New information and inflation expectations among firms

Serafin Frache Rodrigo Lluberas

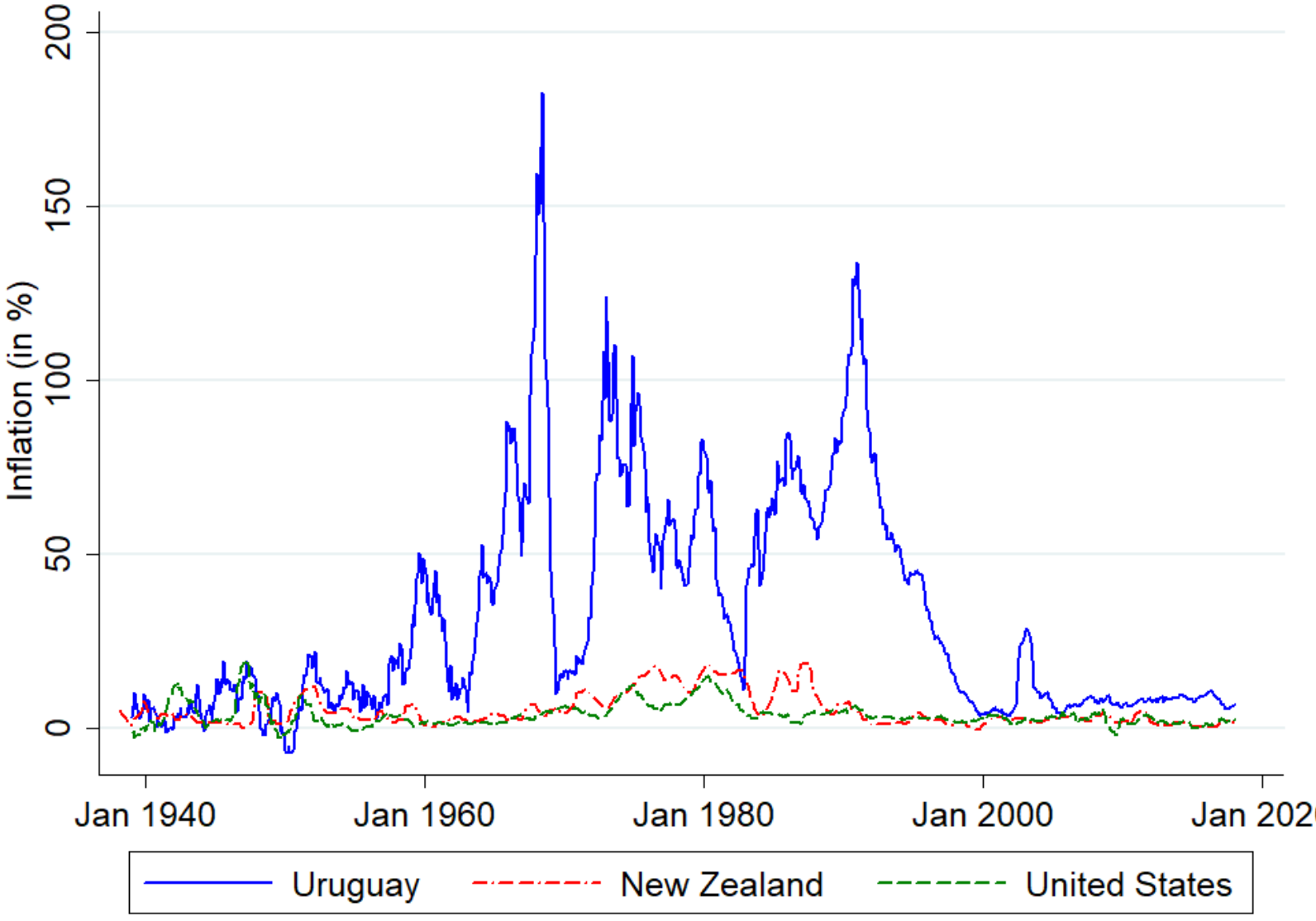
Banco Central del Uruguay

4th June, 2018

Motivation

- Understanding the inflation expectations formation process is key in an inflation targeting regime.
- Central Banks must monitor firms' inflation expectations as they are determinants of firms decisions regarding investment, employment and price setting.
- With few exceptions, the empirical evidence on inflation expectations is focused on households and professional forecasters.
- There is scarce evidence on how firms, as price setters, form their inflation expectations.
- On top of that, the empirical evidence is focused on developed countries with low inflation.
- We contribute to the literature by studying firms' inflation expectations in Uruguay, a small country with a history of relatively high inflation.

Historical inflation: Uruguay, New Zealand and the US



Paper in a nutshell

- First, we present a number of stylized facts about firms' inflation expectations:
  - Firms forecast is close to observed inflation albeit there is persistence in expectations.
  - Existence of information frictions: a high proportion of firms do not revise their short and long run inflation expectations.
  - Finally, there is disagreement across firms, which has increased since mid-2014
- Second, by exploiting the variation in the month of wage adjustment due to the wage barganing mechanism in place since 2005, we study how new information affects firms' inflation expectations. Firms that adjust wages:
  - Expect lower inflation.
  - Revise their expectations downwards.
  - Make smaller forecast errors.
  - Have less disagreement.
  - There is no effect of wage adjustment on firms own cost expectations.

Data

- Data source: monthly longitudinal survey of firms' inflation and own cost expectations.
- Every month since October 2009
- Sample: about 400 firms, representative of the population of firms with at least 50 employees
- Firms are asked about their expected annual change in the Consumer Price Index and own costs for the current year, for the next 12 months and for the monetary policy horizon, which was 18 months until July 2013 and is 24 months since then.

Data

- Questions asked (originally in Spanish):
  - *What do you believe is going to be the change in the CPI?*
  - *What do you believe is going to be the average change in your firm's costs in local currency?*
- The questionnaire is sent electronically by e-mail, no answers are followed-up by a telephone call.
- Logistics by the National Statistical Office.
- The person answering is supposed to be the one responsible for the pricing of the firm but could also be the owner, a general or area manager.

Descriptive statistics: inflation & cost expectations (in %)

	Mean	Median	S.D.	Min	Max
			Inflation		
Year	8.9	9.0	2.0	0.0	40.0
12 months	8.8	8.8	1.8	0.0	35.0
18 months	8.4	8.0	2.0	0.0	40.0
24 months	9.6	9.0	2.3	0.0	75.0
			Costs		
Year	10.3	10.0	3.8	-30.0	120.0
12 months	10.3	10.0	4.0	-50.0	120.0
18 months	9.9	9.0	4.1	-30.0	120.0
24 months	10.8	10.0	3.7	-10.0	80.0

Notes:
18-months expectations are for the period October 2009 to July 2013.
24-months expectations are for the period July 2013 to April 2017.

