

# Exposure to Daily Price Changes and Inflation Expectations

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# Households' Inflation Expectations → Household Finance

- Key variable for economic decisions: perceived real interest rate

$$r_t^i = i_t - \mathbb{E}_t^i \pi_{t+1}$$

- Most **household finance** decisions depend on inflation expectations
  - ▶ Consumption/saving choices (D'Acunto, Hoang, and Weber, 2018)
  - ▶ Mortgage Uptaking, Type (Malmendier and Nagel, 2015)
  - ▶ Stock Market Participation (Das, Kuhnen, and Nagel, 2019)
- Normal times:  $\Delta i_t \rightarrow \Delta r_t$  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*

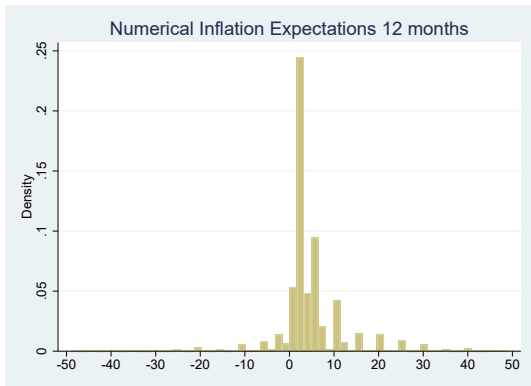
“There are forces in the global economy conspiring to hold inflation down.”

*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*

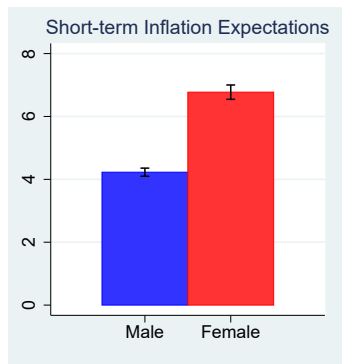
# BUT They Are Wild



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%
- Anchoring treatments largely affect expectations (Roth and Wohlfart, 2018)

## 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*”

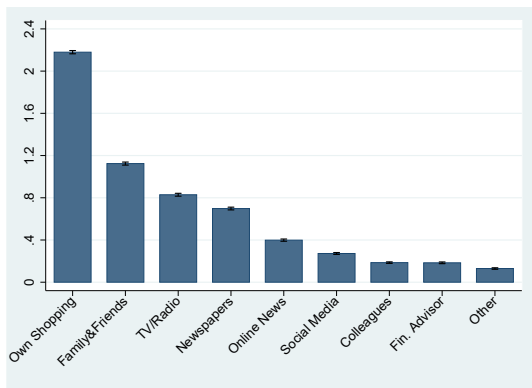
- Large difference in inflation expectations by gender *within* household
- Unconditional difference driven by differences in grocery shopping

# 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 de Bruin 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

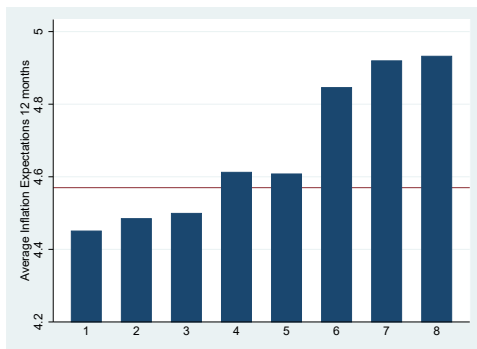


Source: Chicago Booth Expectations and Attitudes Survey

- We ask households to report the most relevant sources of information they thought about 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%

# This Paper

- What explains the process of forming inflation expectations?
  - ▶ Idea (Lucas, 1972): observed price changes in one's daily life
  - ▶ 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?
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Both potentially consistent with rational inattention, more later

# Data Sources

- **Novelty:**
  - ▶ **First time grocery bundles AND expectations at the HH level**
- Nielsen-Kilts 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

- (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

- (General) economic outlook

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

- Consumption and savings

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

# 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: Rational Inattention vs. Frequency Bias/Saliency

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)

→ 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)

→ weigh price changes by frequency of purchases: **Frequency CPI**

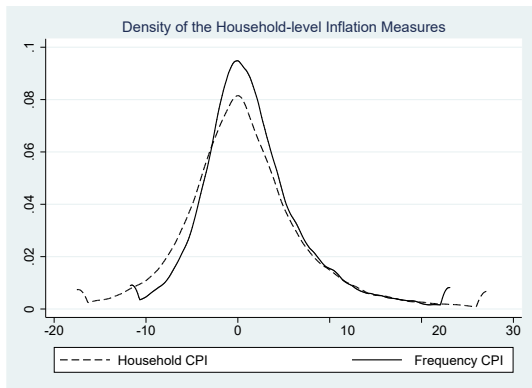
## Definition of Household-level Inflation

