Exposure to Daily Price Changes & Inflation Expectations

Francesco D'Acunto
Boston College

Ulrike Malmendier
UC at Berkeley & NBER

Juan Ospina
Banco de la Republica

Michael Weber
University of Chicago & NBER

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Why Inflation Expectations?

- Most **household finance** decisions depend on inflation expectations
  - Consumption/saving choices (D'Acunto, Hoang, and Weber, 2018)
  - Mortgage uptake, type (Malmendier and Nagel, 2015)
  - Stock market participation (Das, Kuhnen, and Nagel, 2019)
- Normal times: $\Delta i_t \longrightarrow \Delta r_t$ if expectations anchored
- **Especially important when inflation/nominal rates low!**
  (Coibion, Gorodnichenko, Kumar, and Pedemonte, 2018)
  - Policy needs to manage households' expectations
  - Examples: Unconventional Fiscal Policy, Forward Guidance

Especially Important when Low Inflation

"The broader question of how expectations are formed has taken on heightened importance. Many central banks are adopting policies that are directly aimed at influencing expectations of inflation"

Janet Yellen, 2016

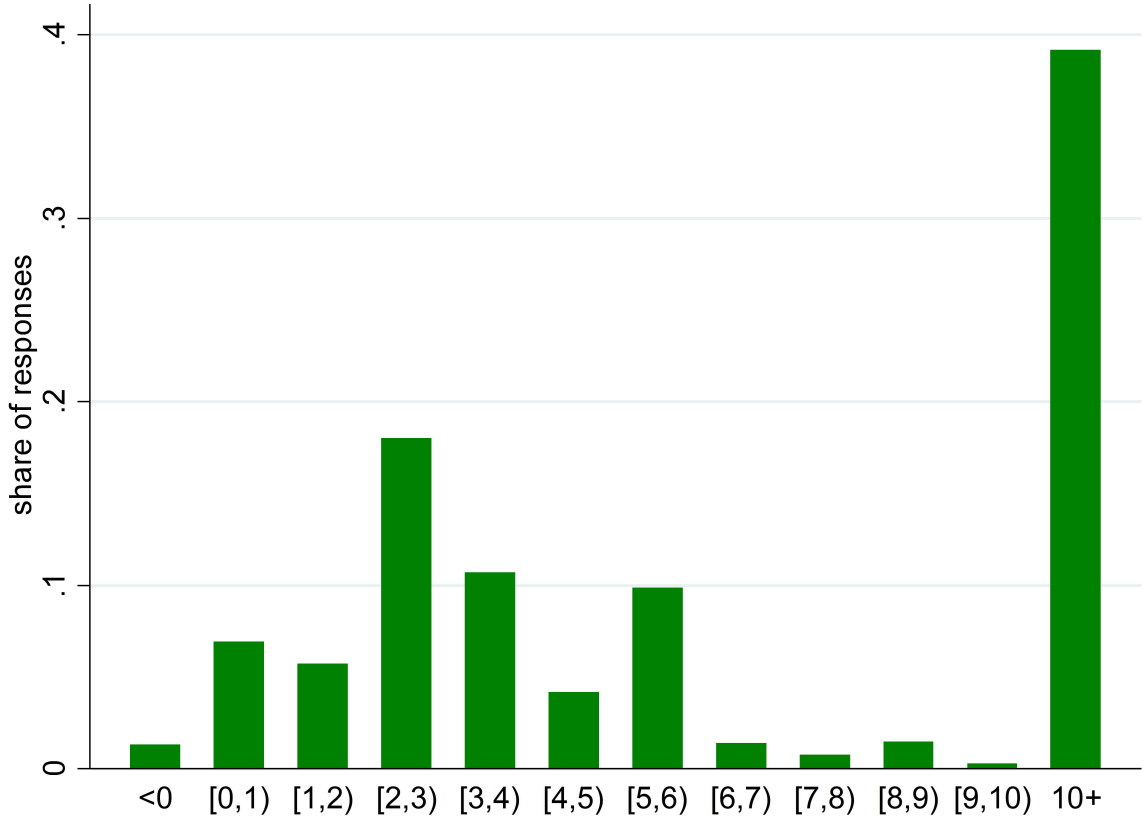
"There are forces in the global economy conspiring to hold inflation down."

