Exposure to Daily Price Changes & Inflation Expectations

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Why Inflation Expectations?

- Most **household** decisions depend on inflation expectations
  - Consumption/saving choices (D'Acunto, Hoang, and Weber, 2018)
  - Buy-versus-rent decision, mortgage uptake, mortgage type (Malmendier and Steiny 2019; Malmendier and Nagel 2015; Botsch and Malmendier 2020)
  - Bond-market participation (Malmendier and Nagel 2011)
  - Stock-market participation (Das, Kuhnen, and Nagel, 2019)
- **Monetary policy** needs to manage households' expectations
  - Example 1: **Unconventional Fiscal Policy** (uses announcements of future increases in consumption taxes to generate inflation expectations and accelerate consumption expenditure)
  - Example 2: **Forward guidance** (central bank communication about the state of the economy and likely future monetary policy, with the goal to influence the financial decisions of households and firms by providing a guidepost for the expected path of interest rates)

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."

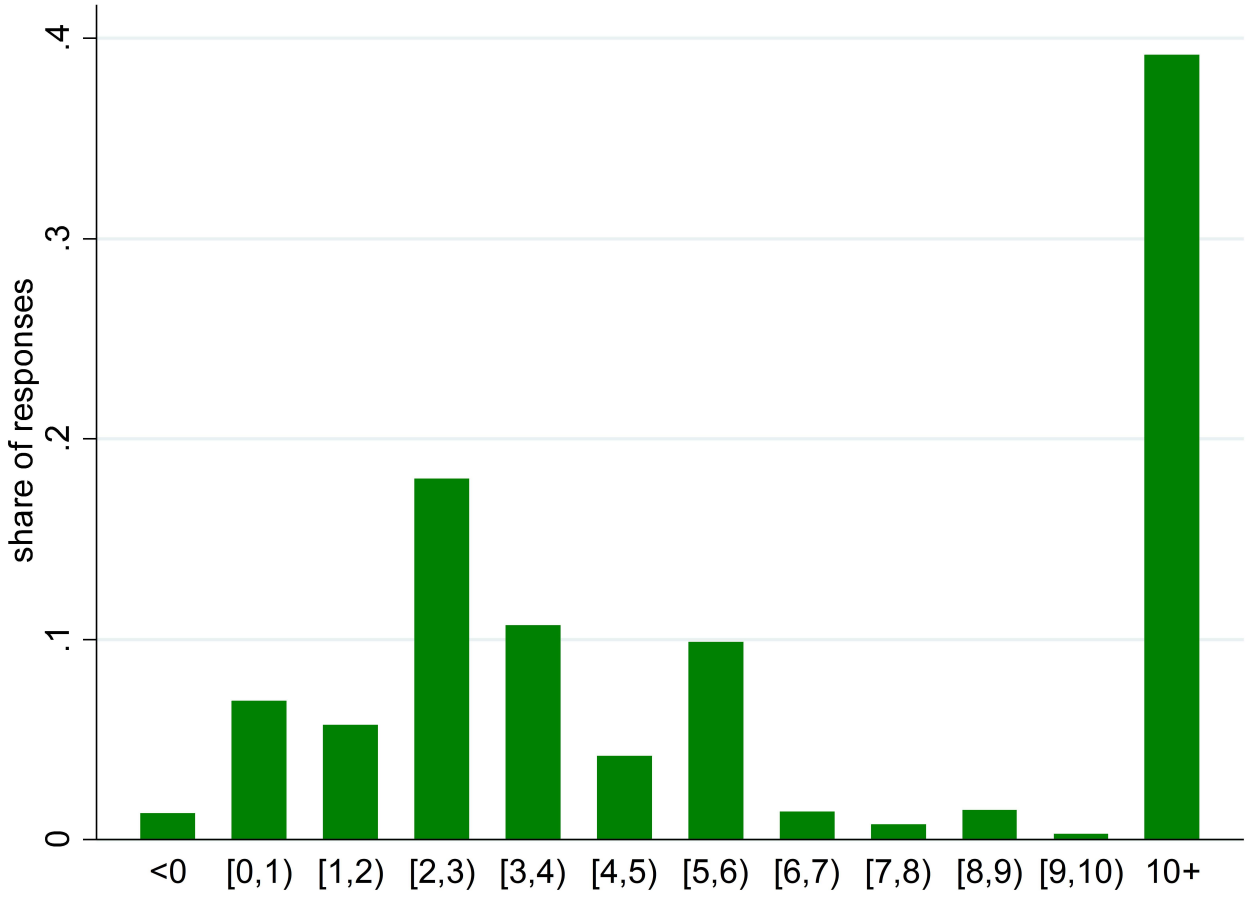
Mario Draghi, 2016

"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

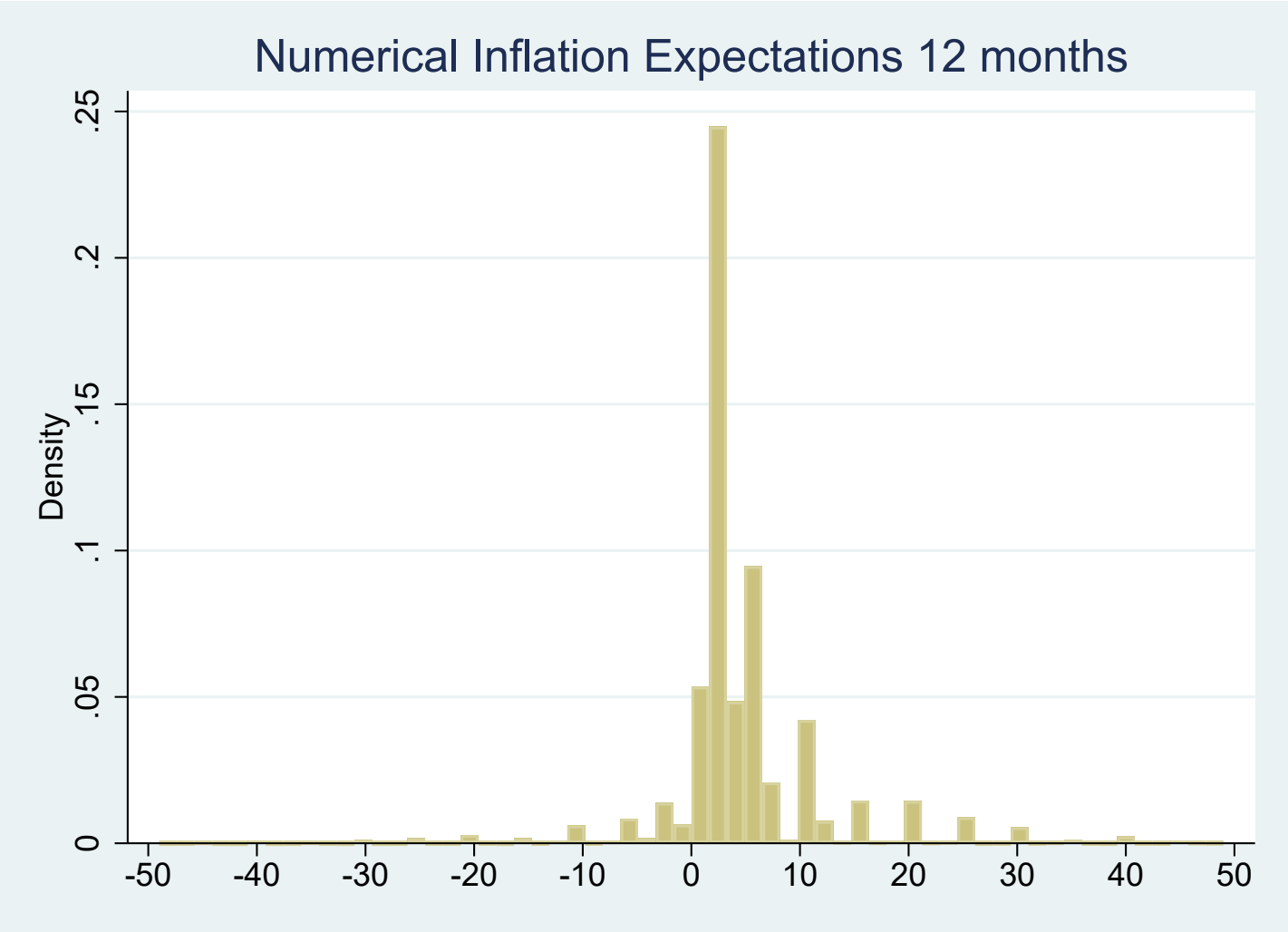
» Cf. discussion about recent Fed policy change to "average inflation target" (WSJ: "A flexible Fed means higher inflation")

