Measuring Consumer Uncertainty about Future Inflation

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Project Team

- Economists
  - Federal Reserve: Olivier Armantier, Mike Bryan, Simon Potter, Rob Rich, Giorgio Topa, Wilbert van der Klaauw, Basit Zafar
  - RAND: Jeff Dominitz, Arie Kapteyn
  - Academic researchers: Chuck Manski (Northwestern); Ken Wolpin (Penn)
- Psychologists
  - Carnegie Mellon University: Wandi Bruine de Bruin, Julie Downs, Baruch Fischhoff
  - Columbia University: Eric Johnson

Project Description: Goals

- Improve our understanding of the Reuters/Michigan Survey inflation measures
- Develop alternative questions
- Measure uncertainty about future inflation
- Track expectations of same individuals over time
- Measure wage growth expectations
- Analyze how people form/update expectations
- Relate inflation expectations to choice behavior

Project Description: Status

- In-depth cognitive interviews;
- Experimental module on inflation expectations (repeated every six weeks) included in RAND American Life Panel internet survey;
- Psychometric surveys: added special modules to ALP; Carnegie Mellon survey;
- Additional experimental module on information updating and links between beliefs and behavior.

Goals of this paper

- Feasibility of asking density questions to measure uncertainty
- Heterogeneity in expressed uncertainty and in density vs point forecasts
- Compare density forecasts to point forecasts
- Characterize inflation forecast uncertainty
- Exploit the panel dimension of our survey.

Point Forecasts

- Over the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?

[*follow up if response is "up" or "down"*]

- By about what percent do you think prices in general will go [up/down] on the average, over the next 12 months?

Density forecasts

What is the percent chance that, over the next 12 months, the following things will happen to prices in general?

- Go up by 12% or more _____percent chance
- Go up by 8% to 12% _____percent chance
- Go up by 4% to 8% _____percent chance
- Go up by 2% to 4% _____percent chance
- Go up by 0% to 2% _____percent chance
- Go down by 0% to 2% _____percent chance
- Go down by 2% to 4% _____percent chance
- Go down by 4% or more _____percent chance

100% total

Sample and Measures

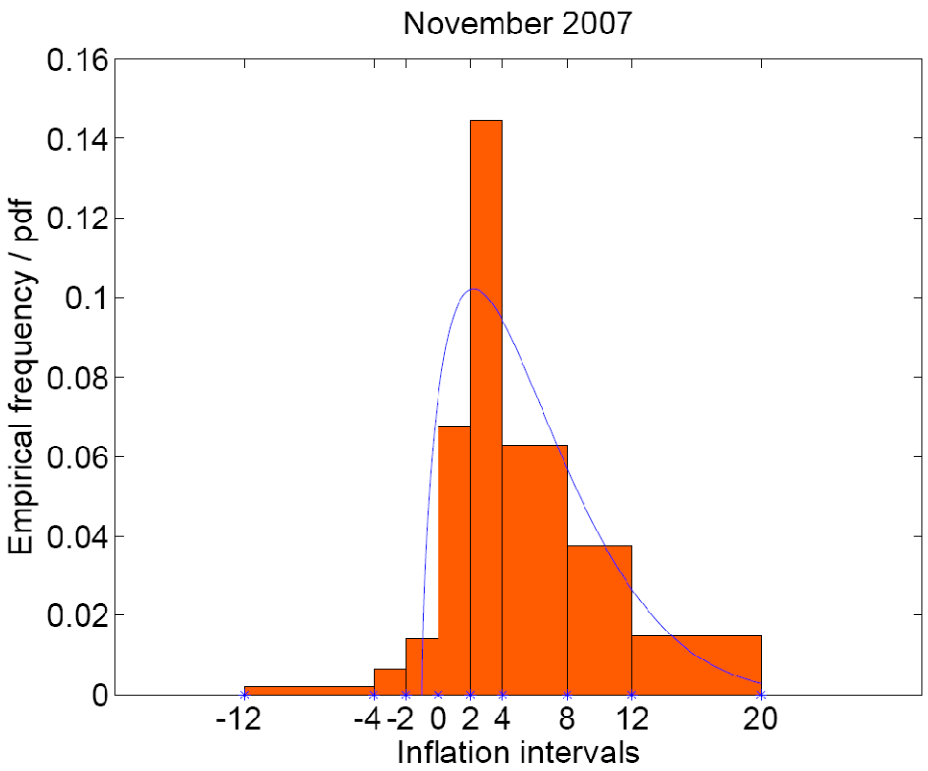
- Members of RAND's American Life Panel participated in
  - A one-time special survey (n=559)
  - A panel survey with 22 waves held since Nov 2007 (n~400 per wave)
- All gave point and density forecasts of price inflation and wage inflation
- For each individual, we computed
  - Density median to reflect *density forecast*
  - Density IQR to reflect *forecast uncertainty*