Definitions

- $F_t^i \pi_{t+h}$: h-month ahead inflation expectation of firm i at time t
- Expectations revisions (current year and different time horizons: 12 and 18/24 months):

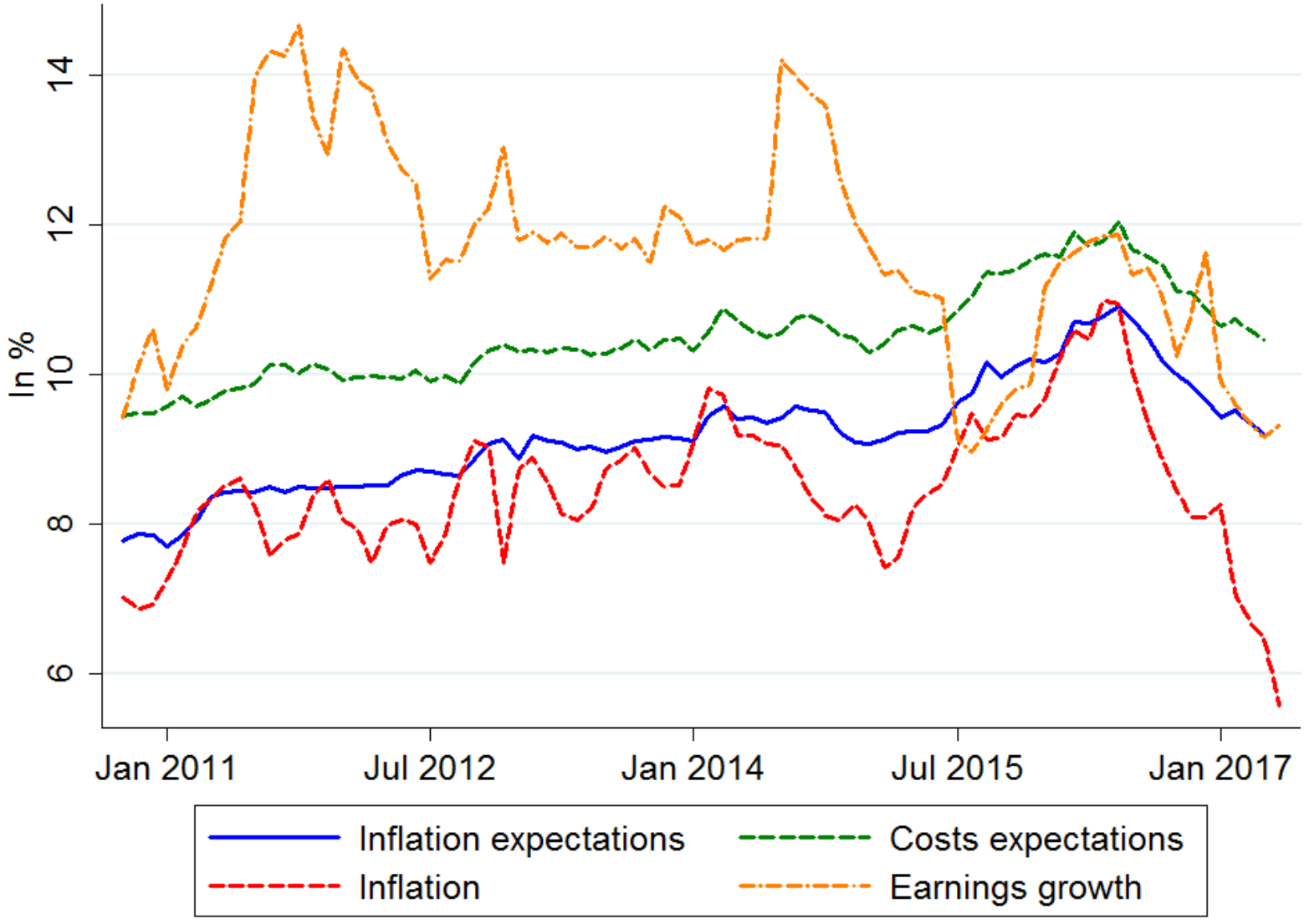
$$R_t^i \pi_{t+h} = F_t^i \pi_{t+h} - F_{t-j}^i \pi_{t+h}$$

- Example:
  - $t =$ August 2013,
  - $j = 6$, then $t - j =$ February 2013
  - $t + 12 =$ August 2013 - July 2014
- Forecast error of firm i at time t is the difference between its h-month ahead inflation expectation at time t and the actual inflation during the same period:

$$FE_{it,T} = \pi_{t+h} - F_t^i \pi_{t+h}$$

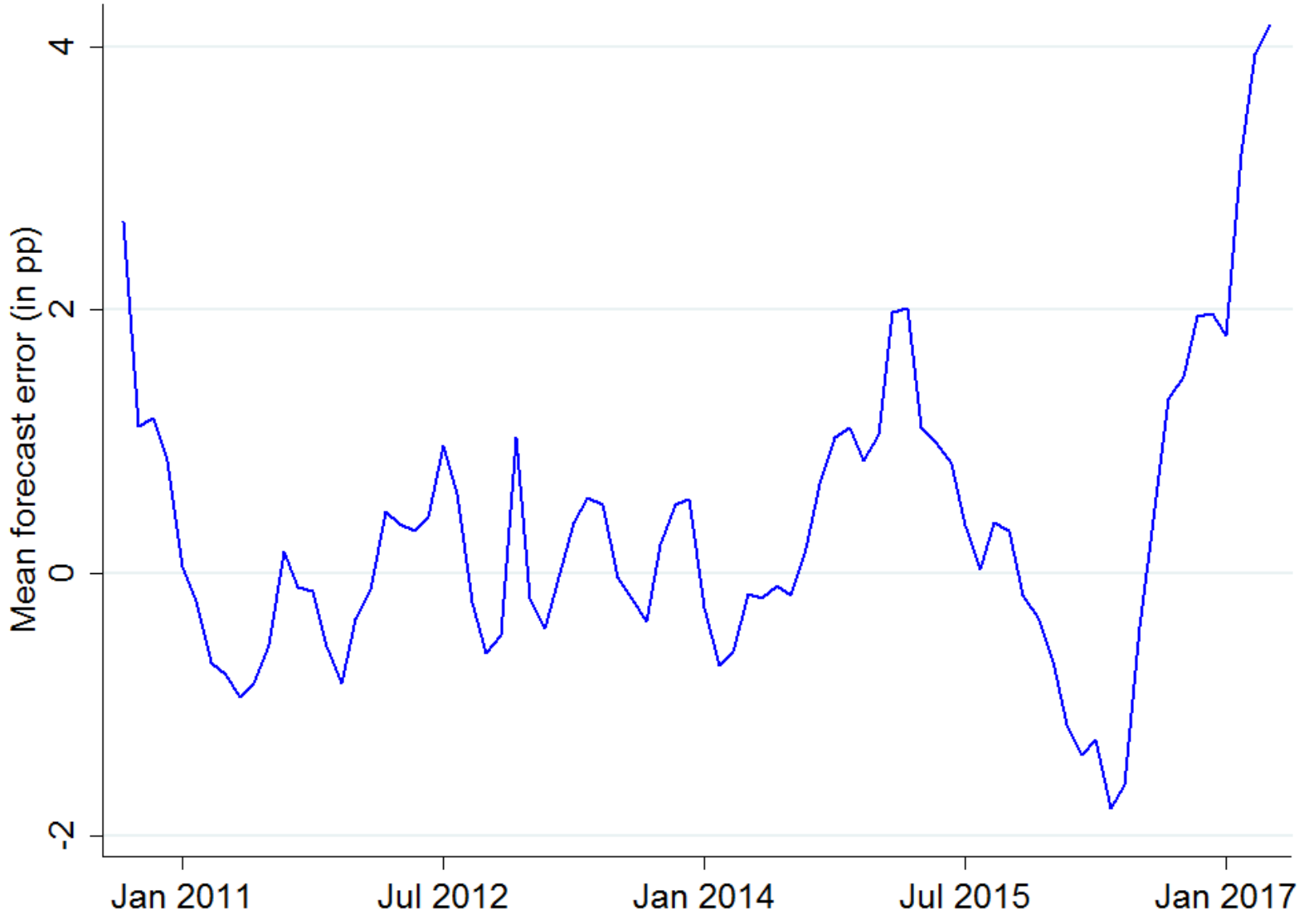
Stylized facts

Average inflation and unit cost expectations



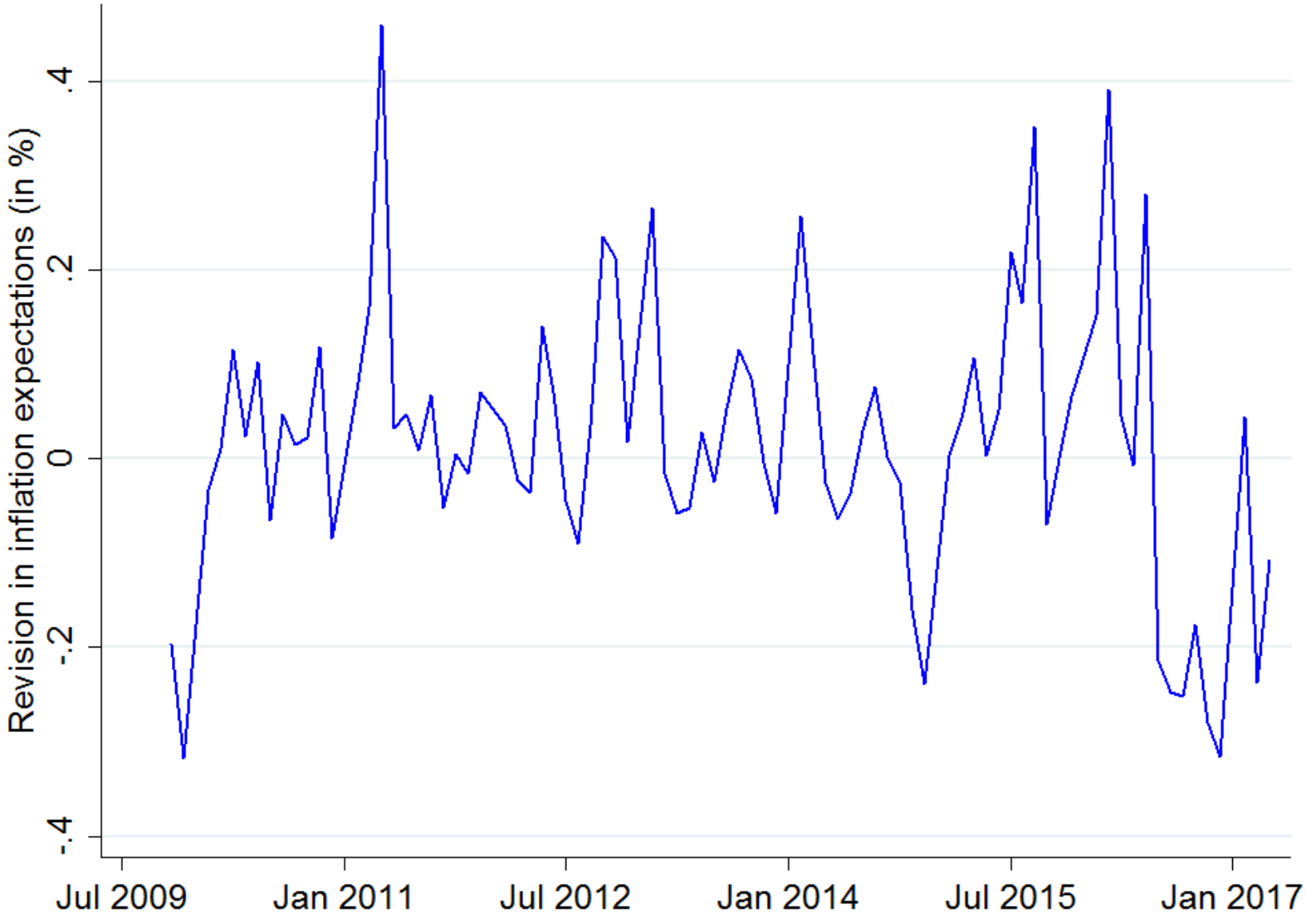
Stylized facts