BUT Households have little knowledge about current inflation...



Source: Chicago Booth Expectations and Attitudes Survey

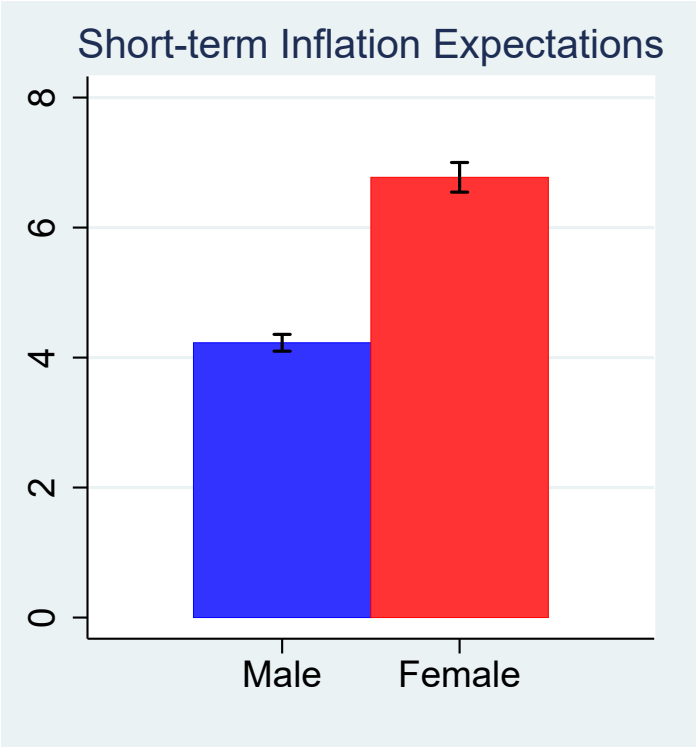
... AND Expectations Are Wild



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%

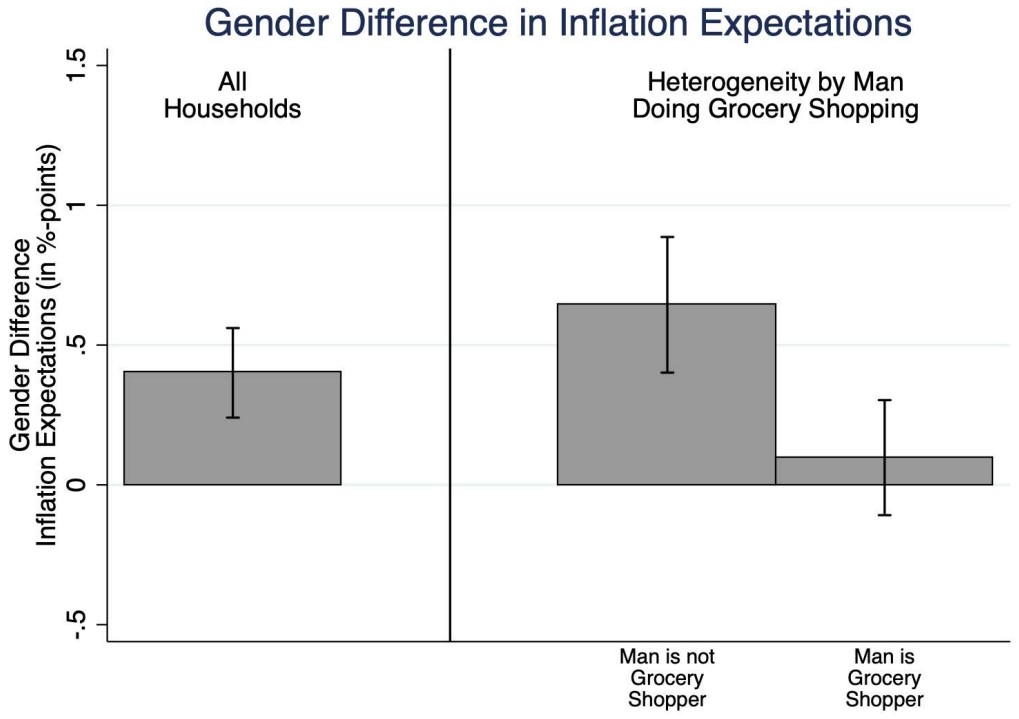
Even Within-Household Inflation Expectations Are Wild