Mario Draghi, 2016

"You see inflation moving down, expectations move down and it's been very, very hard for economies to get off that road once they're on it. We don't want to get on that road"

Jay Powell, 2019

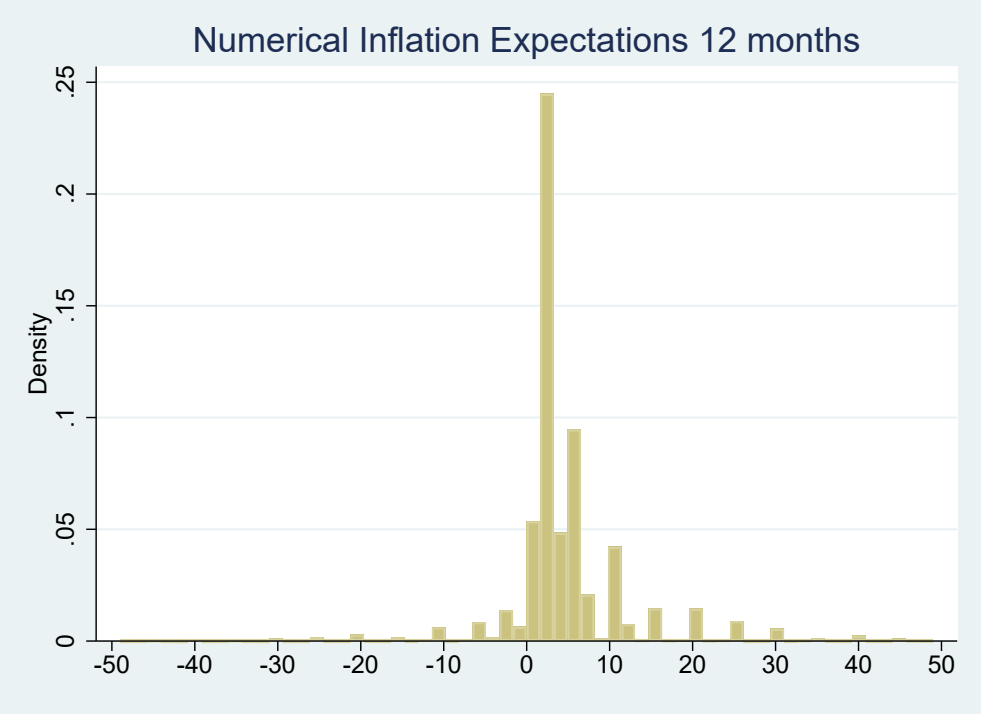
BUT Households have little knowledge...



Source: Chicago Booth Expectations and Attitudes Survey

- Info treatments largely affect expectations (Coibion, Gorodnichenko, Weber, 2019)

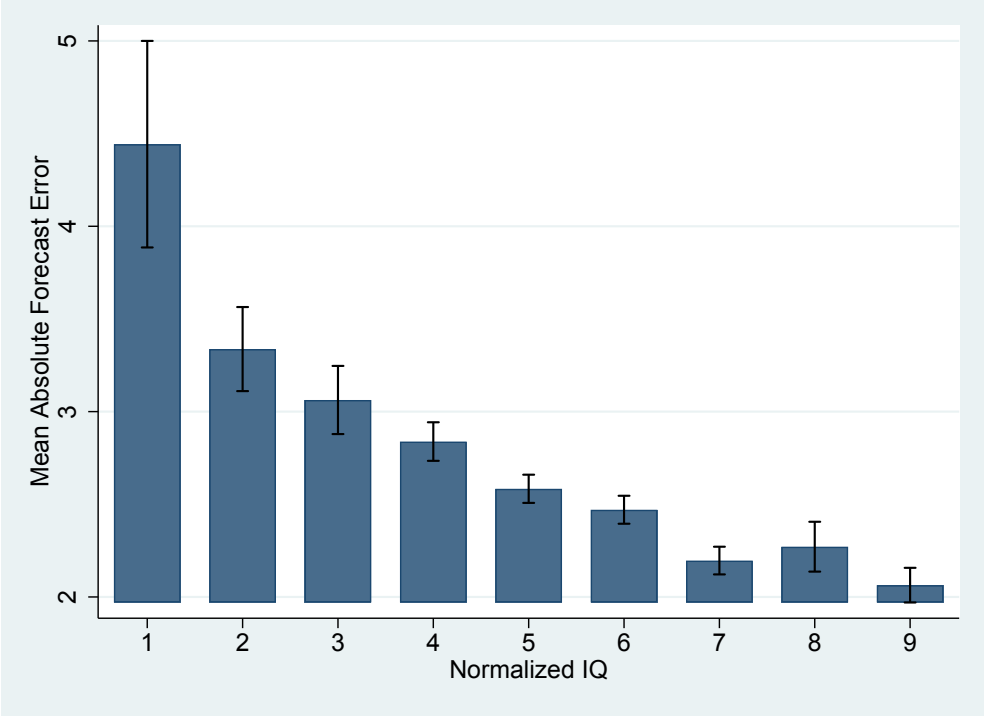
... AND Expectations Are Wild



Source: New York Fed Survey of Consumer Expectations

- Large cross-sectional dispersion at each point in time
- Despite inflation target of 2% and realized inflation below 2%

