Measuring Narratives about the Macroeconomy

Chris Roth

NBER Behavioral Macro Bootcamp, May 21, 2024

Motivation I

- Macroeconomic phenomena are often complex and **consistent with different explanations**.

- Narratives: causal account/story for why an event occurred.

- Provide a **lens** through which individuals can interpret data and forecast future developments.

- Narratives might shape individuals' expectation formation, and affect important economic decisions (Shiller, 2017)

Goal of this lecture

- Provide you with an overview of **state-of-the-art survey methods** to...

  - **measure narratives** and mental models.

  - investigate the **attentional foundations** of expectation formation.

- Teach you how to test predictions of recent theoretical models of associatve memory and similarity-based recall (Bordalo et. el, 2023; 2024).

Outline of talk

Motivation
Andre, Pizzinelli, Roth, Wohlfart, 2022

- Well-documented empirical fact: Substantial **disagreement** in survey expectations about the macroeconomy (Coibion and Gorodnichenko, 2012; Coibion et al., 2018).

    - Holds true for households, firms and professional forecasters.

    - Disagreement matters for the transmission of policies.

- Heterogeneity in survey expectations is often attributed to **differences in information** about the current state of the economy across economic agents.

- Alternative driver of disagreement in survey expectations: heterogeneity in **subjective models of the macroeconomy**.

Subjective Models of the Macroeconomy
Andre, Pizzinelli, Roth, Wohlfart, 2022

- Method: **Hypothetical vignettes**.

- Respondents predict future unemployment and inflation under different macroeconomic shocks, holding constant information about the state of the economy.

- Consider four canonical macro shocks: oil prices, taxes, government spending and **interest rates (focus of today)**.

- Advantage of hypothetical vignettes: we can fix beliefs about the reasons underlying the shock.

Subjective Models of the Macroeconomy
Andre, Pizzinelli, Roth, Wohlfart, 2022

What does the general population think? How do major shocks affect the macroeconomy (u and π)? Example today: Change in federal funds rate.
Method: Prediction of u and π in two hypothetical scenarios identifies perceived causal effect.

Scenario: Federal funds rate stay constant (shortened)

Imagine the **federal funds rate** stays **constant**. The Federal Open Market Committee announces that it will keep the rate constant at 2.5%. The committee announces it does so with no changes in their assessment of the economic conditions.
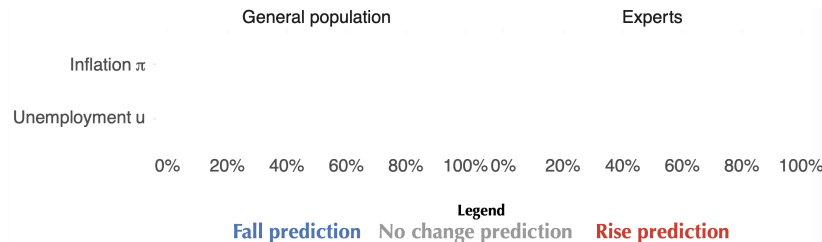
Scenario: Federal funds rate rises (shortened)

Imagine the **federal funds rate** is unexpectedly **0.5 percentage points higher**. The Federal Open Market Committee announces that it is raising the rate from 2.5% to 3%. The committee announces it does so with no changes in their assessment of the economic conditions.

Subjective Models of the Macroeconomy
Andre, Pizzinelli, Roth, Wohlfart, 2022

Respondents indicate the expected unemployment and inflation rates
in the different hypothetical scenarios.