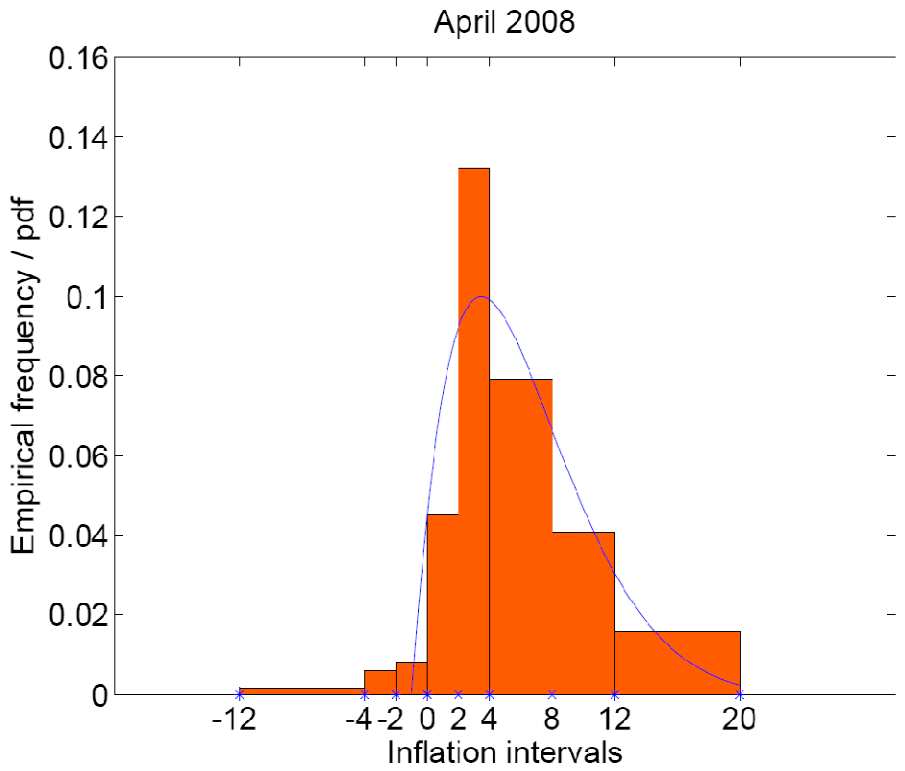
Parametric density estimation

- Approximate underlying density function by a **generalized Beta distribution** (if more than 2 intervals used) or **triangular distribution** (for one or two intervals) as in Engelberg, Manski and Williams (2009)

- Use parameter estimates to derive median and IQR for each individual respondent

Average probabilistic responses and fitted densities





Mean	Median	IQR
5.6	4.7	6.1

Mean	Median	IQR
6.2	5.4	5.9

Source: Fed Mini-Module

Feasibility of Density question

	Special	Panel
Item response rate	98.8%	99.6%
Pct. responses adding to 100%	98.9%	99.1%
Pct. using adjacent bins	98.7%	98.4%
Pct. probability in more than one bin	96.4%	89.4%
Avg Number of Bins with Positive Probability	4.8	3.8
Proportion with Range Responses	43%	29%
Correlation btw range use and Uncertainty	0.11	0.05
Correlation btw range size and Uncertainty	0.58	0.49
Rating of *density forecast* difficulty	M=3.9	-
Rating of *point forecast* difficulty	M=3.6	-