Source: D'Acunto, Malmendier, Weber (2020):
"Gender Roles and the Gender Expectations Gap"

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

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



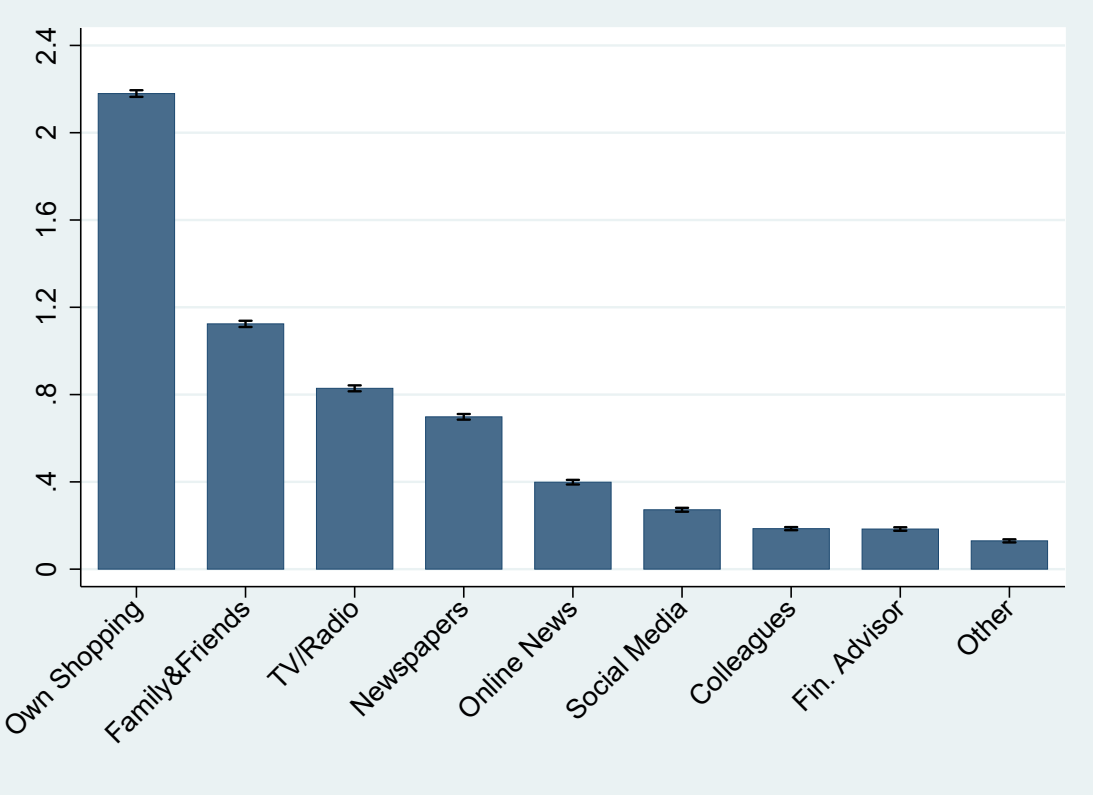
Source: D'Acunto, Malmendier, Weber (2020): *"Gender Roles and the Gender Expectations Gap"*