Mean forecast error: next 12 months



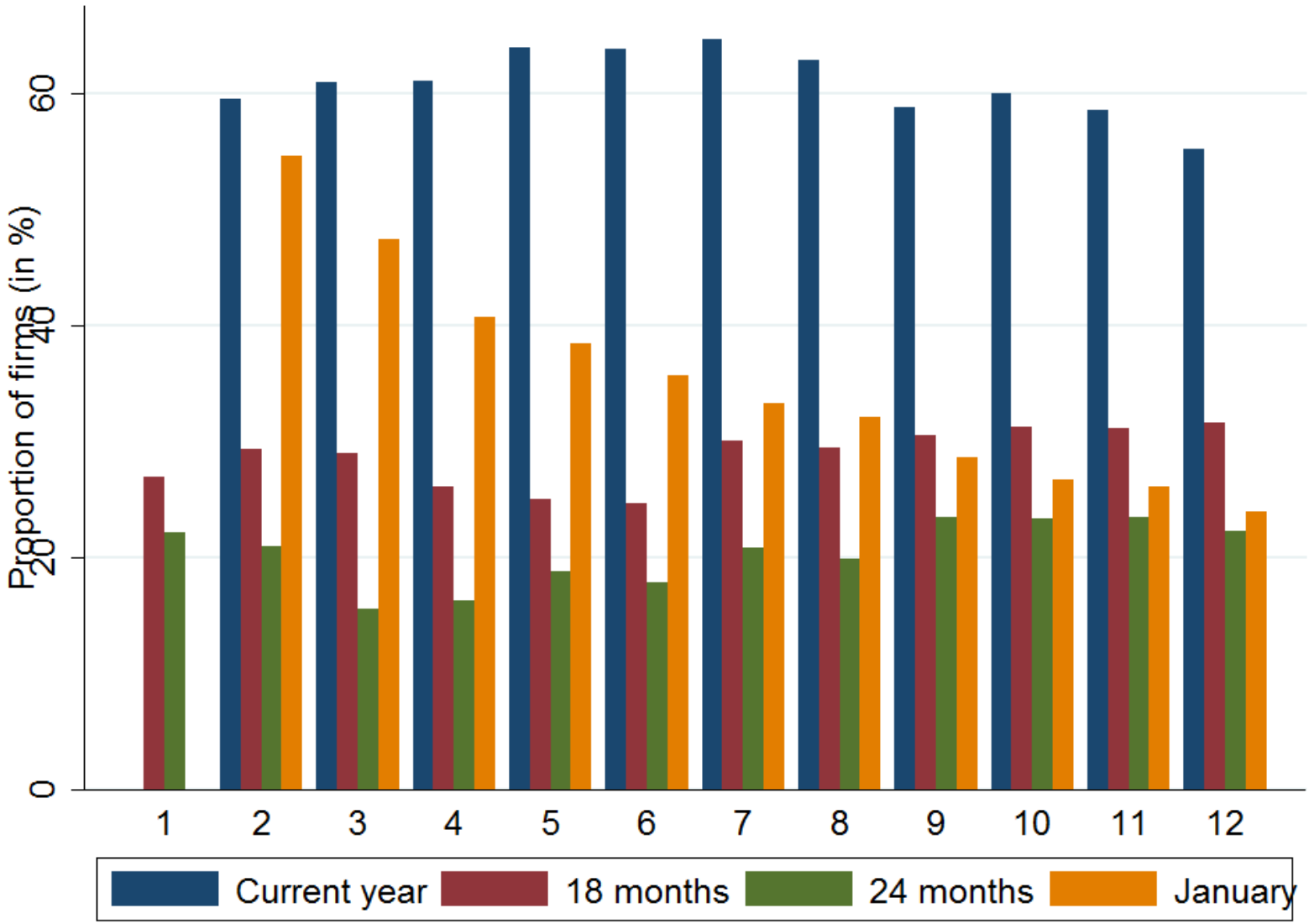
Stylized facts

Average revision in current year inflation expectations

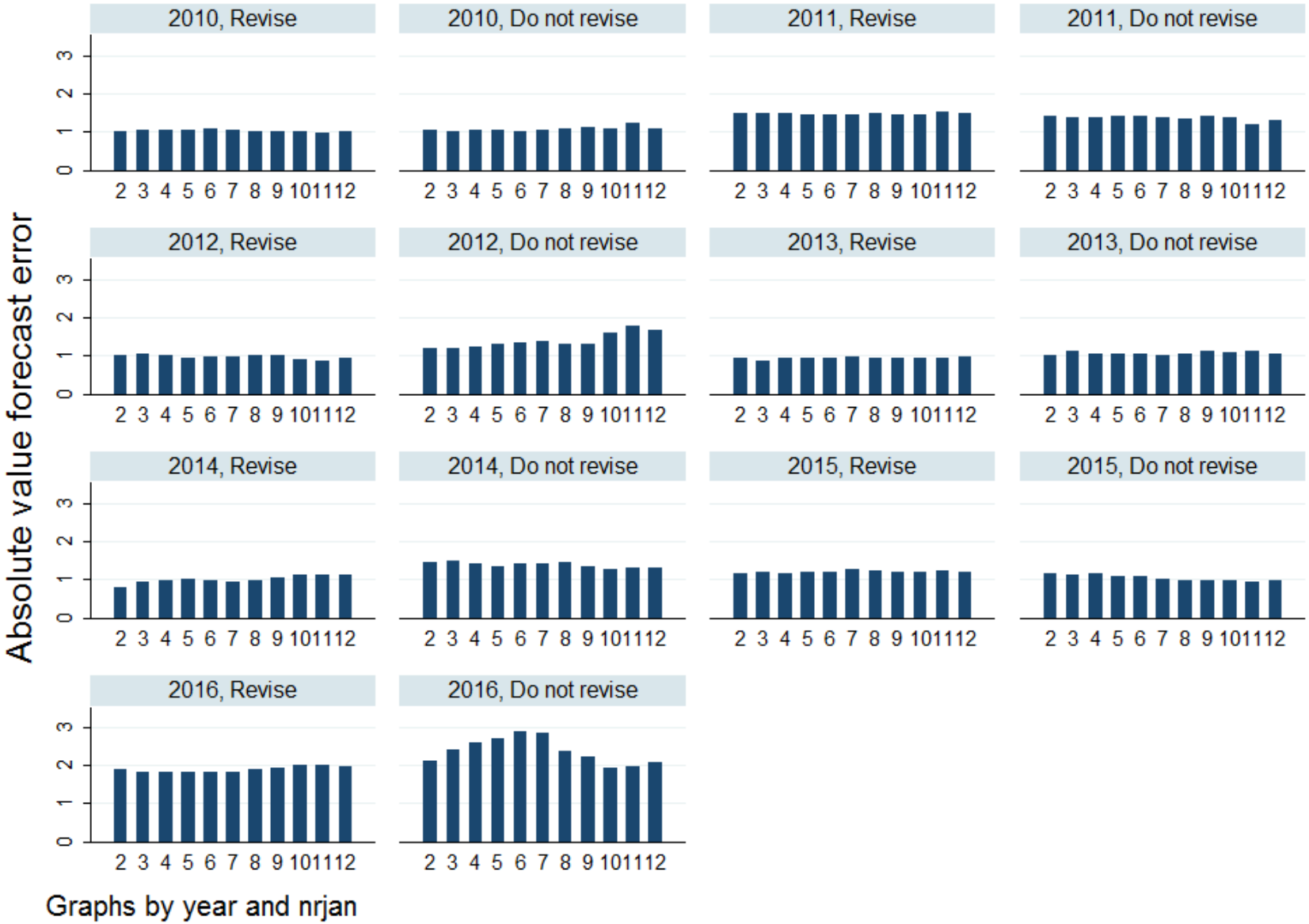