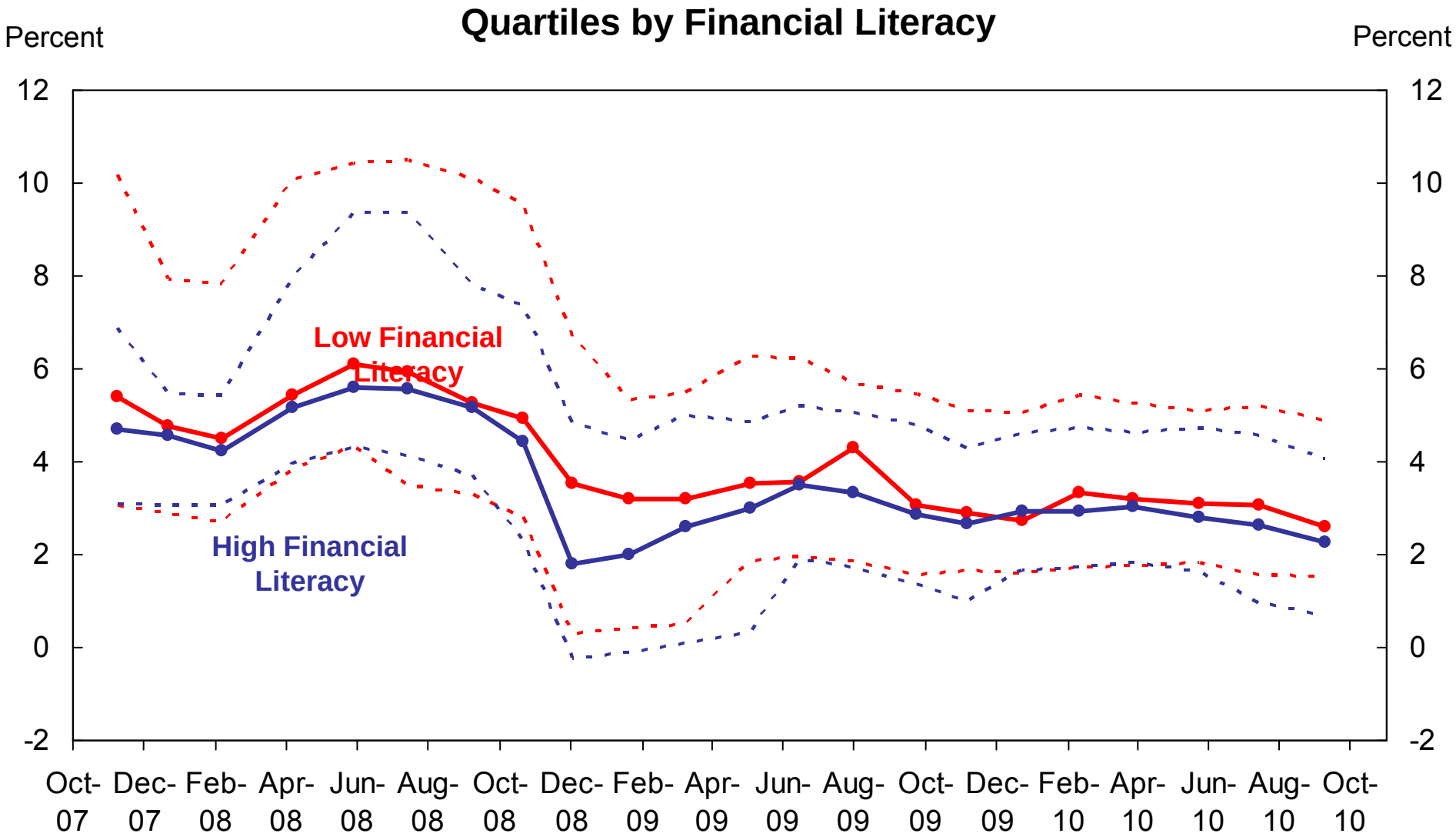
Heterogeneity

	MDN Point forecast	MDN Density forecast	MDN Density IQR
Female	4.8***	4.7***	2.7***
Male	4.1	3.8	2.3
No college	4.8***	4.9***	2.4
College	4.1	3.8	2.5
Income <=$75k	4.8***	4.9***	2.6*
Income >$75k	3.9	3.6	2.4