Subjective Models of the Macroeconomy
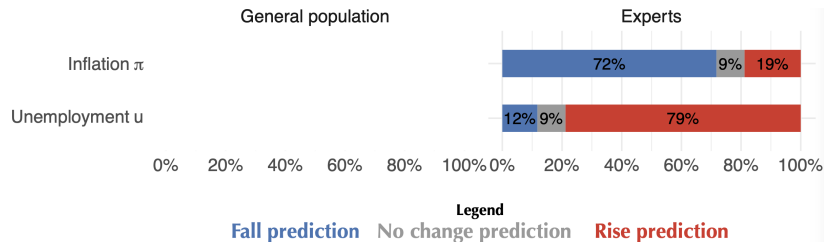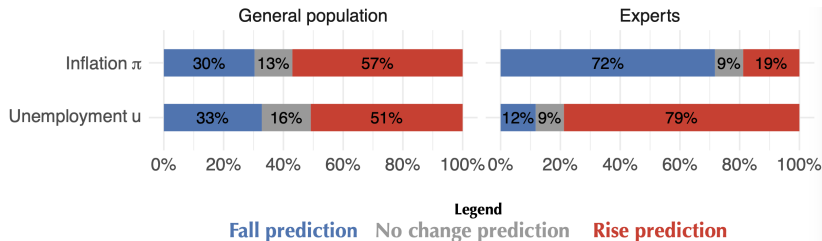Andre, Pizzinelli, Roth, Wohlfart, 2022

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Subjective Models of the Macroeconomy
Andre, Pizzinelli, Roth, Wohlfart, 2022

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The Role of Selective Recall

Sources of heterogeneity: Role of associations
Andre, Pizzinelli, Roth, Wohlfart, 2022

- What drives heterogeneity in predictions within and between households and experts?

- One potential explanation: differences in **associations** that come to respondents' minds.
  - Experts may think of **textbook models**.
  - Households selectively think of **specific propagation mechanisms** and may not account for the full general equilibrium effects of a shock.

- To shed light on the role of the associations, we directly measure respondents' **thoughts** while they make their predictions.

Measuring thoughts: Dual approach
Andre, Pizzinelli, Roth, Wohlfart, 2022

Design similar to main experiment, but measuring **associations** using a dual approach:

1. Elicitation of thoughts in **open-ended text responses** on prediction screen:
   - No priming and immune to ex-post rationalization.
   - But necessarily noisy and incomplete.

2. **Structured question** on a list of 6-7 vignette-specific propagation channels on the next screens:
   - Measure attention to specific channels for which open-text responses are not sufficiently nuanced.
   - Easy to compare across respondents (no judgment calls in coding necessary).
   - But may be subject to ex-post rationalization.
     - Address ex-post rationalization with an experiment shifting attention.

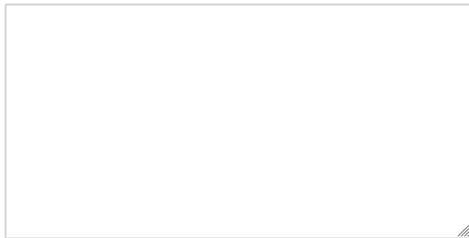# Measuring thoughts: Prediction screen
Andre, Pizzinelli, Roth, Wohlfart, 2022

Your thoughts

Above, you predict how the change in the alternative scenario affects the US economy.
Please tell us how you come up with your predictions.
What are your main considerations in making those predictions?
Please respond in 2-3 sentences.
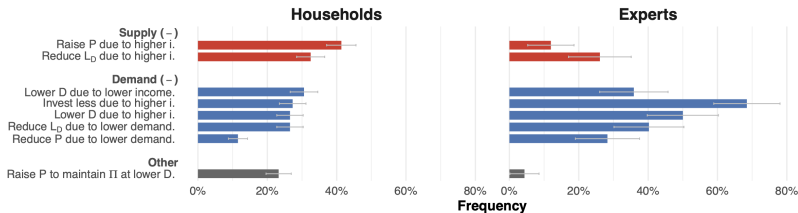
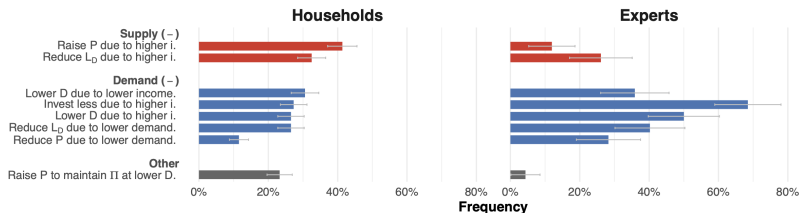- Analyze this data using text-analysis tools and hand-coding of

Attentional foundations of mental models I
Andre, Pizzinelli, Roth, Wohlfart, 2022

Attentional foundations of mental models II
Andre, Pizzinelli, Roth, Wohlfart, 2022

- Substantial heterogeneity in thoughts about transmission mechanisms.