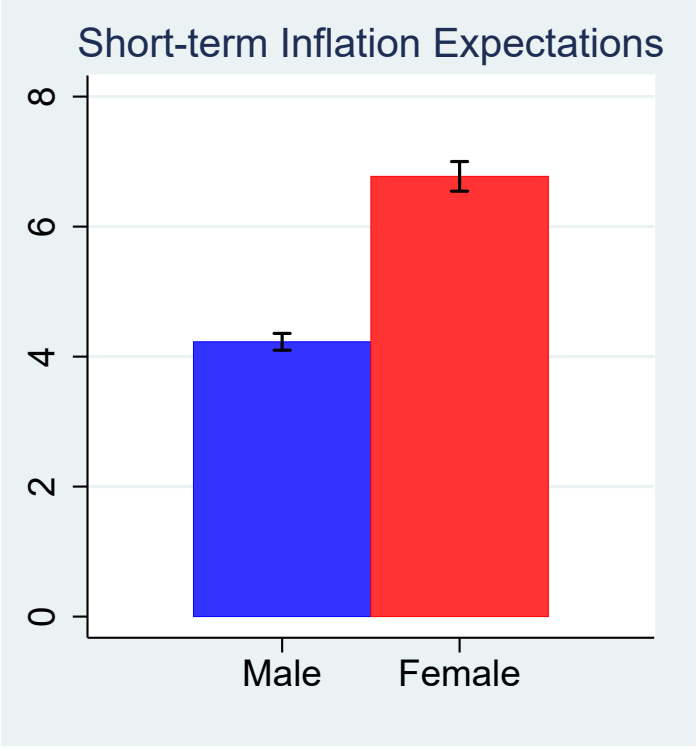
Forecast Accuracy and Expectations



Source: D'Acunto, Hoang, Paloviita, Weber (2019)

- IQ data for all men in Finland from military
- Men with low IQ: absolute forecast error for inflation of 4.5%
- Decreases monotonically with IQ
- Effect unrelated to income and education

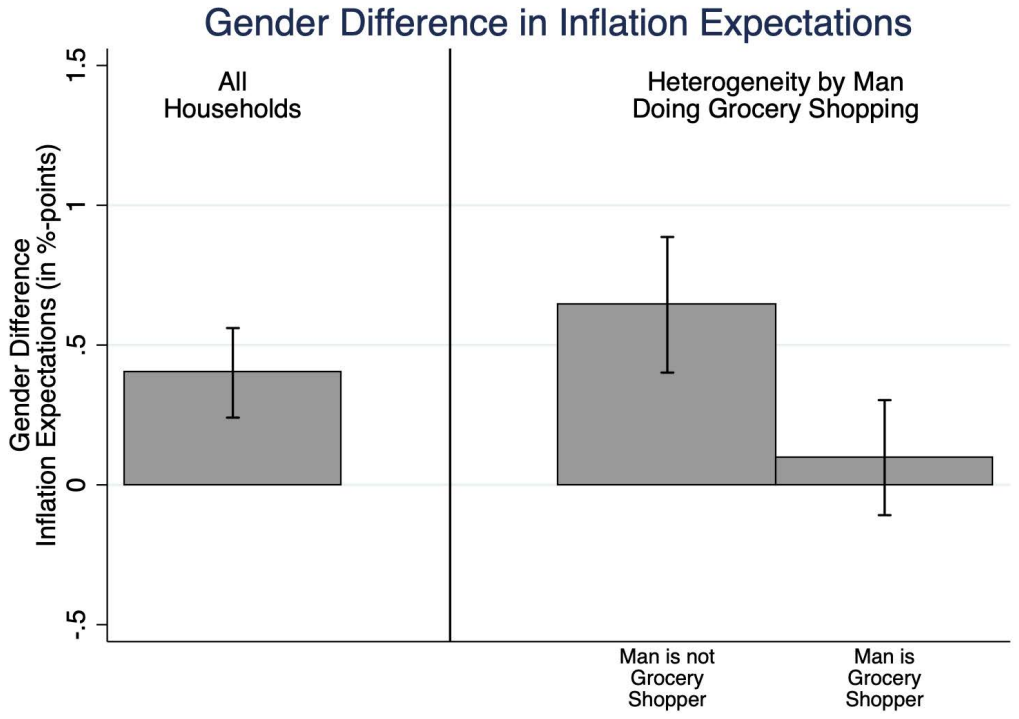
Within-Household Inflation Expectations even Wilder



Source: D'Acunto, Malmendier, Weber (2019):
"Gender Roles Distort Women's Economic Outlook"

- Women have (more) positively biased inflation expectations
- Even within households, who often make the same saving choices