- 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)

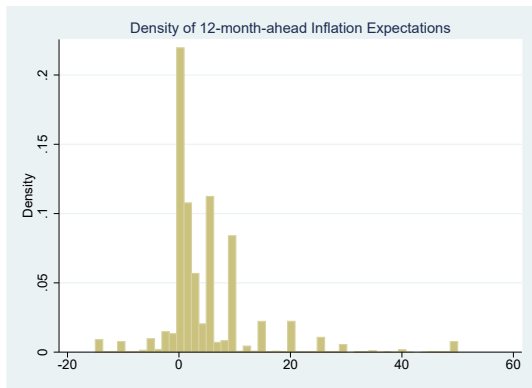
# Realized Inflation at the Household Level



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



# Heterogeneity in Expected Inflation



- Dispersion in expectations across individuals ranging from -20% to +45%
- Bunching at multiples of 5

## Grocery Price Changes and $\mathbb{E}(\text{Inflation})$

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

- Regress expected inflation,  $\mathbb{E} \pi_{i,t:t+1}$ , on observed price changes
  - ▶ Size of Exposure: Household CPI
  - ▶ Frequency of Exposure: Frequency 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 ( $\eta_i$ )
- Cluster standard errors at household level

# Grocery Price Changes and $\mathbb{E}(\text{Inflation})$ : *Household CPI*

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Household CPI	0.17*** (0.04)	0.17*** (0.04)	0.21*** (0.07)				0.05 (0.06)	0.03 (0.06)	0.09 (0.09)
Frequency CPI				0.20*** (0.04)	0.20*** (0.04)	0.31*** (0.09)	0.16*** (0.06)	0.18*** (0.06)	0.23** (0.12)
Nobs	59,126	57,730	57,730	59,126	57,730	57,730	59,126	57,730	57,730
R <sup>2</sup>	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  $\sigma$   $\uparrow$  Household CPI: expect 0.2 pp.  $\uparrow$  inflation next 12 months
- Similar magnitude within individual

# Grocery Price Changes and $\mathbb{E}(\text{Inflation})$ : *Frequency CPI*

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

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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

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

- Coefficient about 20% to 50% higher with Frequency CPI
- Similar magnitude within individual

# Grocery Price Changes and $\mathbb{E}(\text{Inflation})$ : *Both Measures*

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Household CPI	0.17*** (0.04)	0.17*** (0.04)	0.21*** (0.07)				0.05 (0.06)	0.03 (0.06)	0.09 (0.09)
Frequency CPI				0.20*** (0.04)	0.20*** (0.04)	0.31*** (0.09)	0.16*** (0.06)	0.18*** (0.06)	0.23** (0.12)
Nobs	59,126	57,730	57,730	59,126	57,730	57,730	59,126	57,730	57,730
R <sup>2</sup>	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

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

- Frequently-observed price changes drive association with expectation inflation

## 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
  2.
    - ▶
    - ▶
  - 3.

## Large Price Changes and Inflation Expectations

	Bottom		Intermediate		Top	
	Frequency CPI		Frequency CPI		Frequency CPI	
	(1)	(2)	(3)	(4)	(5)	(6)
Frequency CPI	0.30** (0.15)	0.32** (0.15)	0.09 (0.28)	-0.01 (0.33)	0.16** (0.08)	0.20** (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 <sup>2</sup>	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
- 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→ Easier to recall observed price changes
  3. Exposure to *other* prices crowds out salience grocery prices

# Exposure to non-Grocery Prices and Inflation Expectations

Three proxies for frequency of exposure to other price changes:

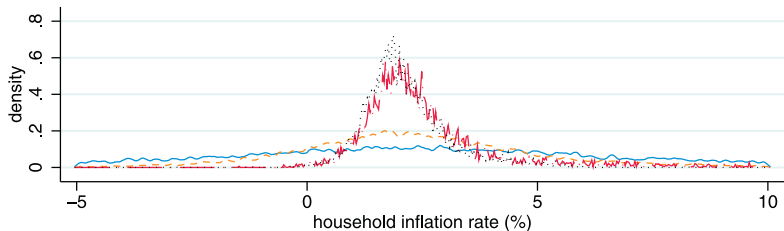
- Monthly Frequency go to Gas Stations
  - ▶ HIGH: 0.16\*\*\*      LOW: 0.27\*\*\*
- Monthly Frequency go to Restaurants
  - ▶ HIGH: 0.13\*\*\*      LOW: 0.25\*\*\*
- Mainly Relying on the Media for Forming Inflation Expectations
  - ▶ YES: 0.08      NO: 0.30\*\*\*

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

# 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