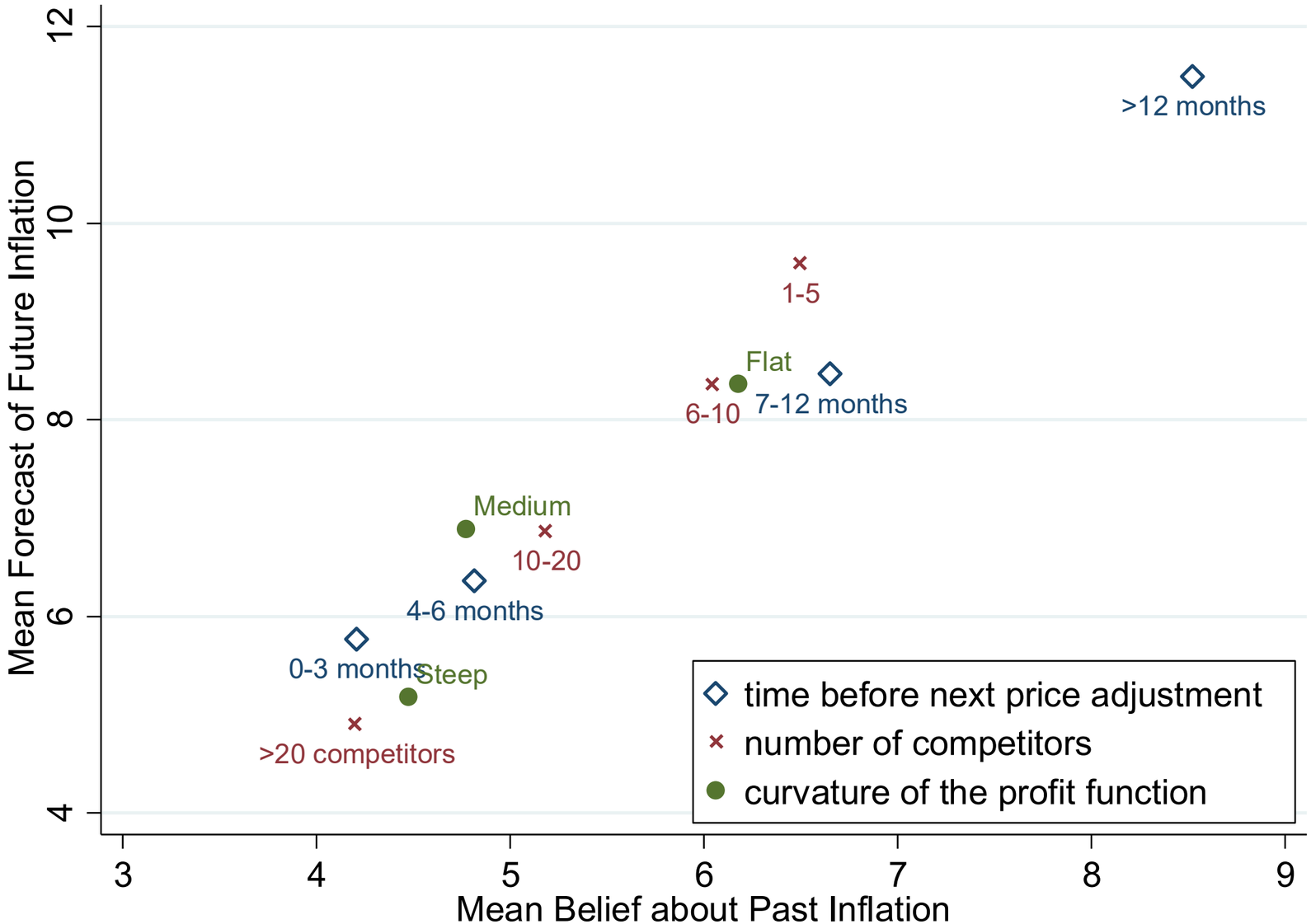



More attentive households have better inflation expectations.