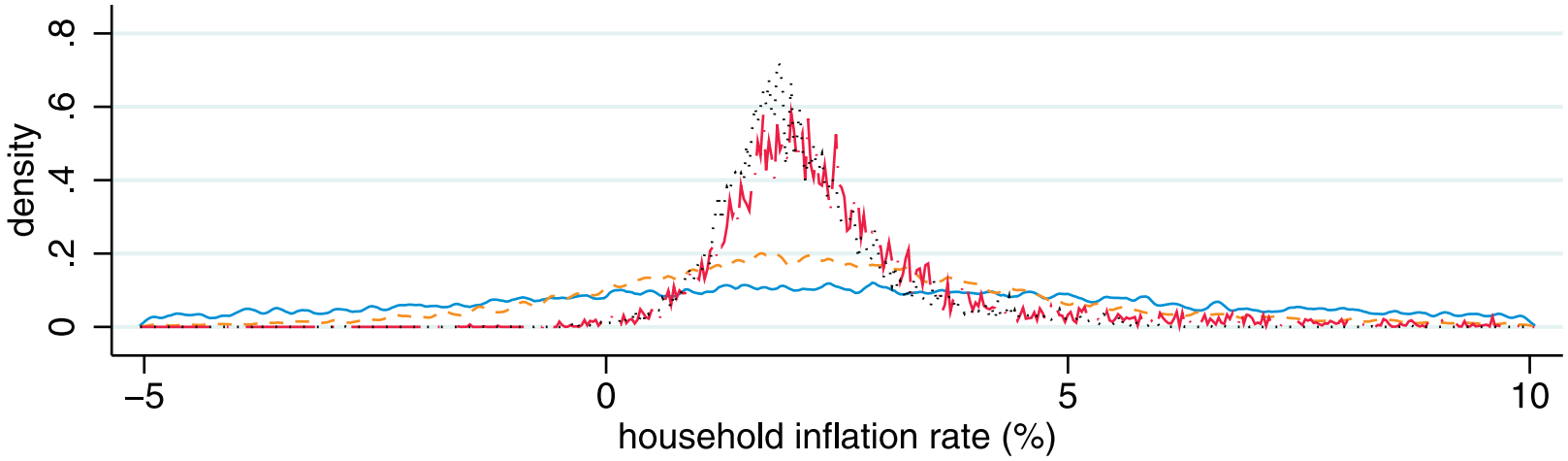
Why Are Women (More) Biased? They Do the Groceries!



Source: D'Acunto, Malmendier, Weber (2019):
"Gender Roles Distort Women's Economic Outlook"

- Large difference in inflation expectations by gender *within* household
- Unconditional difference driven by differences in grocery shopping

Grocery Prices in the Cross-section of Households



Source: Kaplan & Schulhofer-Wohl (JME, 2017)

- Large cross-sectional dispersion in realized shopping-bundle inflation
- Interquartile range of 6.7 percentage points
- Differences in price paid drive dispersion, not goods purchased

This Paper

- How important personal price changes for inflation expectations?
  - Idea (Lucas, 1972): observed price changes in one's daily life
  - Surprisingly, never assessed in the field
  - Need to observe BOTH expectations and prices paid by households
  - We elicit expectations and pair them with households' grocery bundles

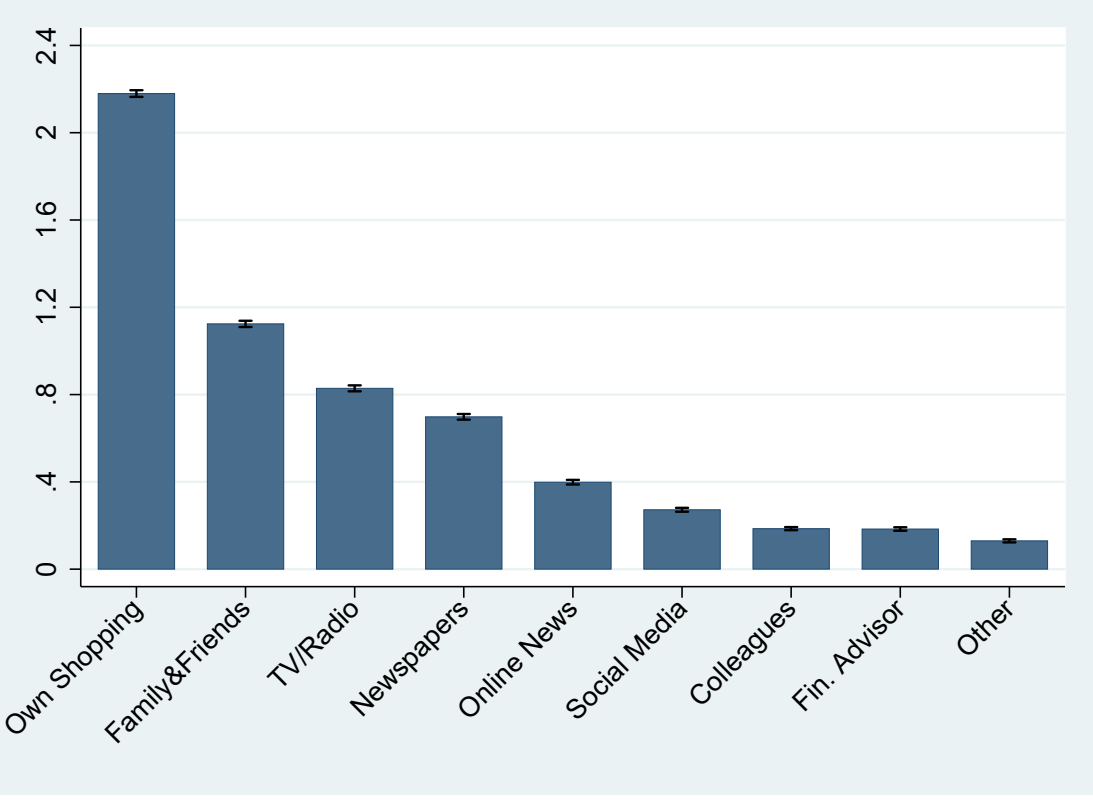
- Why are personal price changes important?
  - **Size of Exposure: expenditure share**