- Relatively less demand-side and more supply-side narratives among households

Some qualitative data
Andre, Pizzinelli, Roth, Wohlfart, 2022

Thoughts about a cost channel	Thoughts about demand-side channels
"If the cost to borrow funds goes up, then a business will have to pay more to pay back a loan. Thus, businesses will have to raise prices. This will result in inflation. A business may not be able to pay employees and have to let them go or a business will not be able to pay back the load and the business will fail. The employees will lose their jobs and raises unemployment"	"with change in fed funds rate upward, unemployment is likely to rise (as cost to business to borrow increases and invest less in expansion) and inflation should in theory be kept in check and even fall."
"I believe if the fed rate increases, the inflation rate will as well because companies will be paying more on their credit and they will pass that on to consumers. Do not think it will affect unemployment."	"Interest rates rising will increase the cost of investment. This will make companies lay people off. However, with higher interest rates, less money will be invested and it will cause inflation to fall."
"If the Fed rate is increased, the following usually happens—the cost of borrowing money for businesses increases—the business has to raise prices—there is usually a corresponding effect on the unemployment rate as employers find they have to cut staff to remain competitive "	"when the interest rate goes up I believe the unemployment rate goes up as well. Inflation will also hurt the job market. If people are not buying the jobs decrease."
"The higher federal funds rate causes the cost of borrowing to rise. As a result, prices are raised. And employment is lowered to cover cost of borrowing."	"the demand will decrease and the investment will be less than usual also saving will be increased"
"When the interest rate rises that would mean that it would cost more for companies to borrow money and so they would charge more for their products (inflation would go up) and they would not have money to expand and hire more people (unemployment would go up). I really don't know if the exact amounts of the inflation and unemployment rises would be the same as the % that the inflation rate rose but I thought maybe it would."	"With the target rate going up, money will become more expensive to borrow, consumer credit rates will rise. This will cause consumer demand to drop and possibly put people out of work"
	"when interest rates increase there is less spending no new jobs"
"The cost of business goes up so business will try to raise prices to make a profit. Business will try to cut costs by employing fewer workers."	"Interest rate hike will cause less overall spending slightly more unemployment and greater inflation as prices adjust to this rate hike."

Associative memory

- Where do associations come from?

- Human memory is known to be associative, selective, and to draw on personal experiences (Bordalo et al., 2023).

- Theories of associative memory predict that
    - **contextual cues** affect the forecasts people make by changing the associations that come to their minds.
    - **different personal experiences** in the memory database should be reflected in differences in associations and forecasts.

Contextual cues
Andre, Pizzinelli, Roth, Wohlfart, 2022

- Proof of concept that an exogenous change in contextual cues can change people's selective retrieval of propagation mechanisms and, thereby, **causally** affect their forecasts.

- **Priming experiment** with households:
  - Focus on **monetary policy vignette** and **inflation forecast**.
  - Ask subgroups to predict effects on production **costs** or product **demand** before forecasting inflation on the survey screen.
  - Pure control group forecasting inflation only.
  - Elicitation of thoughts using **open-ended question** on prediction screen to measure the first stage.
  - Experiment shows that exogenous attention manipulation causally shifts inflation expectations.
  - Open-text data post-treatment allows us to verify an **attentional first-stage**.
- We also provide evidence that experiences are predictive of associations and forecasts.

Inflation Narratives

Outline of talk

Narratives about the Macroeconomy
Andre, Haaland, Roth, Wohlfart, 2022

Why has the inflation rate increased?

In previous years, the US inflation rate has mostly varied between 1.5% and 2.5%. At this rate, a bundle of goods and services that costs $1,000 in one year, would cost between $1,015 and $1,025 in the next year.

Recently, however, the inflation rate has increased. It is now at 6.8%. At this rate, a bundle of goods and services that costs $1,000 in one year, would cost $1,068 in the next year.