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

This Paper

- How important personal exposure to price changes for inflation expectations?
  - Idea (Lucas, 1972): price changes in one's daily life
    - In his seminal islands model, Lucas posits that agents use the prices they observe in their daily lives to form expectations about aggregate inflation.
    - "*[T]he history of prices* [...], *observed by an individual is his source of information on the current state of the economy and of the market z in which he currently finds himself; equivalently, this history is his source of information on future price.*" (Lucas 1975)
    - Surprisingly, never assessed in the field.
- Need to observe BOTH expectations and prices paid by households
- We use novel data, combining Kilts-Nielsen with the Chicago Booth Attitudes and Expectations Survey, which elicit expectations that can be paired with households' grocery bundles.

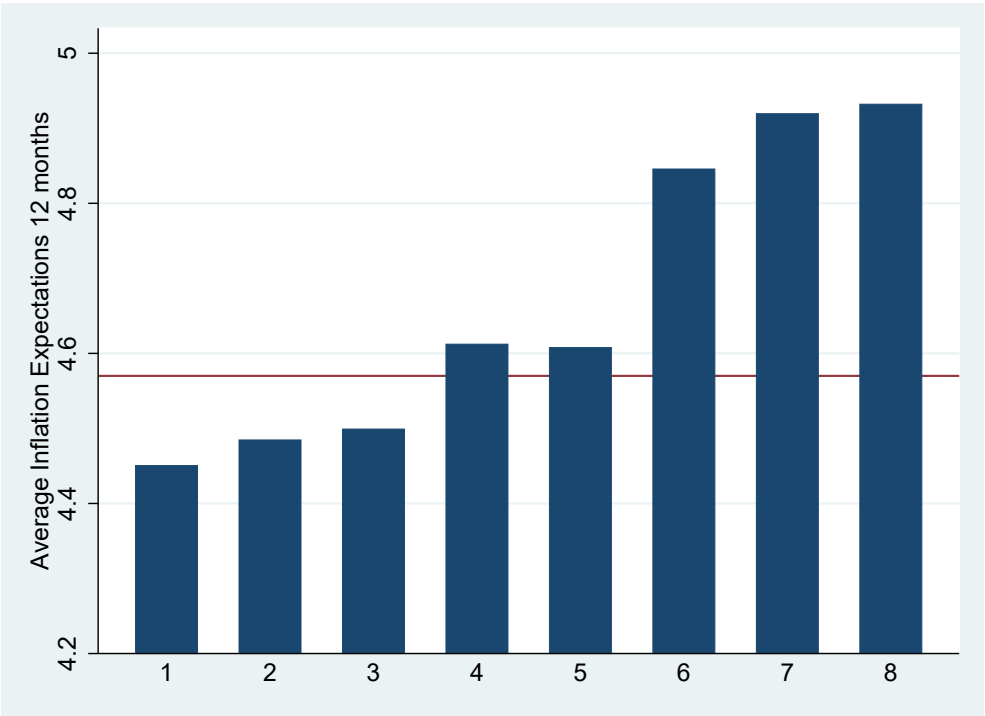
Shopping is the Most Important Source of Information