    Weigh more price changes of goods HHs spend more money on (e.g., Cavallo, Cruces, and Perez-Truglia, 2015)
  - **Frequency of Exposure and Recall**:

    Weigh more price changes of goods HHs purchase frequently (e.g., Bruine et al, 2015; Georganas et al., 2014, Bordalo et al., 2019)

Both potentially consistent with rational inattention, more later

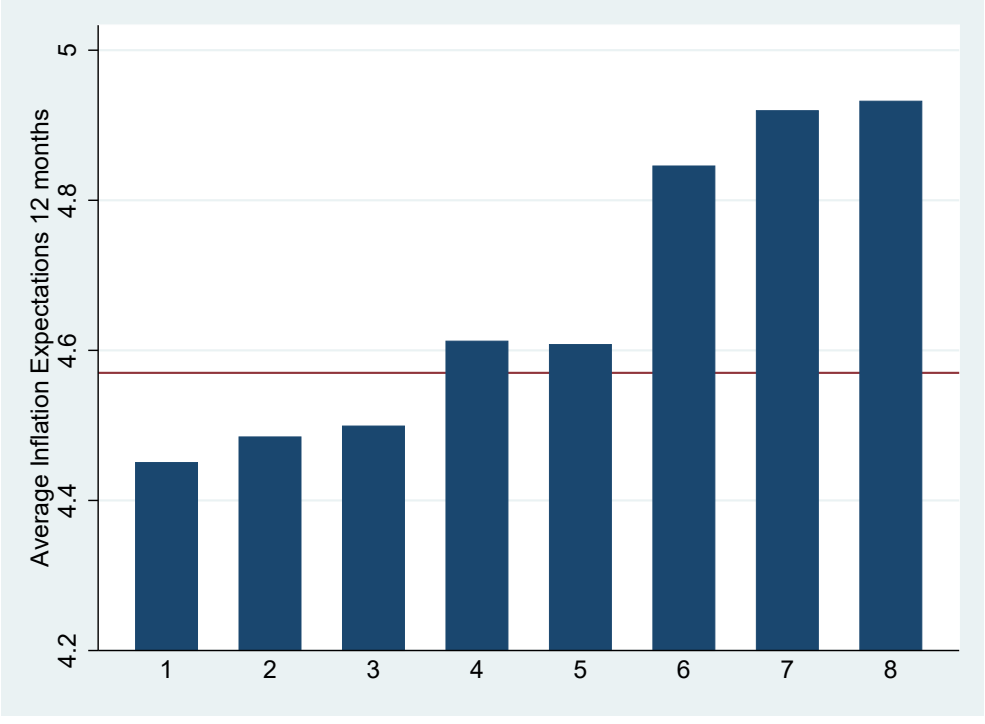
Shopping is the Most Important Source of Information



Source: Chicago Booth Expectations and Attitudes Survey

- Most relevant sources of information when we asked their inflation expectations
- Own (and family) shopping much more common than media, other sources

Variation in Households' Bundles → Inflation Expectations



Source: Chicago Booth Expectations and Attitudes Survey

- Sort households into bins by grocery price changes
- High-low portfolio: difference in expected inflation of 0.5 percentage points
- Economically sizeable given inflation target of 2%

Summary

- Data Sources
  - Novel survey on expectations and attitudes of Nielsen households
- Why do we focus on perceived inflation from groceries?
  - Doing groceries $\rightarrow$ inflation expectations
- Baseline: observed price changes and inflation expectations
  - Observed price changes positively associated with inflation expectations
- Heterogeneity across households
  - Information sources important
  - Sophistication matters
  - Results not fully consistent with rational inattention