Heterogeneity in Uncertainty by Financial Behavior

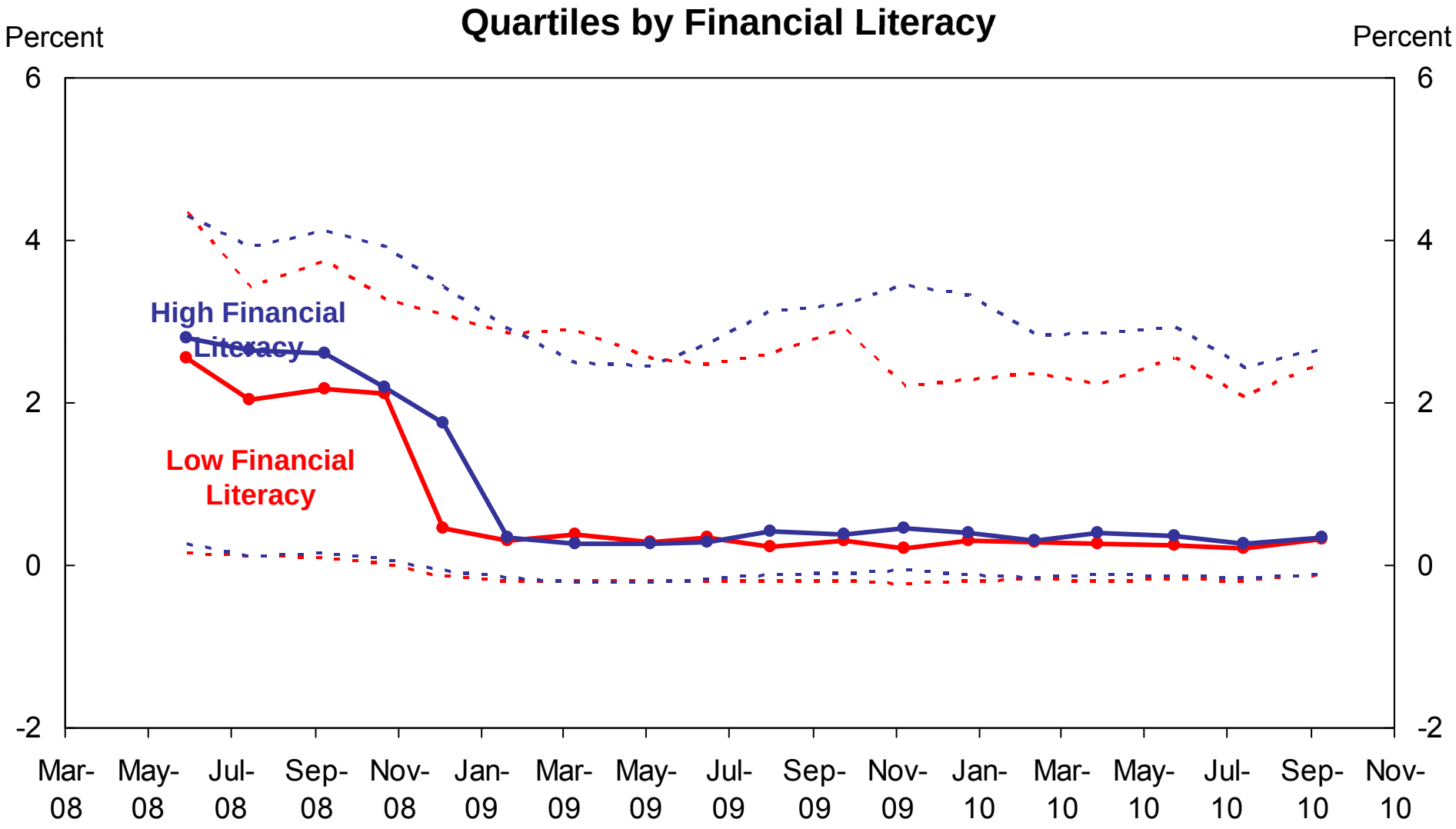
Rank correlations	Uncertainty	Pt forecast
Financial Literacy	-0.24**	-0.26**
Planning Horizon	-0.18**	-0.14**
Responsibility Investing	-0.13**	-0.11*

Year-Ahead Inflation Expectations(PG)



NYFed-ALP Panel. 25th, 50th, and 75th percentiles of the distribution of point forecasts of year-ahead 'prices in general,' by financial literacy.

Year-Ahead Inflation Expectations(WG)