# INCENTIVES: FIRMS' INFLATION EXPECTATIONS & PERCEPTIONS




New Zealand firms with stronger incentives to pay attention to inflation (more competitors, steeper profit function, shorter time to the next price adjustment) have better inflation expectations and perceptions.

Source: Coibion, Gorodnichenko and Kumar (2018)

# RESPONSE OF BELIEFS TO INFORMATION

Simple Bayesian updating predicts:

$$posterior_i = (1 - G) \times prior_i + G \times signal = prior_i + G \times (signal - prior_i)$$

where $G$ will be large when signal is credible and informative and small otherwise. When $G$ is small, posteriors will be close to priors.

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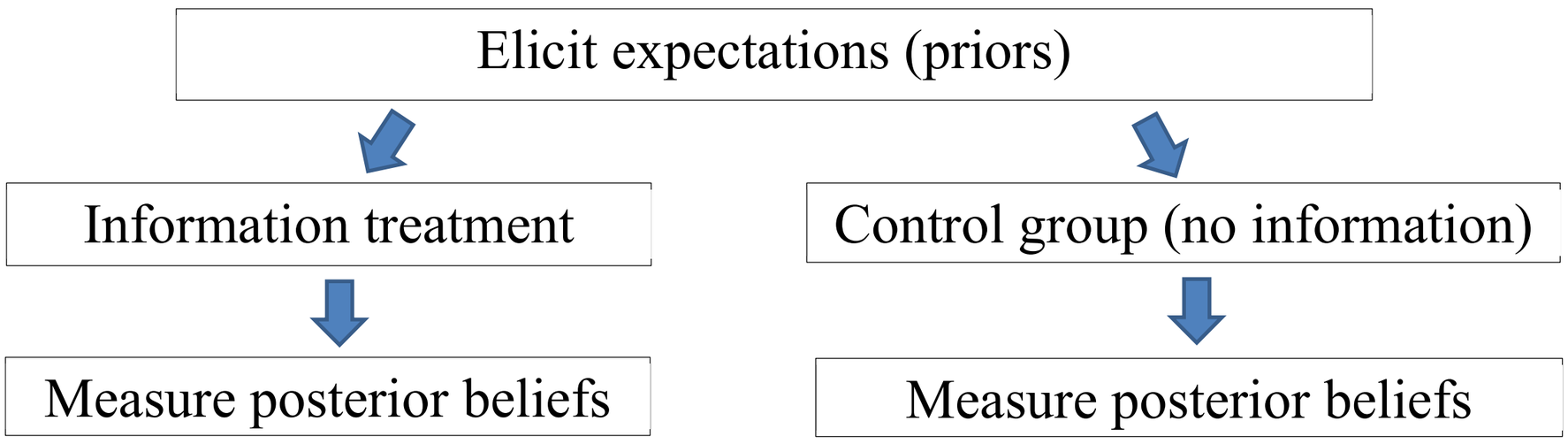

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**RCT Implementation:**

- Measure prior beliefs of all agents
- Randomly assign agents to "control" and "treatment" groups such that only those in the treatment group are provided with signal.
- Measure posterior beliefs of all agents.

Examples of treatments:

Coibion et al. (AER 2024) "Professional forecasters are uncertain about economic growth in the euro area in 2021, with **the difference between the most optimistic and the most pessimistic predictions being 4.8 percentage points**. By historical standards, this is a big difference."

Coibion et al. (JPE 2022): "The inflation target of the Federal Reserve is 2% per year."