Data Sources

- Nielsen Homescan Database
  - Purchase file: quantities and prices at the UPC level
  - Trips file: expenditure growth
  - Panelist file: demographics
- Chicago Booth Expectations and Attitudes Survey
  - Customized survey on all households members in panel
  - 2 waves: June 2015 and June 2016
  - Expectations: inflation, interest rates, income, employment

Chicago Booth Expectations and Attitudes Survey I

- (Additional) Demographics

  Education, employment, industry, looking for job

- Other expenditures and income

  Income growth, mortgage, rent, college tuition, gas, health care, restaurants

- Prices, inflation, and house prices

  Short- & long-run, point estimate & distribution, prices of goods vs. inflation

Chicago Booth Expectations and Attitudes Survey II

- (General) economic outlook

  Aggregate & personal outlook, interest & mortgage rates, short- & long-run

- Consumption and savings

  Good time to consume & save, savings rate, portfolio allocation

- Financial literacy

  Inflation & real consumption, compounding, risk aversion

Measures of Inflation Expectations

- Asking about inflation (NY Fed) versus prices (Michigan) matters
  - Prices of goods people purchase results in (larger) upward bias
- Randomize questions
- Ask for point estimate and distribution
- Also elicit long-run inflation expectations

Channels and Mechanisms

- Question on primary grocery shopper in household
- Asked whether had specific prices in mind
- Sources of information
- Past price changes of specific goods
- Expenditure shares

Summary Statistics

- Full Nielsen panel: 92,511 unique households
- Survey: 49,383 individuals from 39,809 HHs (43% response rate)
- 40 questions with average response time of 14 min 49 sec
  - 67% women
  - Mean age: 53
  - Modal income: USD 80k
  - 28% with college degree

Measures: Economic Exposure vs. Frequency Bias/Salience

Construct household-level measures of *perceived* inflation

- *Size of Exposure*:

  proportion of overall budget spent on each good purchased matters

  e.g., Cavallo, Cruces, Perez-Truglia (2015); Armantier et al. (2016)

  $\rightarrow$ weigh price changes by expenditure shares: **Household CPI**

- *Frequency of Exposure*:

  frequency of exposure to goods' prices should matter

  Watanabe (2016): frequent stimuli recalled more, even if agent pays no attention

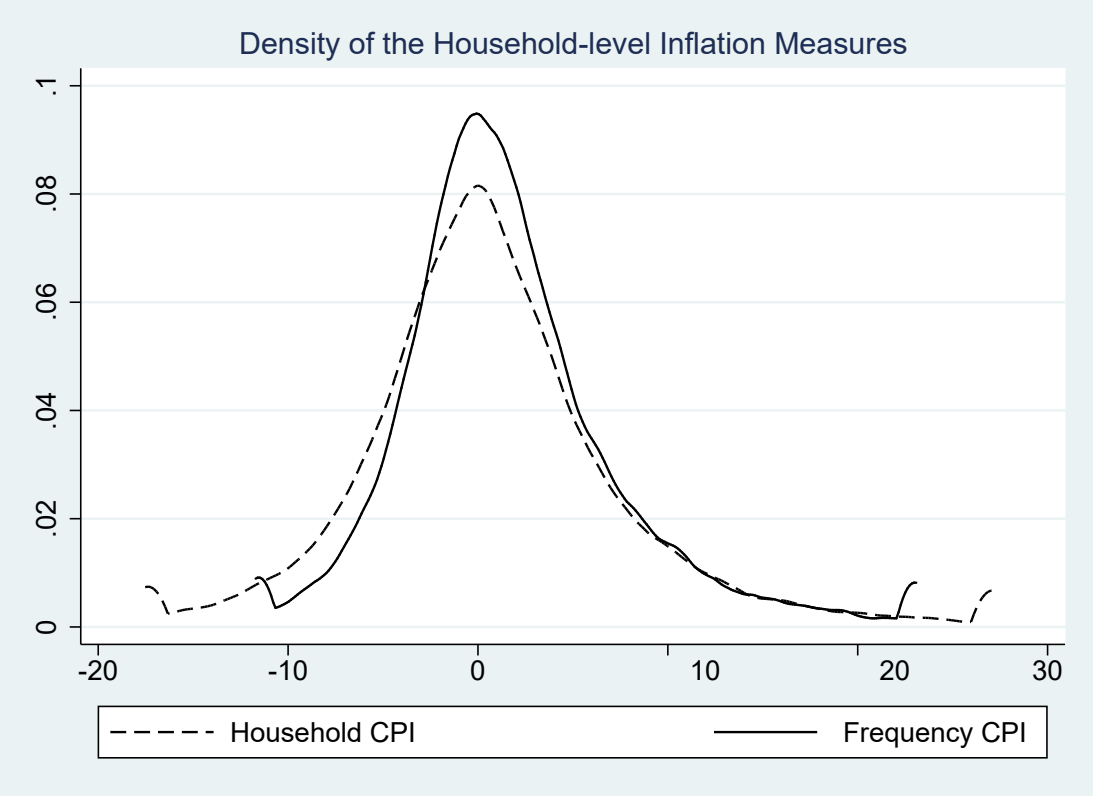
  In Economics: de Bruin et al. (2011); Bordalo, Gennaioli, & Shleifer (2013, 2019)