Which factors do you think caused the increase in the inflation rate? Please respond in full sentences.

"I think the biggest factor in the large inflation rate over the last year or so is probably the pandemic. With labor shortages and business shutdowns because of the pandemic, certain goods are harder to get a hold of, and supply chains have been heavily impacted."

"I fully believe that our President is responsible for this disaster of inflation. [...] Our President has not helped with the backflow of container ships sitting out in the harbors. [...]"

Narratives about the macroeconomy
Andre, Haaland, Roth, Wohlfart, 2022
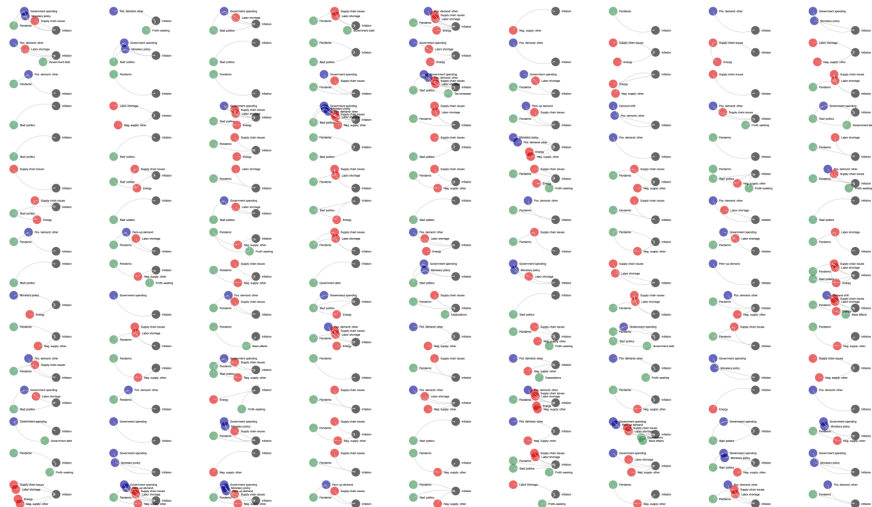
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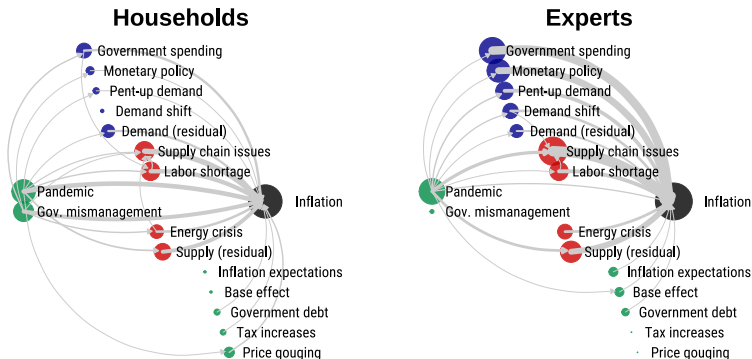
Take-aways:

- Lots of heterogeneity both within and across samples.
- Households more likely to engage in supply-side thinking compared to demand-side thinking.

The consequences of narratives
Andre, Haaland, Roth, Wohlfart, 2022

We conduct a series of additional experiments which demonstrate that narratives...

- have a direct impact on **inflation expectations**

- shape the **interpretation of new information**

Revision of paper (with Mirko Widerholt) features a macro model incorporating narratives.

New approaches to measuring narratives

Digression I: Speech data to measure narratives
Graeber, Noy and Roth (2024) and Graeber, Roth and Schesch (2024)

- Recent innovation: measuring narratives with **speech recordings**.

- **Advantages of Speech Recordings**
  - Captures the spontaneity and natural flow of thoughts.
  - Includes emotional tones, emphasis, and disfluencies.
  - Potentially reduces cognitive cost relative to writing.

- **Disadvantages of Speech Recordings**
  - Potential self-consciousness of participants (though most respondents prefer speech recordings over writing).
  - Complexity in analyzing speech (non-verbal cues).
  - Technical issues like poor audio quality, though this rarely occurs in practice.