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- Estimate treatment effect:

$$posterior_i = \alpha + \beta \times prior_i + \delta \times T_i + \gamma \times (T_i \times prior_i) + error_i$$

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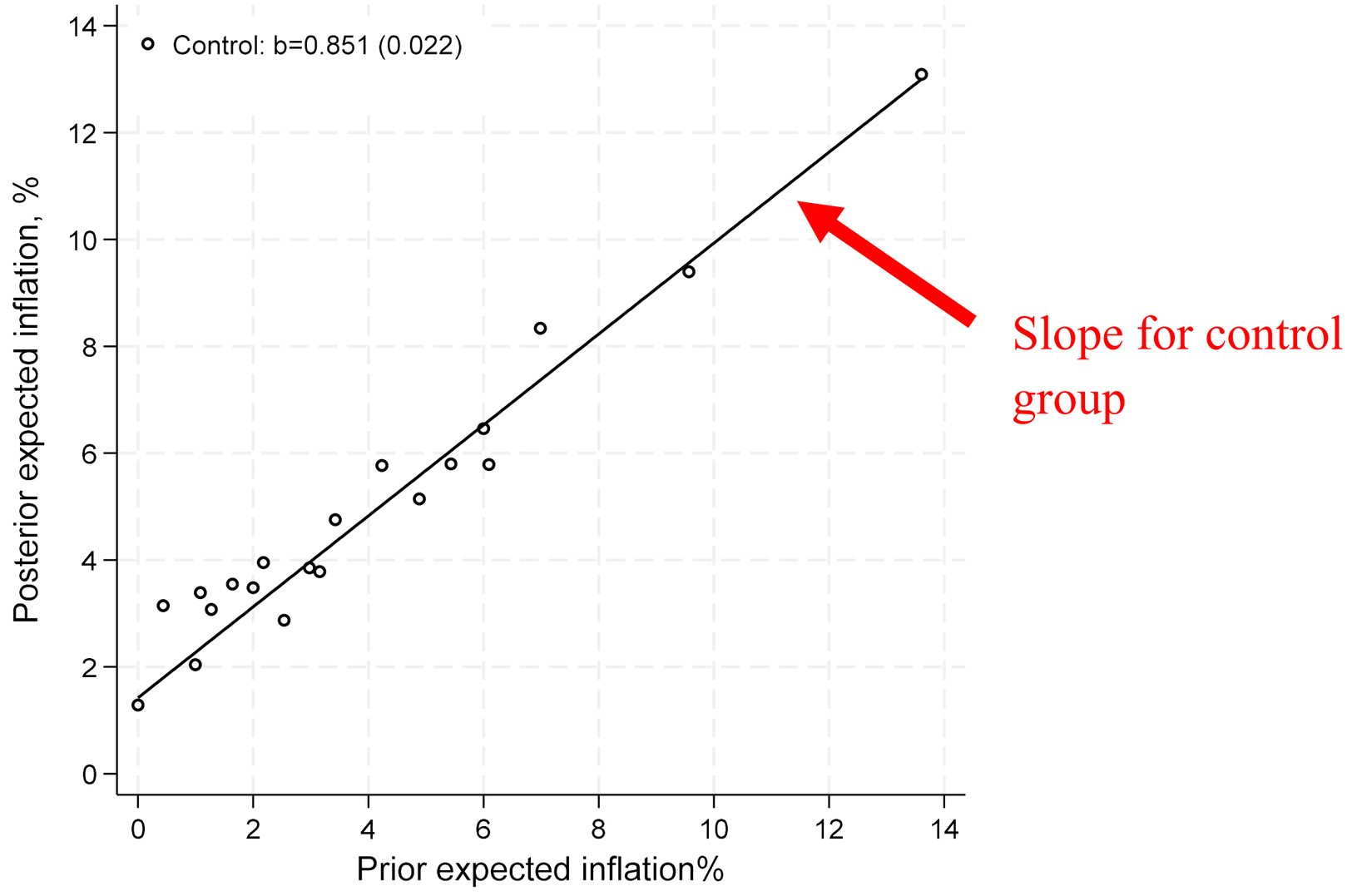
  - *Treatment group:* $T_i = 1,\ posterior_i = (\alpha + \delta) + (\beta + \gamma) \times prior_i$, so $\hat{\gamma}$ tells us how much weight treated firms still place on their prior (equivalent to $-G$).