  $\rightarrow$ weigh price changes by frequency of purchases: **Frequency CPI**

Realized Inflation at the Household Level

- Chained Laspeyres price index
- Base period for wave 1: June 2013 to May 2014
- Prices: volume-weighted average within year
- $CPI_{i,t} = \frac{\sum_{n=1}^{N} \Delta p_{n,i,t} \times \omega_{n,i}}{\sum_{n=1}^{N} \omega_{n,i}}$
- $p_{n,i,t}$: log price of good n faced by household i at time t
- $\omega_{n,i}$: weight of good n in inflation rate for household i
- Household CPI: $\omega_{n,i} = p_{n,i,0} \times q_{n,i,0}$
- Frequency CPI: $\omega_{n,i} = f_{n,i,0}$ (frequency of purchases in base period)

Realized Inflation at the Household Level



Source: Chicago Booth Expectations and Attitudes Survey

- Mean realized inflation of 0.81% (household CPI) and 1.61% (frequency CPI)
- Realized inflation food and beverages of 1.56% in 05/2015 and 0.71% in 05/2016

Observed Price Changes and $\mathbb{E}$(Inflation)

$$\mathbb{E}\,\pi_{i,t:t+1} = \alpha + \beta \times \textit{Observed}\ \pi_{i,t-1:t} + X_i'\gamma + Y_i'\gamma + \eta_I + \eta_t + \epsilon_i,$$

- Regress expected inflation, $\mathbb{E}\,\pi_{i,t:t+1}$, on observed price changes
  - Frequency CPI
  - Household CPI
- Demographics X: income, age, education, gender, employment, home owner, marital status, household size, race, risk aversion, patience
- Expectations Y: income, economic outlook, financial outlook
- Fixed effects: county, survey wave, question type, individual (η_I)
- Cluster standard errors at household level

Observed Price Changes and $\mathbb{E}$(Inflation): Household CPI

$$\mathbb{E}\,\pi_{i,t:t+1} = \alpha + \beta \times \textit{Observed}\ \pi_{i,t-1:t} + X_i'\gamma + Y_i'\gamma + \eta_I + \eta_t + \epsilon_i,$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Household CPI	0.17***	0.17***	0.21***				0.05	0.03	0.09
	(0.04)	(0.04)	(0.07)				(0.06)	(0.06)	(0.09)
Frequency CPI				0.20***	0.20***	0.31***	0.16***	0.18***	0.23**
				(0.04)	(0.04)	(0.09)	(0.06)	(0.06)	(0.12)
Nobs	59,126	57,730	57,730	59,126	57,730	57,730	59,126	57,730	57,730
R^2	0.0279	0.0952	0.7905	0.0281	0.0954	0.7905	0.0281	0.0954	0.7905
Demographics		X	X		X	X		X	X
Expectations		X	X		X	X		X	X
County FE		X	X		X	X		X	X
Individual FE			X			X			X

Standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

- 1 std higher observed price changes: expect 0.2 pp. higher inflation next 12 months
- Similar magnitude within individual

Observed Price Changes and $\mathbb{E}$(Inflation): Frequency CPI

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Expectations		X	X		X	X		X	X
County FE		X	X		X	X		X	X
Individual FE			X			X			X

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Expectations		X	X		X	X		X	X
County FE		X	X		X	X		X	X
Individual FE			X			X			X

Standard errors in parentheses

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- Frequently-observed price changes drive association with expectation inflation

Heterogeneity: Information Sources

- Ask in wave 2 which sources of information participants thought about
- Possible choices:
  - Newspaper, Magazine
  - Radio, Television
  - Social networking websites
  - Other websites
  - Colleagues
  - Friends & Family
  - Financial advisors
  - Shopping experience
- Create dummies for media, own experiences, other people

Observed Price Changes, Expected Inflation & Info Sources

$$\mathbb{E}\,\pi_{i,t:t+1} = \alpha + \beta \times \textit{Observed}\ \pi_{i,t-1:t} + X_i'\gamma + Y_i'\gamma + \eta_I + \eta_t + \epsilon_i,$$

	Media		Other People		Own Experience	
	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Frequency CPI	0.30***	0.08	0.28***	0.12*	0.14***	0.28***
	(0.07)	(0.07)	(0.08)	(0.07)	(0.06)	(0.08)
Nobs	13,224	12,823	12,306	13,741	16,541	9,506
R^2	0.1131	0.0517	0.1167	0.0556	0.0717	0.1243
Demographics	X	X	X	X	X	X
Expectations	X	X	X	X	X	X
County FE	X	X	X	X	X	X

Standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

- Individuals relying on media & others do not extrapolate from observed Δ prices
- Individuals relying on own experience drive results

Heterogeneity: Sophistication

- Large heterogeneity in forecast accuracy by cognitive abilities

  D'Acunto, Hoang, Paloviita, Weber (2019 a,b,c)

- Effect muted for more sophisticated individuals?