Digression II: Conducting qualitative interviews with AI
Chopra and Haaland, 2024

- Traditional methods use single open-ended questions.

- AI interviews employ a series of follow-up questions after the initial response.

  - AI programmed to use broad, neutral, open-ended questions.

  - Adaptive probing helps clarify ambiguities and achieve **greater depth and breadth in responses**.

- Scalability: Conducts multiple interviews simultaneously.

- Uses transformer-based language models, like OpenAI's GPT-4.

- The interviews are text-based via chat interfaces and can be integrated into survey software like Qualtrics.

- **Challenges in AI-assisted interviews**
  - Concerns over algorithmic biases and data privacy.
  - Increased complexity and cost of analyzing data.
  - May not effectively capture spontaneous top-of-mind responses.

Outline of talk

Attention to the Macroeconomy
Link, Peichl, Roth and Wohlfart, 2023

- **We collect new panel data measuring attention to the macroeconomy based on open-ended survey responses**.
  - Quarterly surveys between December 2020 and March 2023, i.e., before and during a historic shock to inflation.
  - Samples of $\approx$ 5,000 German households and $\approx$ 3,000 German firms per wave.

- Establish a series of novel stylized facts about the empirical properties of attention to the economy and its link to beliefs.

- Discuss the extent to which different theories can account for the empirical patterns and which ones they fail to explain.

- Evidence purely descriptive, but based on naturally occurring variation in attention, large samples, period with a changing economic environment.

Measurement

Open-ended measurement of attention allocation
Link, Peichl, Roth and Wohlfart, 2023

Open-ended question, prompting respondents on the mindset
relevant for their economic decision-making:

***What topics come to mind when you think about the economic
situation of your company/household?***

Open-ended measurement of attention allocation
Link, Peichl, Roth and Wohlfart, 2023

Open-ended question, prompting respondents on the mindset relevant for their economic decision-making:

What topics come to mind when you think about the economic situation of your company/household?

- Unique snapshot of the topics that are on top of respondents' minds; should write about **aggregate** or **household-/firm-level** topics depending on attention allocation.

- Could reflect info recently received from the **external world** or more distant experiences drawn from **memory database**.
    - → Sufficiently flexible to capture varying notions of attention from theoretical literature.

- Measurement itself should not draw respondents' attention to any specific (macro-)economic topic.

Example responses
Link, Peichl, Roth and Wohlfart, 2023

"Inflation rate and the monetary value of one's own savings"

"That credit interest rates are becoming increasingly expensive and prices are rising. Hopefully, there will be a salary increase soon."

"The faltering economy and rising inflation"

"Concern about job loss in the future."

"We are doing well. No debt. A vacation is possible."

"There is hardly any suitable skilled personnel, investment backlog and tough competition"

"Automation + process optimization"

Coding of open-ended responses
Link, Peichl, Roth and Wohlfart, 2023

Coding scheme for responses to the open-ended question to quantitatively analyze the unstructured text data:

- Codes for a range of topics:
    - **Macroeconomic**: pandemic, inflation, growth, monetary policy, . . .
    - **Household-level**: income, spending, saving, housing costs, . . .
    - **Firm-level**: supply chain, input factors, product demand, costs, . . .

- Each response can be assigned multiple codes.

- Instruct research assistants to apply the coding scheme to the open-text responses.

Reliability of our coding scheme
Link, Peichl, Roth and Wohlfart, 2023

- 92.1% of household responses and 99.4% of firm responses can be assigned at least one code.

- Double-coding of subset: High inter-rater reliability ($\approx 90\%$).

- Large overlap with automated word counts. ▸ More

- Large overlaps with AI-based classification. ▸ More

$\rightarrow$ **Coding scheme allows reliable coding of the open-ended data.**

Validation of open-ended attention data
Link, Peichl, Roth and Wohlfart, 2023

We validate the open-ended attention measure in three ways:

(1) Strongly correlated with measures of news consumption. ▸ More

(2) Strongly correlated with attention measures based on structured survey question. ▸ More

(3) Time variation closely aligned with Google searches. ▸ More

Some Facts on Attention

Attention allocation over time
Link, Peichl, Roth and Wohlfart, 2023

Attention allocation over time
Link, Peichl, Roth and Wohlfart, 2023

Panel A: Households | Panel B: Firms

- Attention shifting from Covid-19 to inflation over the sample period.