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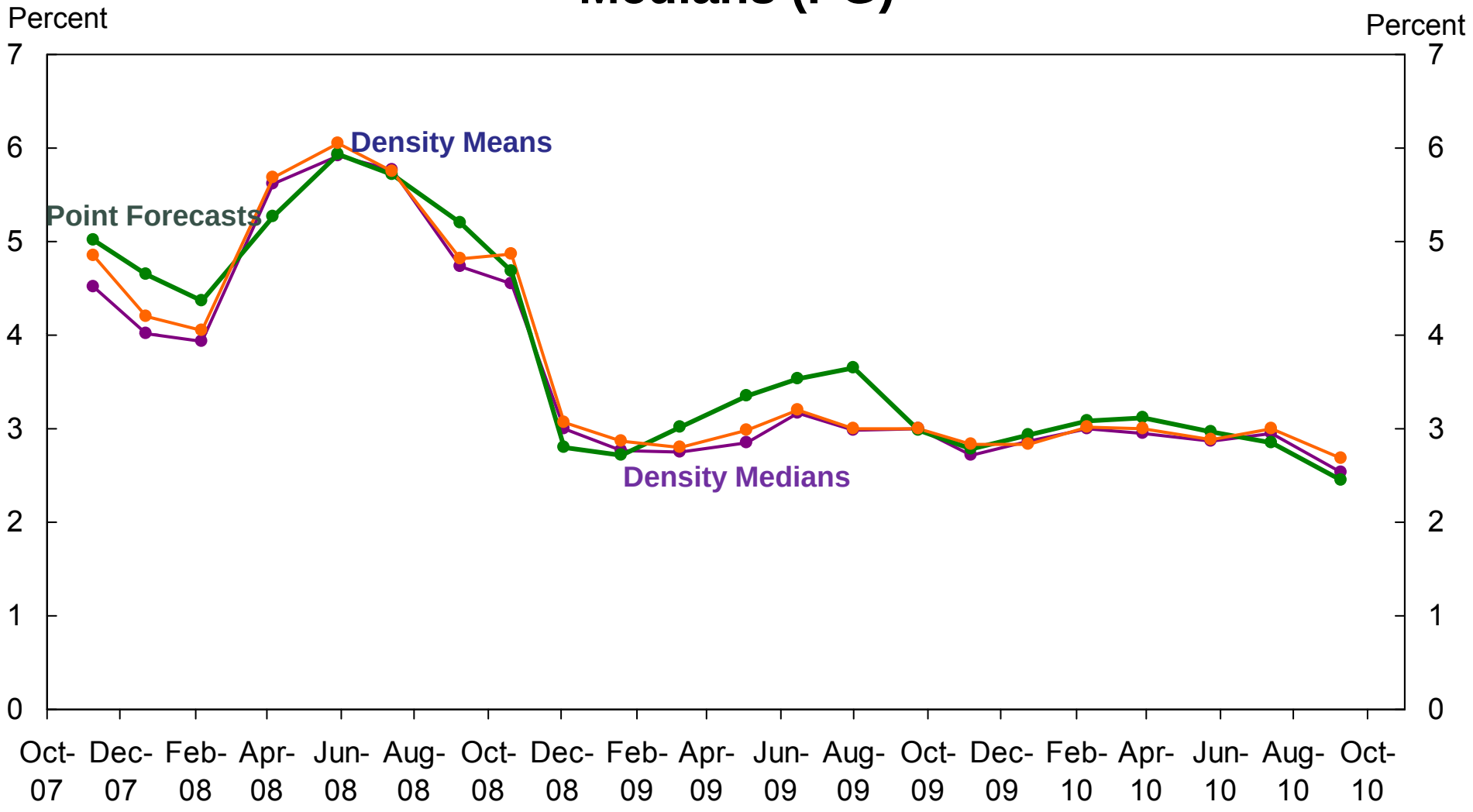
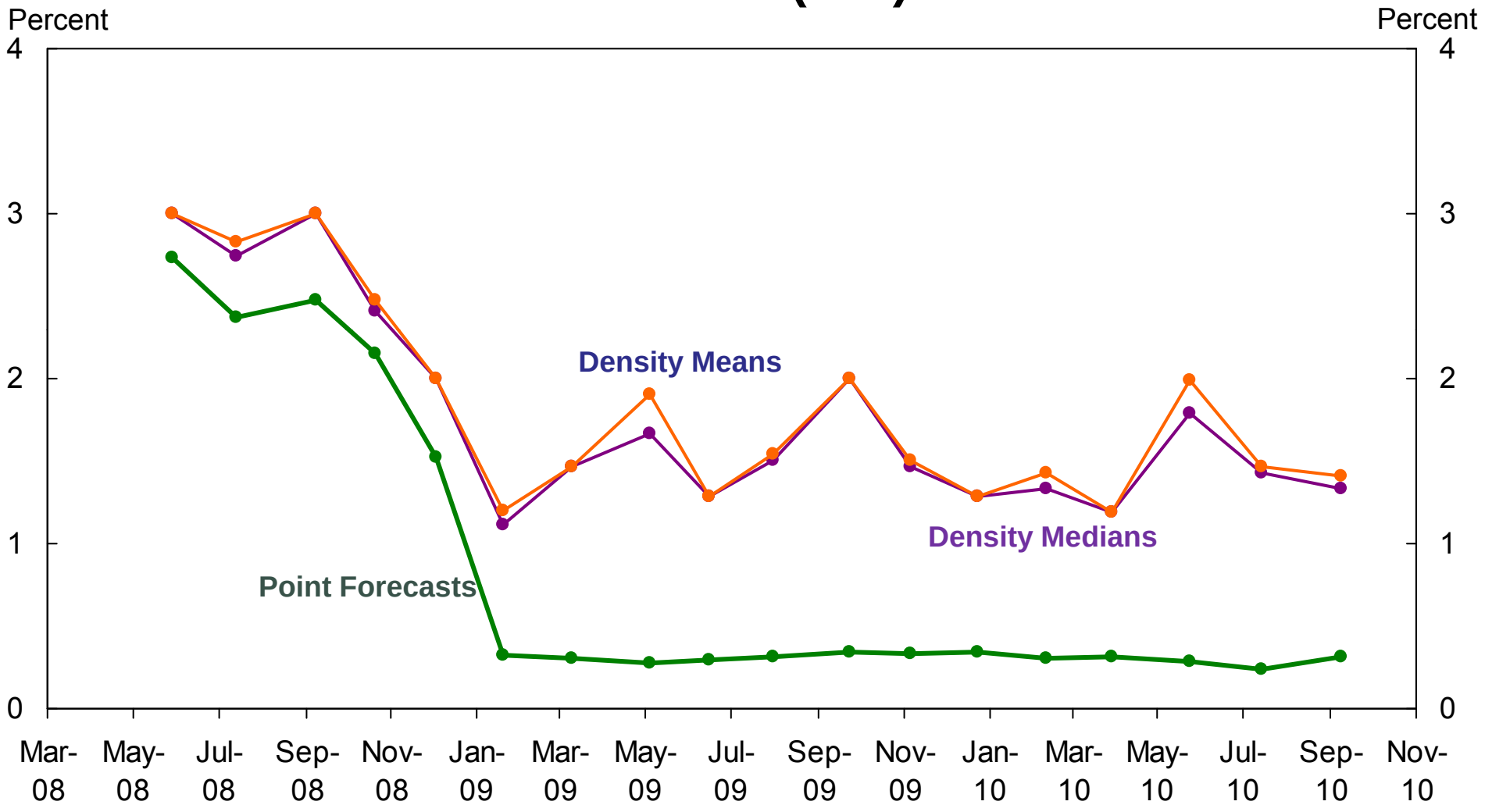
1 Year Ahead Point Forecasts and Density Means and Medians (PG)



NYFed-ALP Panel.