High proportion of firms that do not revise their expectations

Proportion of firms that do not revise their expectations

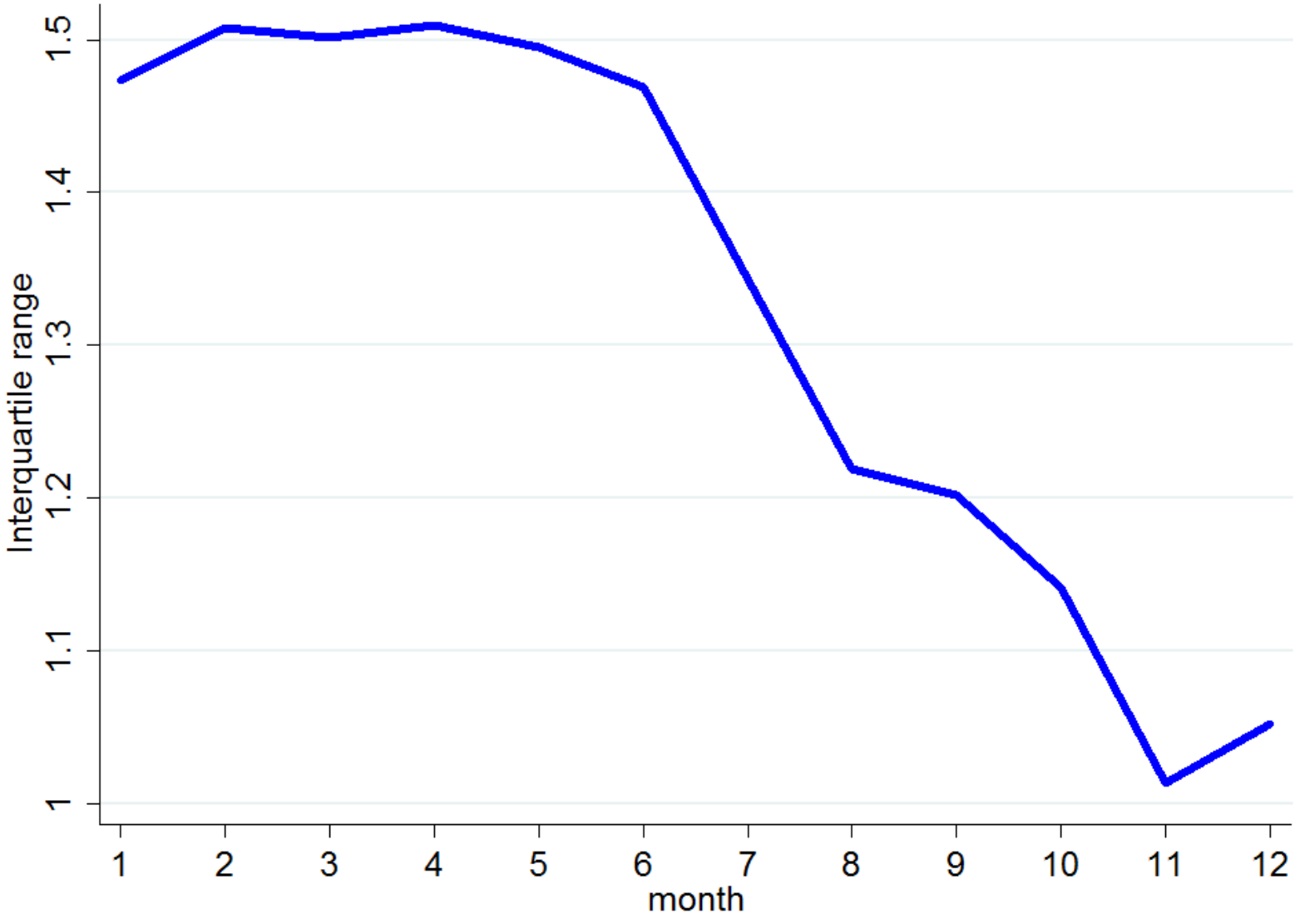


Not because they are good at forecasting...