Attention and beliefs

Attention and beliefs about inflation
Link, Peichl, Roth and Wohlfart, 2023

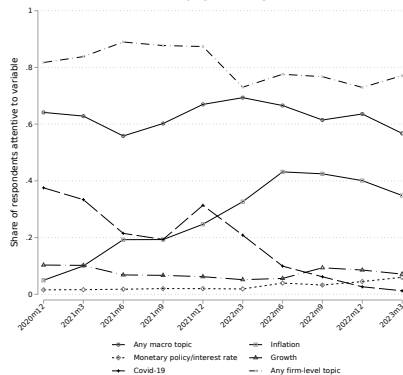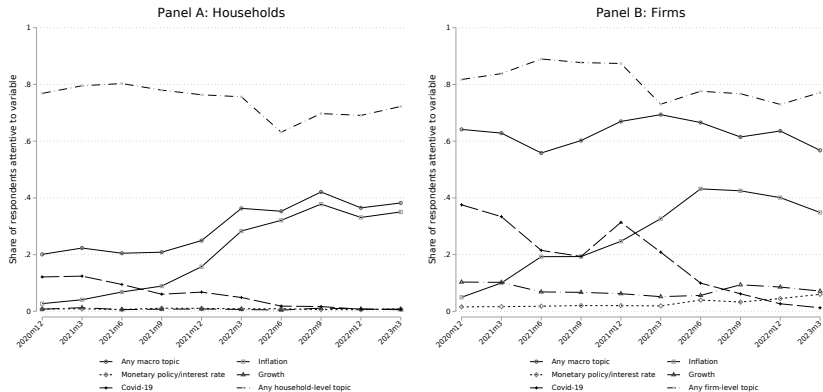|	Absolute change in expectation ≥ 0.5 p.p.	Confidence (z)	Expected inflation	Absolute deviation from expert forecast	Perceived current inflation	Absolute deviation from current level
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Households						
Attention to inflation	0.021***	0.168***	0.167*	0.101	-0.110	-0.500***
	(0.007)	(0.016)	(0.087)	(0.085)	(0.072)	(0.061)
Distinct respondents	6,716	10,758	10,758	10,758	8,330	8,330
Observations	20,983	34,980	34,980	34,980	24,407	24,407
R-squared	0.02	0.12	0.16	0.10	0.14	0.07
Mean dep. var.	0.79	0.04	7.08	4.88	6.32	2.67
SD dep. var.	0.41	0.99	6.49	6.17	5.26	4.26
Panel B: Firms						
Attention to inflation	0.013**	0.043**	0.211***	0.198***		
	(0.006)	(0.017)	(0.046)	(0.045)		
Distinct respondents	4,402	6,193	6,235	6,235		
Observations	18,426	27,126	28,112	28,112		
R-squared	0.02	0.02	0.49	0.23		
Mean dep. var.	0.80	0.04	5.47	3.00		
SD dep. var.	0.40	1.02	3.44	2.72		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

- Attentive agents adjust inflation expectations more frequently.
- More likely to take note of the rapidly changing outlook for inflation over sample period.

Attention and beliefs about inflation
Link, Peichl, Roth and Wohlfart, 2023

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- Attentive agents more confident in their inflation expectations.

Attention and beliefs about inflation
Link, Peichl, Roth and Wohlfart, 2023

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- Attentive households hold smaller misperceptions about current inflation

Attention and beliefs about inflation
Link, Peichl, Roth and Wohlfart, 2023

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- But attentive agents' expectations deviate more strongly from expert benchmarks!

Attention and beliefs about inflation: Relation to theories
Link, Peichl, Roth and Wohlfart, 2023

- Higher frequency of updating, higher confidence and smaller mis-perceptions of current inflation among attentive agents **consistent with standard theories**.
  - Sticky information models. (Carroll, 2003; Mankiw and Reis, 2006; Reis, 2006b)
  - Noisy information/rational inattention models (Sims, 2003; Woodford, 2003).