1 Year Ahead Point Forecasts and Density Means and Medians (WG)



NYFed-ALP Panel.

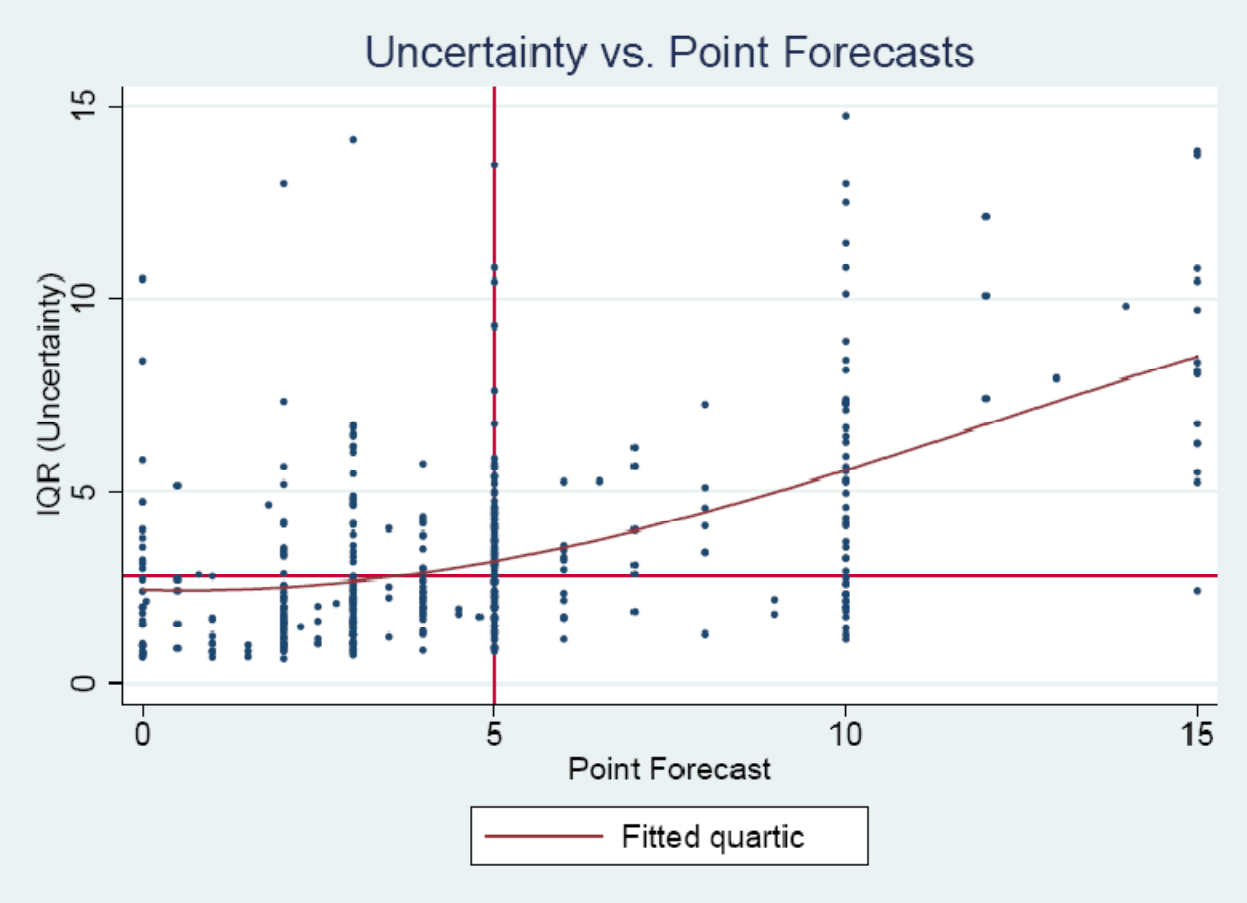
Point forecasts, density means and density medians

	Panel	**Special**
Correlation btw Point Forecast and Density Median	0.83**	0.71**
Correlation btw Point Forecast and Density Mean	0.84**	0.72**
% Observations with Point Forecast in (Density Q3 – Density Q1)	54.7%	56.8%
% Observations with Point Forecast outside (Density Q3 – Density Q1)	45.3%	43.2%