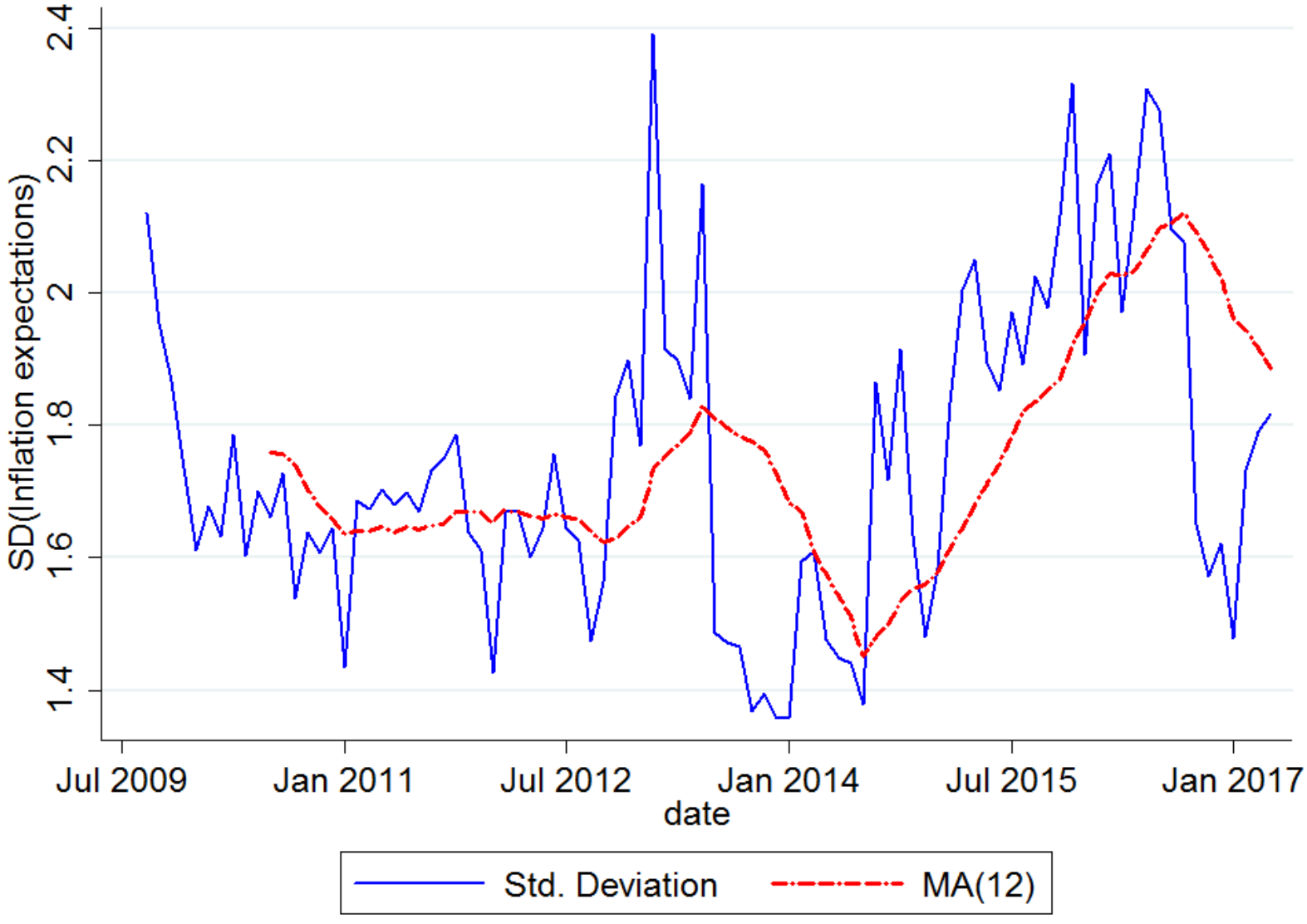
But dispersion of expectations decreases through the year

Inflation expectations during the year: interquantile range



Disagreement on inflation expectations across firms

Standard deviation of inflation expectations



Own cost and inflation expectations

- About 73% of the firms that change the one-year ahead inflation expectations simultaneously update their own cost expectations.
- Correlation between inflation and unit cost expectations at different time horizons:

	Correlation
12m	0.4687
18m	0.4735
24m	0.5266
Year	0.3846

Strategic complementarity

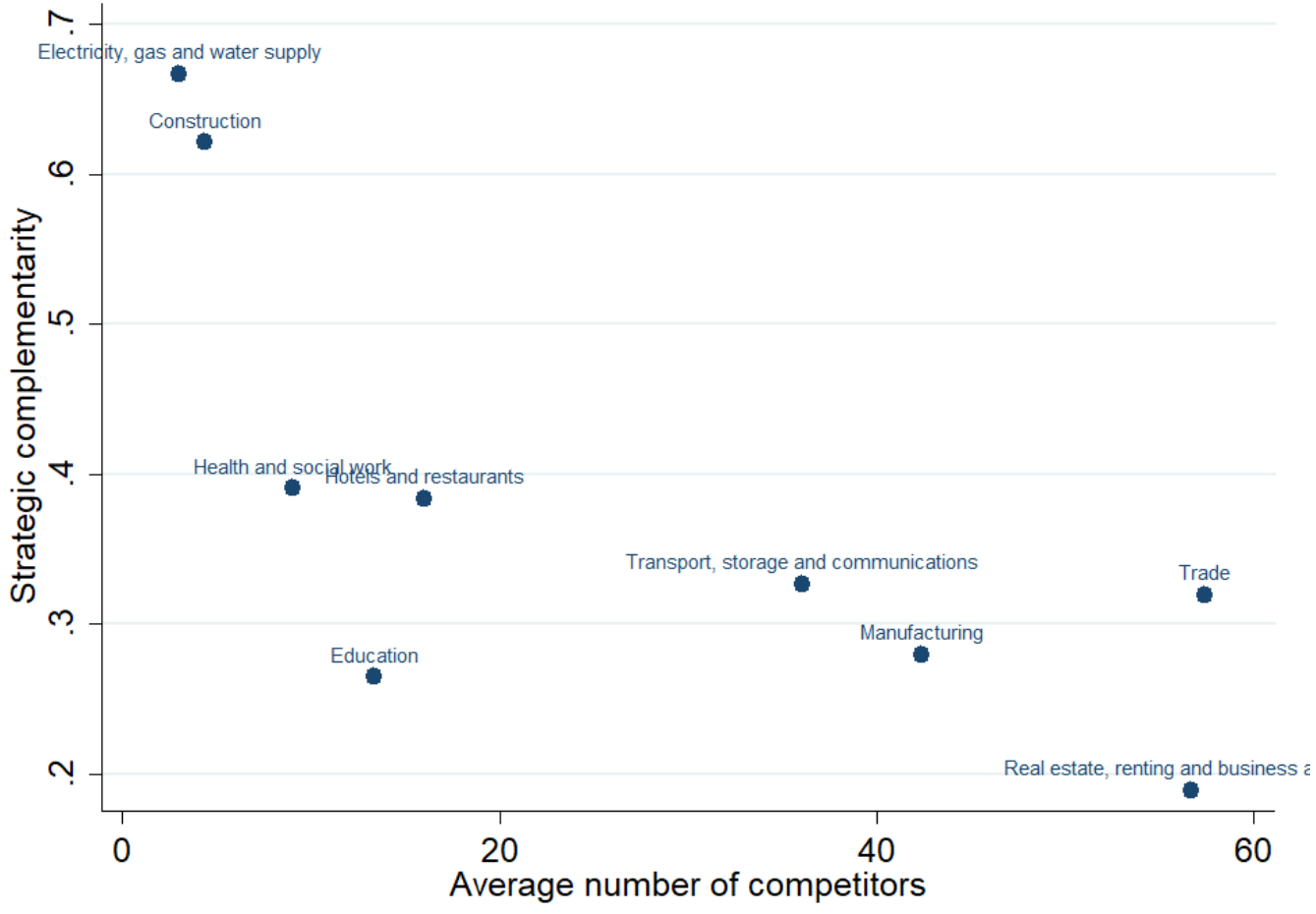
- Firm k in industry j best response pricing (Afrouzi, 2017):

$$p_{j,k} = (1 - \alpha)E^{j,k}[q] + \alpha E^{j,k}[p_{j,-k}]$$

- Where: α is the degree of strategic complementarity.
- Average strategic complementarity among Uruguayan firms is 0.28, far below that of firms in New Zealand (0.90).
- Uruguayan firms are more aware of the aggregate price changes than their industry price.