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

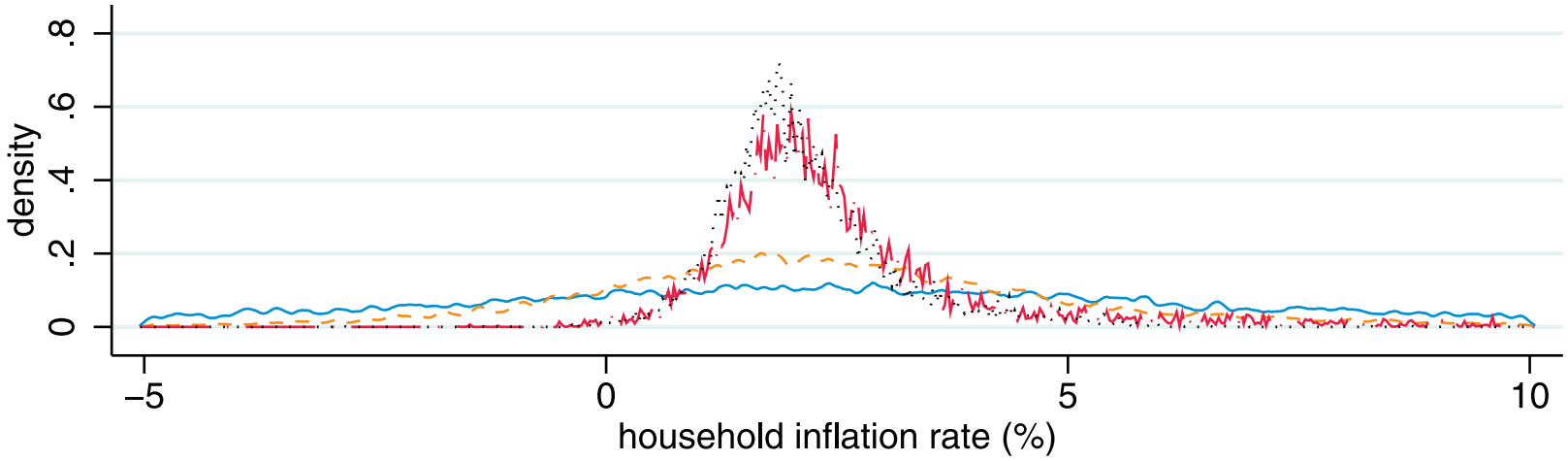
Variation in Inflation in Households' Grocery Bundles → Inflation Expectations



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%.

Grocery Prices in the Cross-section of Households

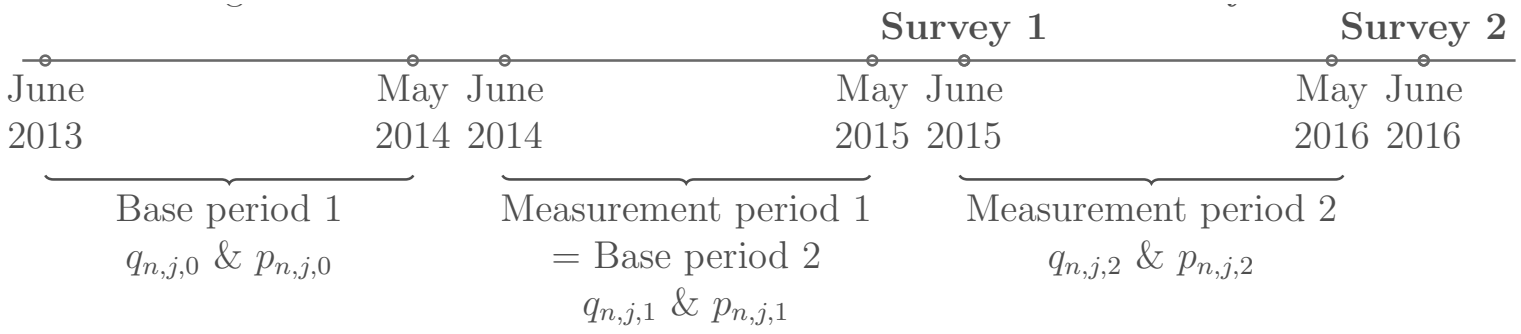


Source: Kaplan & Schulhofer-Wohl (JME, 2017)