Measures of Central Tendency and Uncertainty

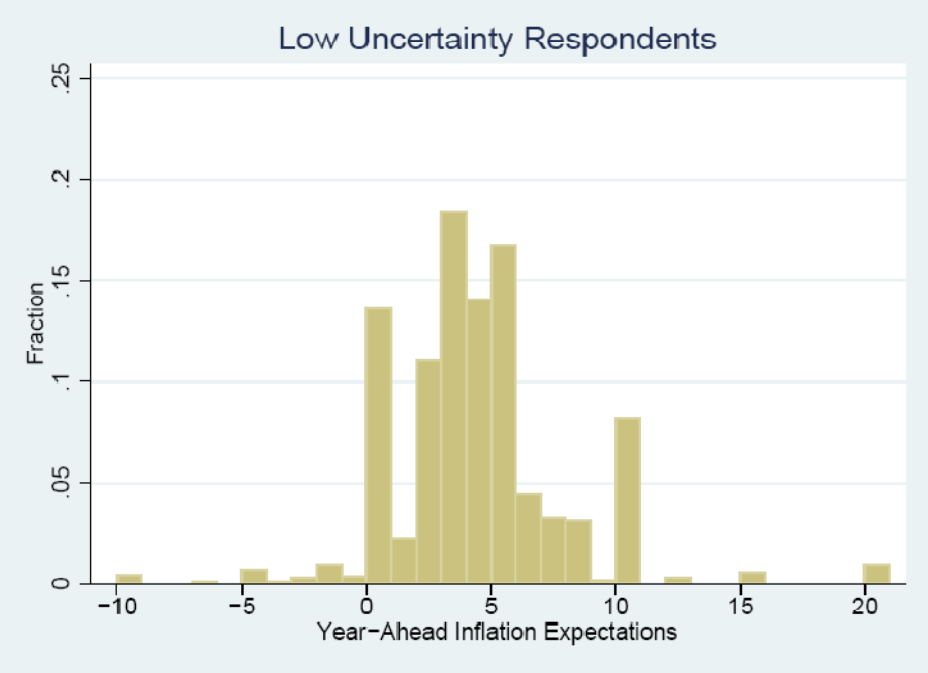
Correlation between individual forecast uncertainty and:	**Panel**	**Special**
Point Forecast	0.46**	0.53**
Density Median	0.44**	0.47**
Density Mean	0.48**	0.53**

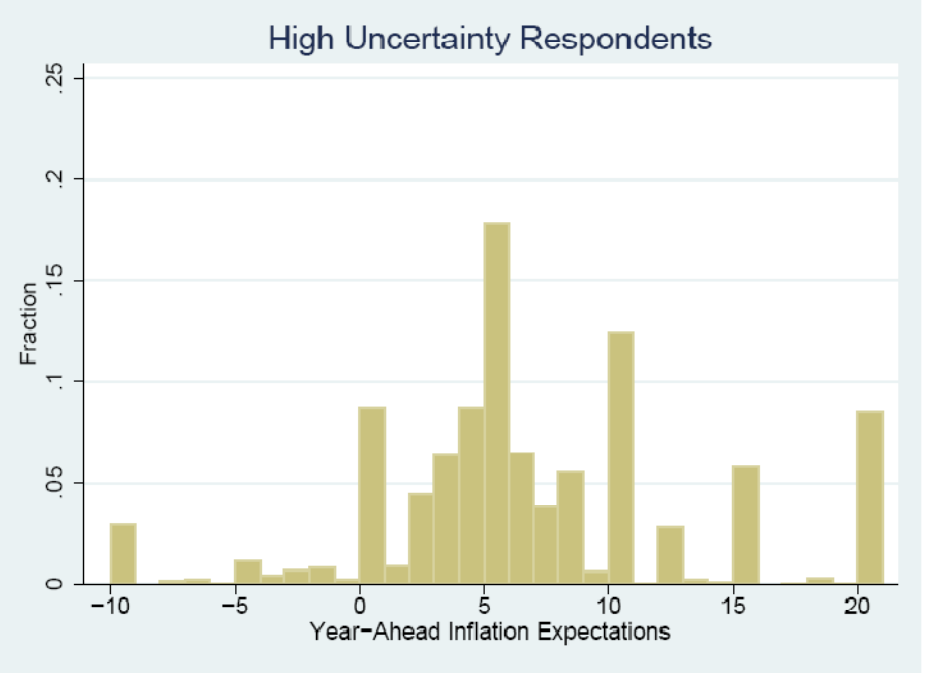
Point Forecasts vs. Uncertainty



Fed-ALP December Special module.