# ILLUSTRATION: NIELSEN RCT 2018Q2




Slope for control group

Because different questions are used for priors and posteriors, it is common for the slope coefficient to be less than one for control group. How different from one depends on question wording, etc.

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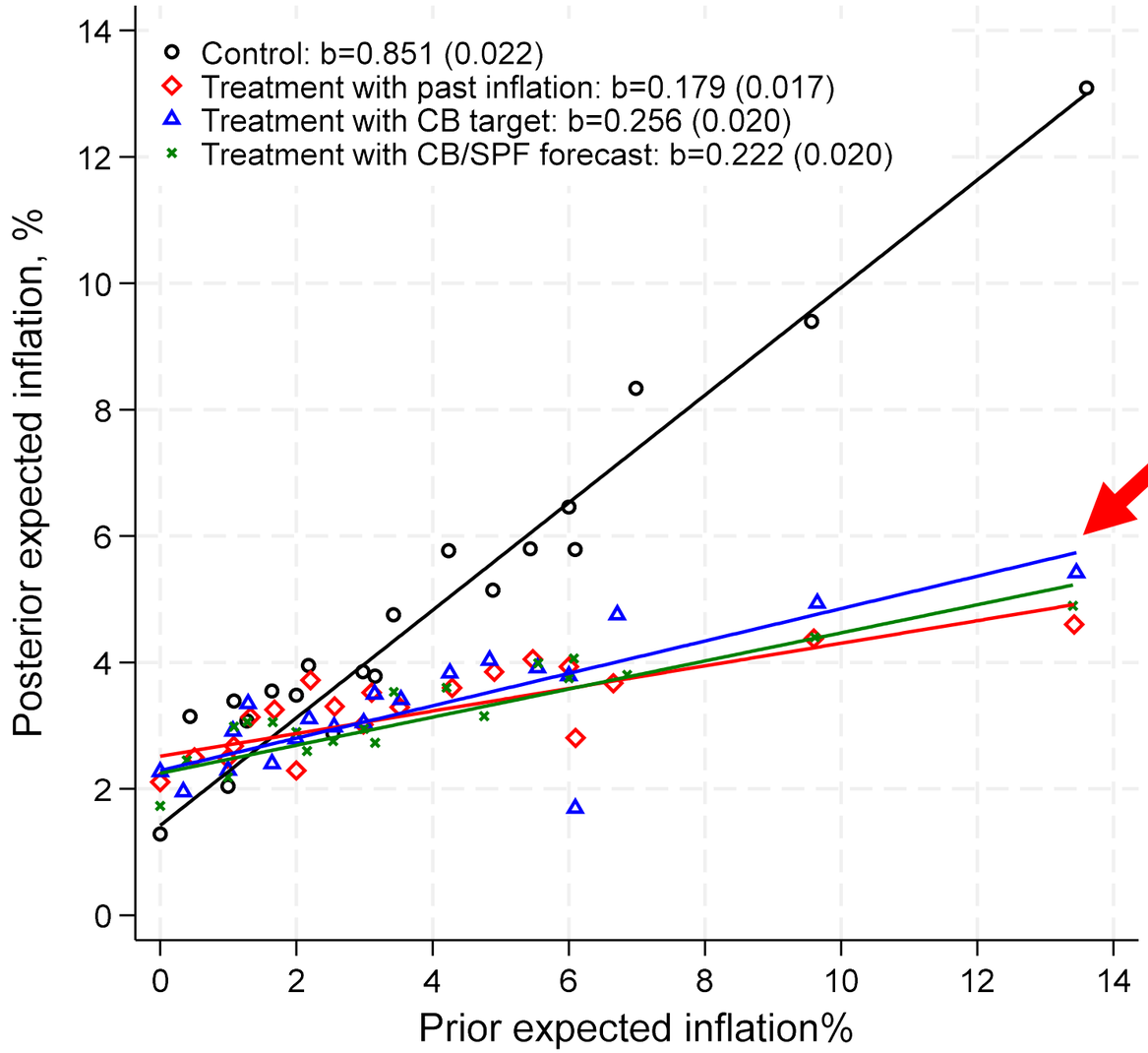
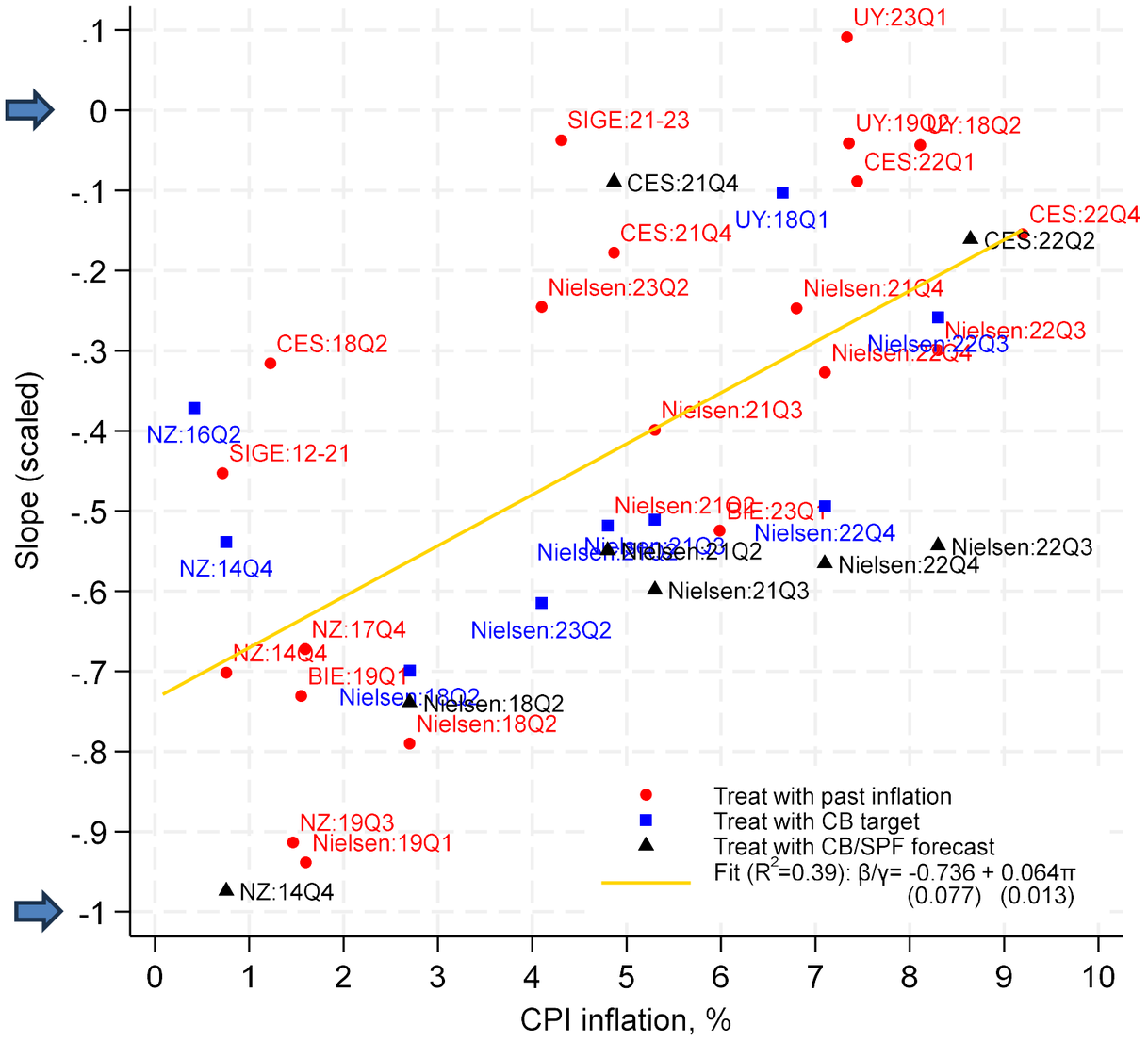