- Split samples by
  - Quantitative major
  - Mortgage holder
  - Propensity to round expectations: sign of uncertainty

Observed Prices, Expected Inflation & Sophistication

$$\mathbb{E}\,\pi_{i,t:t+1} = \alpha + \beta \times \textit{Observed}\ \pi_{i,t-1:t} + X_i'\gamma + Y_i'\gamma + \eta_I + \eta_t + \epsilon_i,$$

	Quantitative Major		Mortgage Holder		Rounders	
	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Frequency CPI	0.21***	0.15**	0.23***	0.13***	0.09***	0.24***
	(0.04)	(0.07)	(0.06)	(0.05)	(0.03)	(0.05)
Nobs	47,773	9,957	19,582	21,429	19,860	37,870
R^2	0.0938	0.1341	0.1114	0.1178	0.0683	0.1008
Demographics	X	X	X	X	X	X
Expectations	X	X	X	X	X	X
County FE	X	X	X	X	X	X

Standard errors in parentheses

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- Effect muted for more sophisticated individuals

More on Frequency and Recall

- We test for 3 additional predictions of salience/recall

1. Larger price changes (in any direction) should matter more
   - Large price changes are more salient, surprising
   - Irrespective of expenditure share on goods
2.
   -
   -
3.

Large Price Changes and Inflation Expectations

	Bottom Frequency CPI		Intermediate Frequency CPI		Top Frequency CPI	
	(1)	(2)	(3)	(4)	(5)	(6)
Frequency CPI	0.30**	0.32**	0.09	−0.01	0.16**	0.20**
	(0.15)	(0.15)	(0.28)	(0.33)	(0.08)	(0.08)
Range Frequency CPI	[-0.117, -0.009]		[-0.009, 0.028]		[0.028, 0.231]	
Nobs	19,706	18,568	19,707	18,903	19,713	18,749
R^2	0.0230	0.1002	0.0293	0.1038	0.0314	0.1122
Demographics		X		X		X
Expectations		X		X		X
County FE		X		X		X

Standard errors in parentheses

- Split the sample in 3 equal-sized group by size grocery price changes
- Reaction fully driven by larger price changes, in either direction

More on Frequency and Recall

- We test for 3 additional predictions of salience/recall

1. Larger price changes (in any direction) should matter more
   - Large price changes are more salient
   - Irrespective of expenditure share on goods
2. Less frequent shoppers should react more to price changes
   - If shop frequently, most prices do not change & small changes (+ / -)
   - If shop infrequently:
     (i) less price changes observed in general
     (ii) larger price changes on average
     $\rightarrow$ Easier to recall observed price changes
3.

Less Frequent Shoppers and Inflation Expectations

Three proxies for frequency of grocery shopping:

- Primary Grocery Shopper for the Household
  - YES: 0.17*** NO: 0.27***
- Shopping Frequency
  - Once a week or more: 0.17*** Less than once a week: 0.28***
- Distance from Primary Shopping Outlet
  - <20m: 0.14*** 20m>t>60m: 0.27*** >60m: 0.80***

Overall, effect larger for less frequent shoppers

More on Frequency and Recall

- We test for 3 additional predictions of salience/recall

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- Large price changes are more salient
- Irrespective of expenditure share on goods

2. Less frequent shoppers should react more to price changes

- If shop frequently, most prices do not change & small changes (+ / -)
- If shop infrequently:
  (i) less price changes observed in general;
  (ii) larger price changes on average
  $\rightarrow$ Easier to recall observed price changes

3. Exposure to *other* prices crowds out salience grocery prices

Exposure to non-Grocery Prices and Inflation Expectations

Two proxies for frequency of exposure to other price changes:

- Monthly Frequency go to Gas Stations
  - HIGH: 0.16^{***} LOW: 0.27^{***}
- Monthly Frequency go to Restaurants
  - HIGH: 0.13^{***} LOW: 0.25^{***}

Overall, effect larger for shoppers less exposed to alternative price changes

Conclusions

- Inflation expectations only policy tool in times of low rates
- What explains the variation in households' inflation expectations?
- This paper: easy-to-recall price changes drive inflation expectations
- Size of exposure vs. frequency of exposure and recall
  - Frequency CPI (overweigh frequent goods) drives the results
  - Effects stronger for larger price changes
  - Effects stronger for less frequent shoppers
  - Effects stronger for shoppers less exposed to other price changes
- Bottom line:
  Facts inform theoretical work & experiments to pin down channels