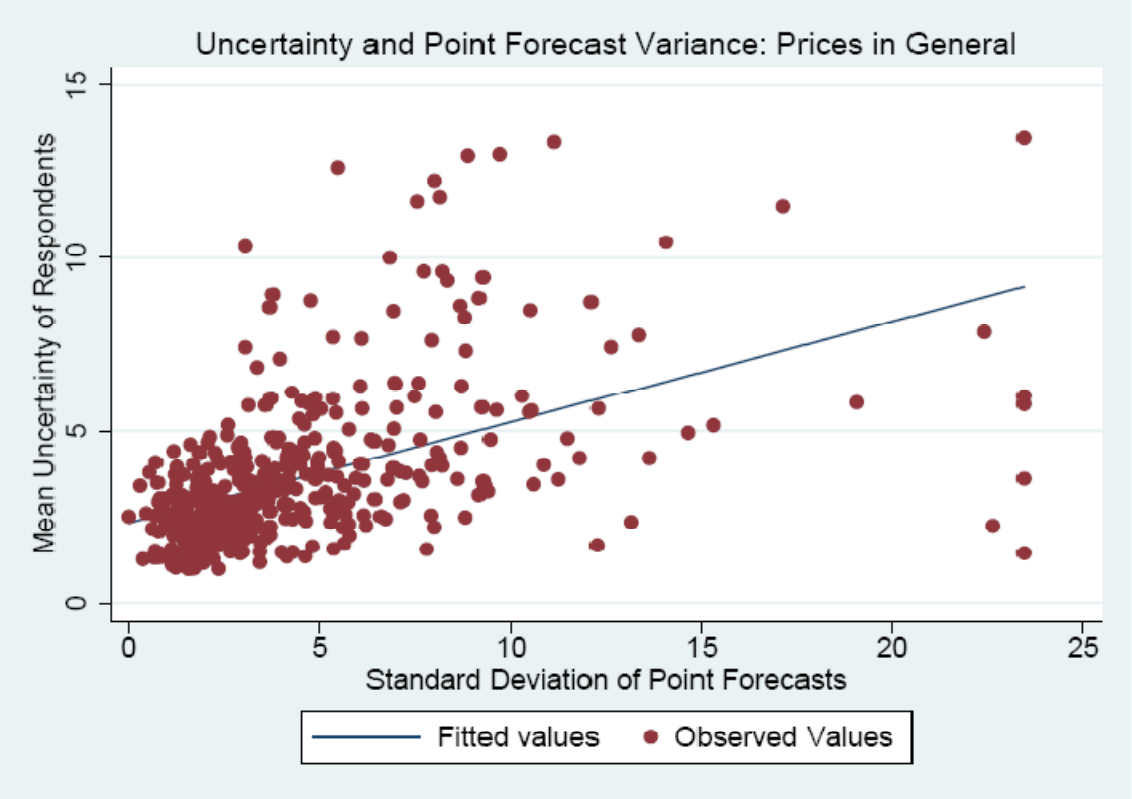
Point Forecast Distributions for Low and High Uncertainty Respondents





Fed-ALP Panel pooled. Values greater than 20 are coded to 20 and values less than -10 are coded to -10.

Average Individual Uncertainty Vs. Variability in Point Forecast



Dynamics - Panel Data Regressions

	Estimate (std error) of a_1
Model 1: $iqr(\pi)_{it} = a_0+a_1\, iqr(\pi)_{it-1}+\varepsilon_{it}$	0.47 (0.05)
Model 2: $iqr(\pi)_{it} = a_0+a_1\, iqr(\pi)_{it-1}+X_i'b+\varepsilon_{it}$	0.45 (0.05)
Model 3: $iqr(\pi)_{it} = a_0+a_1\, iqr(\pi)_{it-1}+X_i'b+\theta_i+\varepsilon_{it}$	0.05 (0.03)
Model 4: $\lvert\pi_{it}-\pi_{it-1}\rvert = a_0+a_1\, iqr(\pi)_{it-1}+X_i'b+\varepsilon_{it}$	0.52 (0.07)
Model 5: $\lvert\pi_{it}-\pi_{it-1}\rvert = a_0+a_1\, iqr(\pi)_{it-1}+X_i'b+\theta_i+\varepsilon_{it}$	0.39 (0.03)

Fed-ALP Panel micro data – balanced panel. π_{it} denotes individual *i*-th point forecast of year-ahead inflation in survey wave t, and $iqr(\pi)_{it}$ denotes individual *i*-th uncertainty (as measured by the density IQR) of year-ahead inflation in survey wave t. X_i represents a vector of demographic characteristics of individual I, θ_i is an individual random effect and ε_{it} are i.i.d residuals. Models 3 and 5 were estimated using the Arellano-Bound estimation procedure in Stata.

Conclusions

- Responses to probabilistic questions have internal consistency and measurement reliability.
- Measures of central tendency from density forecasts strongly correlated with point forecasts.
- Forecast uncertainty positively related to point forecasts, and associated with demographics and financial literacy.
- Individuals with higher uncertainty make larger revisions to point forecasts over time.