Attention and beliefs about inflation: Relation to theories
Link, Peichl, Roth and Wohlfart, 2023

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  - Sticky information models. (Carroll, 2003; Mankiw and Reis, 2006; Reis, 2006b)
  - Noisy information/rational inattention models (Sims, 2003; Woodford, 2003).

- Stronger deviation of expectations from benchmarks **at odds with standard theories**.
  - Agents relying on their own, potentially mis-specified **subjective model of the economy** to interpret signals (Andre et al, 2022).
  - Retrieval of specific experiences from memory database when increasing attention (Bordalo et al, 2023; 2024).

Experiences and attention

Associative memory and attention allocation
Link, Peichl, Roth and Wohlfart, 2023

Theories of associative memory posit that ...

- what is on top of individuals' minds depends on the experiences in their memory database (Bordalo et al., 2024)

- the context determines which experiences individuals retrieve through similarity-based recall (Enke et al, 2024).

- Study correlations between experiences with inflation and attention allocation, and **how the strength of these correlations responds to the inflation shock**.

Measures of inflation experiences
Link, Peichl, Roth and Wohlfart, 2023

- Focus on households, for which we have high-quality experience measures available.

- **Two types of inflation experiences:**

  (1) Collective cohort-level experience: having lived through the oil crises of the 1970s $\rightarrow$ Age $\geq$ 55.

  (2) Personal experiences: survey measures on ever having incurred substantial real income drops or real wealth losses due to inflation (elicited prior to inflation shock).

Experiences and changes in attention over the shock period
Link, Peichl, Roth and Wohlfart, 2023

Panel A:
Experienced the
1970s oil crises
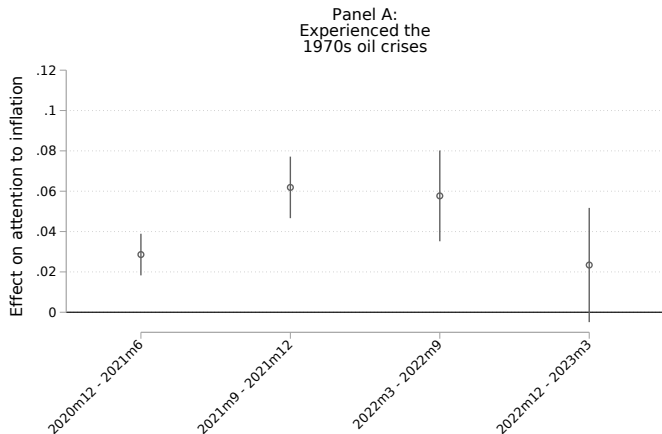
- Correlation between experience and attention increases with the
  similarity of the context to the experience, consistent with
  similarity-based recall.
- Experiences of adverse inflation are associated with a stronger
  increase in inflation expectations in response to the shock.

Take-aways

Methods

- Hypothetical vignettes to measure mental models.

- Open-ended questions as a powerful tool **to measure narratives and the attentional foundations** of expectation formation.
  - See Haaland, Roth, Stantcheva, Wohlfart (2024) for guidance on methodological issues.

Nature of expectations

- Lots of dispersion in expectations.
- People's expectations are many times not stable or well-defined.
- Instead, households and firms form their expectations on-the-fly depending on contextual cues and their experiences (see Bordalo et al., 2023).

Outline of talk

Exciting areas: **Macro Narratives in the field**

(How) do narratives shape high-stakes behaviors of firms and households?

- Flynn and Sastry (2022) show that firms' hiring decisions respond strongly to narratives, as measured in public firms' end-of-year business and financial reports.

- Recent advances in LLMs offer numerous new opportunities to characterize narratives based on large text data bases out there (e.g. earnings calls data).

Exciting areas: **Linking surveys to theory**

How should we integrate survey based measures of expectations and attention into our (macro)models?

- Roth, Wiederholt and Wohlfart (2023) feed in expectations under different policy counterfactuals into a simple HANK model.

- Yang (2024) examines which beliefs are decision-relevant.
  - Important implications for which variables should be integrated into macro models.