Slopes for treatment groups that are provided with information about inflation are much flatter, i.e. $\hat{\gamma} < 0$

This is an example of treatments having a very powerful effect on beliefs. We can focus on $\hat{\gamma} / \hat{\beta}$ $(\approx -0.75)$ as our metric for the strength of the treatment effect.

# TREATMENTS, E(INFLATION) AND MACRO ENVIRONMENT

Attentive agents ("FIRE")




Inattentive agents

Nielsen: HHs, USA

CES: HHs, euro area

BIE: firms, USA

NZ: firms, New Zealand

SIGE: firms, Italy

UY: firms, Uruguay

*Treatment effects systematically vary with inflation: endogenous inattention!*

# MANAGEMENT OF INFLATION EXPECTATIONS

Task: need to lower inflation expectations

Solutions:

- Generate recession ("Volcker" vs. "soft landing")
- Communication
  - People are attentive to inflation and so they are more likely to listen to policy communication
  - People are attentive to inflation and so just talking is less likely to convince people

# FROM BELIEFS TO ACTIONS

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Framework:

First stage ("Bayesian learning")

$$Belief_{i,t+\epsilon}^{Post} = \alpha + \beta \times Belief_{i,t}^{Prior} + \delta \times Treatment_{i,t} + \gamma \times \left(Treatment_{i,t} \times Belief_{i,t}^{Prior}\right) + Controls + error$$

Second Stage:

$$Action_{i,t+h} = b_1 Belief_{i,t+\epsilon}^{Post} + b_2 Belief_{i,t}^{Prior} + b_3 PlannedAction_{i,t} + Controls + error$$