- 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

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 versus frequencies

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 of Exposure

- *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

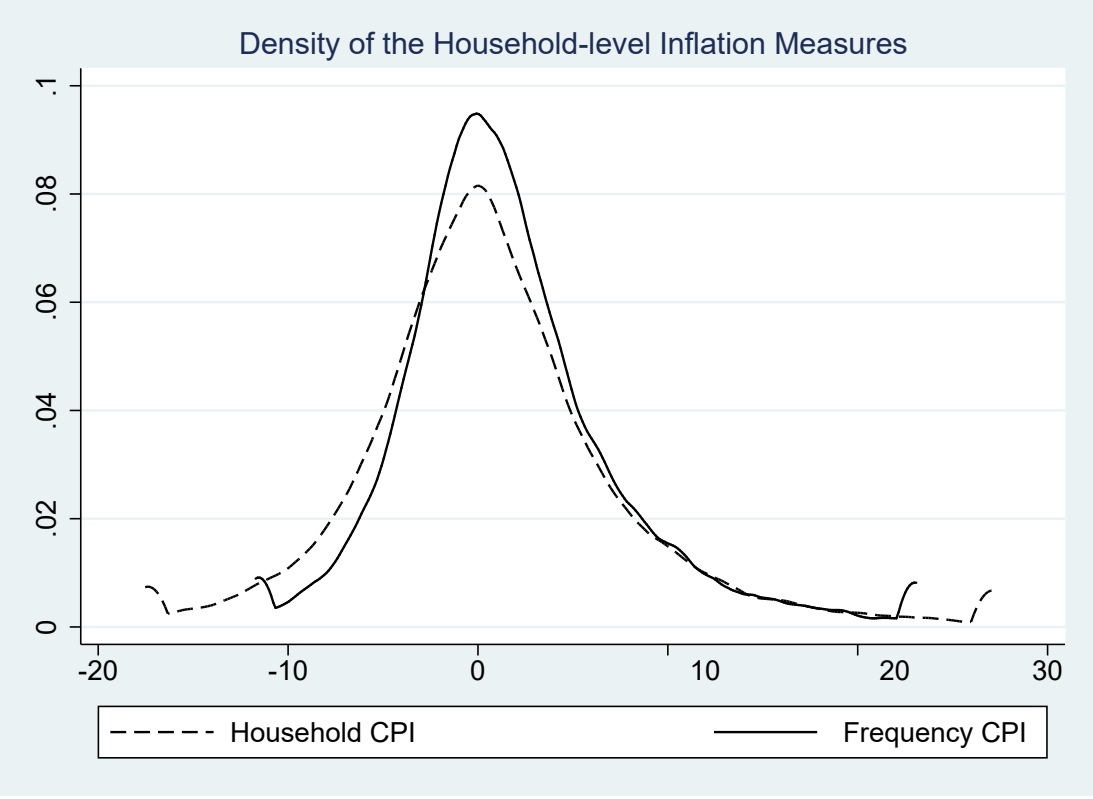
  In Economics: de Bruin et al. (2011); Bordalo, Gennaioli, & Shleifer (2013, 2019)

  $\rightarrow$ 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
- Measurement period for wave 1: June 2014 to May 2015
- 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

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

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

- Regress expected inflation, $\mathbb{E}\,\pi_{i,t:t+1}$, on price changes experienced in personal shopping bundle
  - 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

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

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

	(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

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

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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

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- Frequently-observed price changes drive association with expectation inflation

Heterogeneity: Sophistication

- Effect muted for more sophisticated individuals?
- Split samples by
  - Quantitative major
  - Mortgage holder
  - Propensity to round expectations: sign of uncertainty

Exposure, Expected Inflation & Sophistication

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

	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

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

- Effect smaller but still sizeable and significant for more sophisticated individuals

More on Frequency and Recall

- We test for 3 additional predictions

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

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. 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

- The environment consumers live in and their exposure to specific price-signals 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