Number of competitors and strategic complementarity by sector

Strategic complementarity decreases with the number of competitors



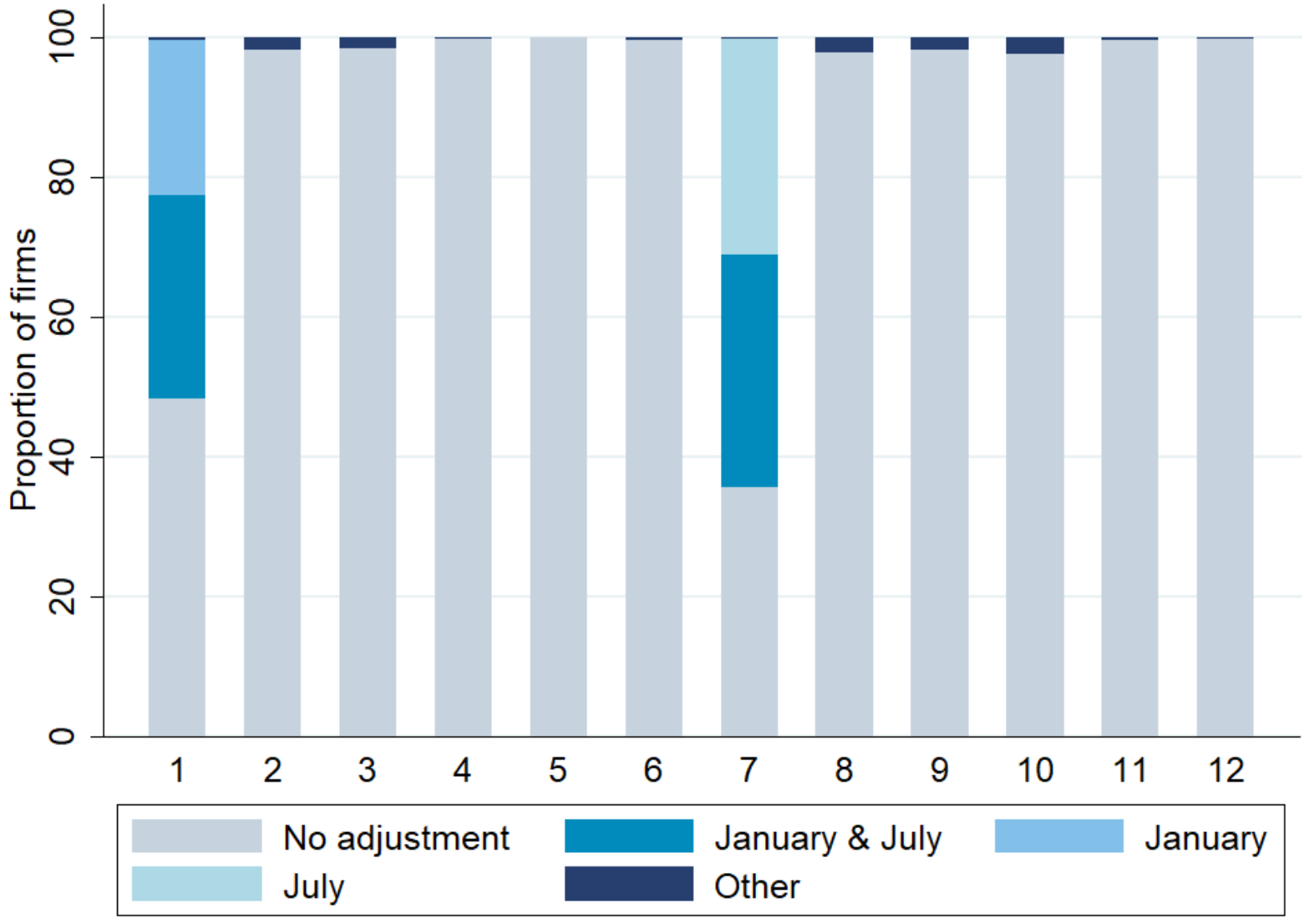
Wage bargaining negotiations

- In 2005 a mechanism of collective wage bargaining negotiation was re-established (Mazzucchi (2009))
- Tripartite wage councils (*consejos de salarios*):
  - Union organizations
  - Business organizations
  - The State
- Negotiations are at industry level and affects all formally employed workers
- They agree the frequency of wage increments with components related to expected inflation and productivity

Inflation expectations and wage adjustments

- We exploit the variation in the month of wage adjustment previously agreed in the negotiation between workers and firms to estimate the impact of acquiring information about past inflation on expected future inflation.
- We take the month of wage adjustment as indicative of firms acquiring new or more information.
- If that is the case, we should expect differences in inflation expectations between firms that adjust and those that do not adjust wages in a given month.

Proportion of firms that adjust wages by month



Models

- Inflation expectations in the next 12 months:

$$F_t^i \pi_{t+12} = \alpha_i + \beta_1 A_{it} + \beta_2 \pi_{t-1} + \beta_3 t + \gamma_m + \epsilon_{it}$$

- Forecast error (absolute value):

$$|FE_{it,t+12}| = \alpha_i + \beta_1 A_{it-12} + \beta_2 \pi_{t-13} + \beta_3 t + \gamma_m + \epsilon_{it}$$

- Inflation expectations revisions:

$$|R_t^i \pi_{t+h}| = \alpha_i + \beta_1 A_{it} + \beta_2 \pi_{t-1} + \beta_3 t + \gamma_m + \epsilon_{it}$$

- Own cost expectations in the next 12 months:

$$F_t^i C_{t+12} = \alpha_i + \beta_1 A_{it} + \beta_2 \pi_{t-12,t-1} + \beta_3 t + \gamma_m + \epsilon_{it}$$

Regression results

Table: Regression results summary

	β_1	s.e	t	p-value
$F_t^i \pi_{t+12}$	-0.0751*	0.0402	-1.87	0.065
$\lvert FE_{it,t+12} \rvert$	-0.155**	0.0648	-2.39	0.019
$\lvert FE_{it,y} \rvert$	-0.0932	0.0715	-1.30	-0.196
$\lvert FEX_{it,t+12} \rvert$	-0.211**	0.0976	-2.16	0.034
$\lvert R_t^i \pi_{t+h} \rvert$	-0.0109	0.0439	-0.25	0.804
$\lvert R_t^i \pi_y \rvert$	-0.00649	0.0216	-0.30	0.765
$\lvert R_t^i \pi_{y0} \rvert$	-0.0808***	0.0236	-3.42	0.001
$F_t^i C_{t+12}$	-0.0619	0.0638	-0.97	0.334