# THE EFFECT OF INFLATION EXPECTATIONS ON HH SPENDING

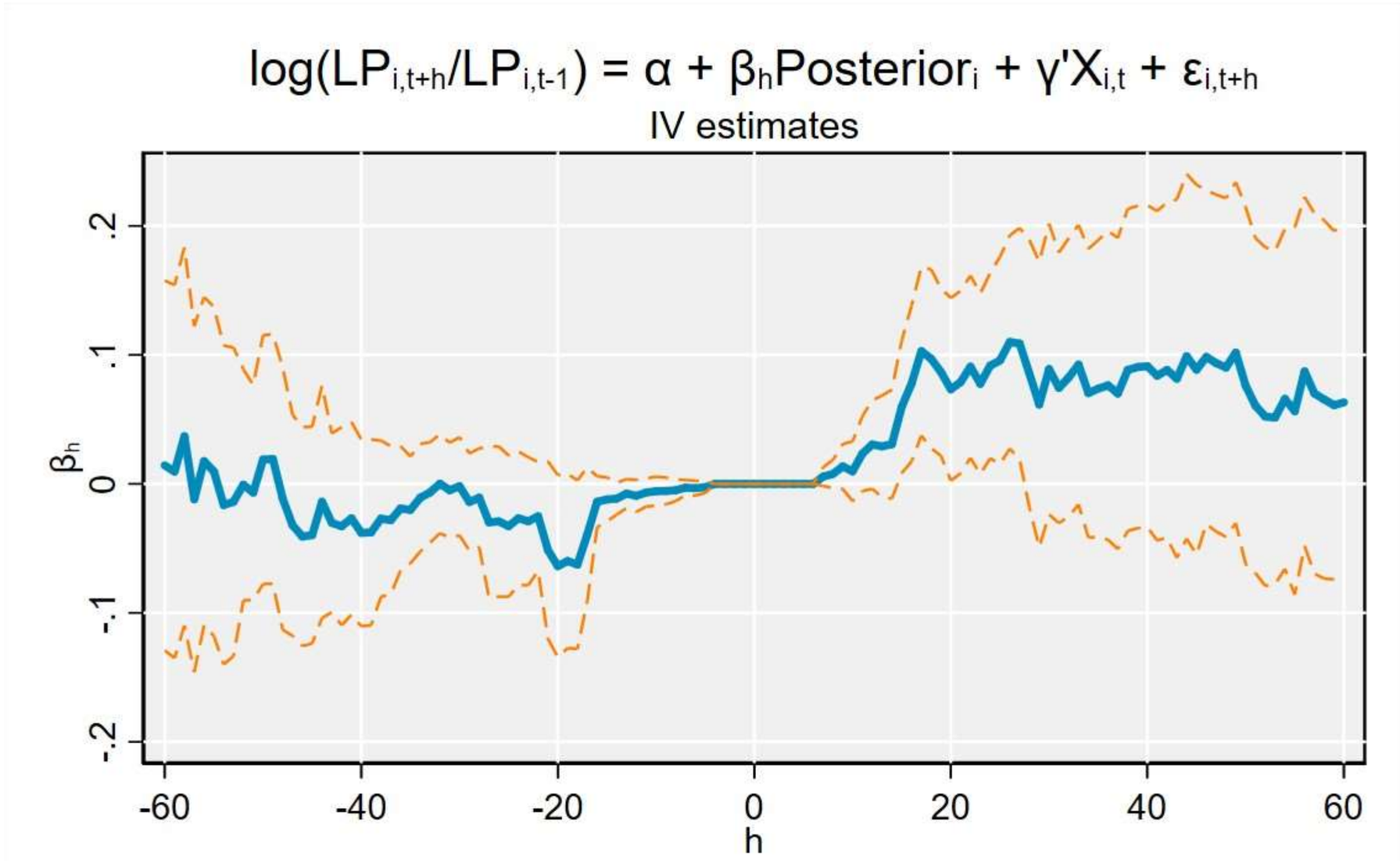
Coibion, Gorodnichenko and Weber (JPE 2022):

Spending on any durable good, extensive margin, Nielsen HomeScan Panel

| | 3 months after treatment | 6 months after treatment |
|---|---|---|
| | (1) | (2) |
| Posterior inflation expectations | -1.472*** | -1.743*** |
| | (0.263) | (0.403) |
| Observations | 11,080 | 9,755 |
| R-squared | 0.06 | 0.08 |
| 1st stage F-stat | 110.6 | 86.54 |

Households have a stagflationary view of inflation

# EFFECTS OF INFLATION EXPECTATIONS ON ONLINE PRICES




Notes:
1/ LP stands for listed price.
2/ The vector of controls $X_i$ includes the prior expectation.

Source: Coibion, Gorodnichenko, Kumar and Talavera (2024)

# CONCLUDING REMARKS

- FIRE is useful and the New Keynesian macroeconomics is an epitome of FIRE success

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- Pronounced deviations from FIRE in the survey data
- There are alternatives to FIRE such that one does not have to abandon rationality
- The behavior of survey expectations is consistent with at least some of these alternatives

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- FIRE is useful and the New Keynesian macroeconomics is an epitome of FIRE success
- Pronounced deviations from FIRE in the survey data
- There are alternatives to FIRE such that one does not have to abandon rationality
- The behavior of survey expectations is consistent with at least some of these alternatives
- Challenges for future work for non-FIRE models:
  - Current state: "theory ahead of business cycle measurement"
  - Few measures of real-time beliefs of firms and other price setters linked to actions
  - How to rule out many alternative deviations from FIRE
    - Impose discipline on non-FIRE models
    - Derive testable implications and test them

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