Regression results: lags and leads

Table: Regression results summary: lags and leads

	Lag	A_{it}	Lead
$F_t^i \pi_{t+12}$	-0.0933*	-0.0671	-0.053
$\lvert FE_{it,t+12} \rvert$	-0.151*	-0.173**	-0.154*
$\lvert FE_{it,y} \rvert$	-0.0852	-0.0883	0.0136
$\lvert FEX_{it,t+12} \rvert$	-0.268**	-0.246**	-0.203*
$\lvert R_t^i \pi_{t+h} \rvert$	-0.0381	-0.00557	0.00822
$\lvert R_t^i \pi_y \rvert$	-0.00635	-0.0037	-0.0366
$\lvert R_t^i \pi_{y_0} \rvert$	-0.029	-0.0808***	-0.0359
$F_t^i C_{t+12}$	-0.0721	-0.0625	-0.0594

Disagreement and wage adjustments

$$D^{e}_{t,t+12} = \alpha + \beta_1 A_t + \beta_2 t + \epsilon_t$$

	Std. Deviation	Interquantile range
A_t	-0.204	-0.386**
	[0.117]	[0.131]
t	0.00294***	-0.00101
	[0.000855]	[0.00151]
Cons.	-0.113	2.408*
	[0.541]	[0.976]
N	92	92
R-sq	0.132	0.09

Sign of revisions

	Coeff. on A_{it}	s.e	t	p-value
S_{it}	-0.248***	0.0673	-3.68	0.000
$R_t^i \pi_{t+h}$	-0.143**	0.0691	-2.07	0.042

- Firms are less likely to revise their inflation expectations upwards or do not revise them at all in the months of wage adjustment.
- Firms that adjust wages revise, on average, their expectations downwards.

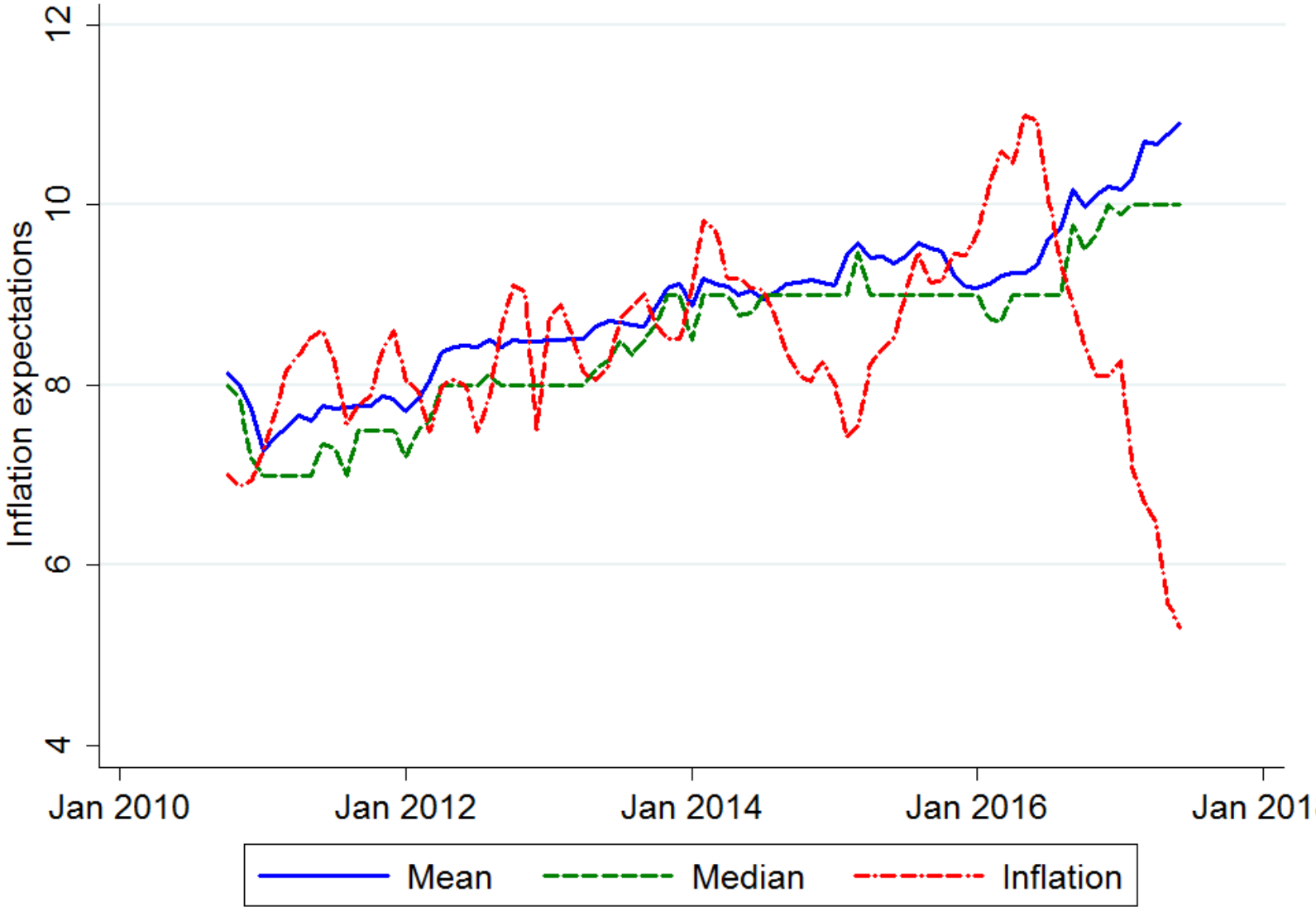
Summary

- We provide evidence on how firms form their inflation expectations and how this is affected by the acquisition of new information.
- We show that firms forecast errors are persistent, that there is an important proportion of firms that do not revise their expectations frequently and that there is substantial disagreement about future inflation across firms.
- We exploit the variation in the month of wage adjustment to show how the acquisition of information affects inflation expectations.
- Our results suggests that on average in the months of wage adjustment:
  - Firms that adjust their wages expect future inflation to be lower than firms that do not adjust wages.
  - We also show inflation forecast is more accurate and that there is less disagreement about future inflation across firms.
- These results points to the idea that the acquisition of information by firms affects their beliefs about future inflation.

EXTRA SLIDES

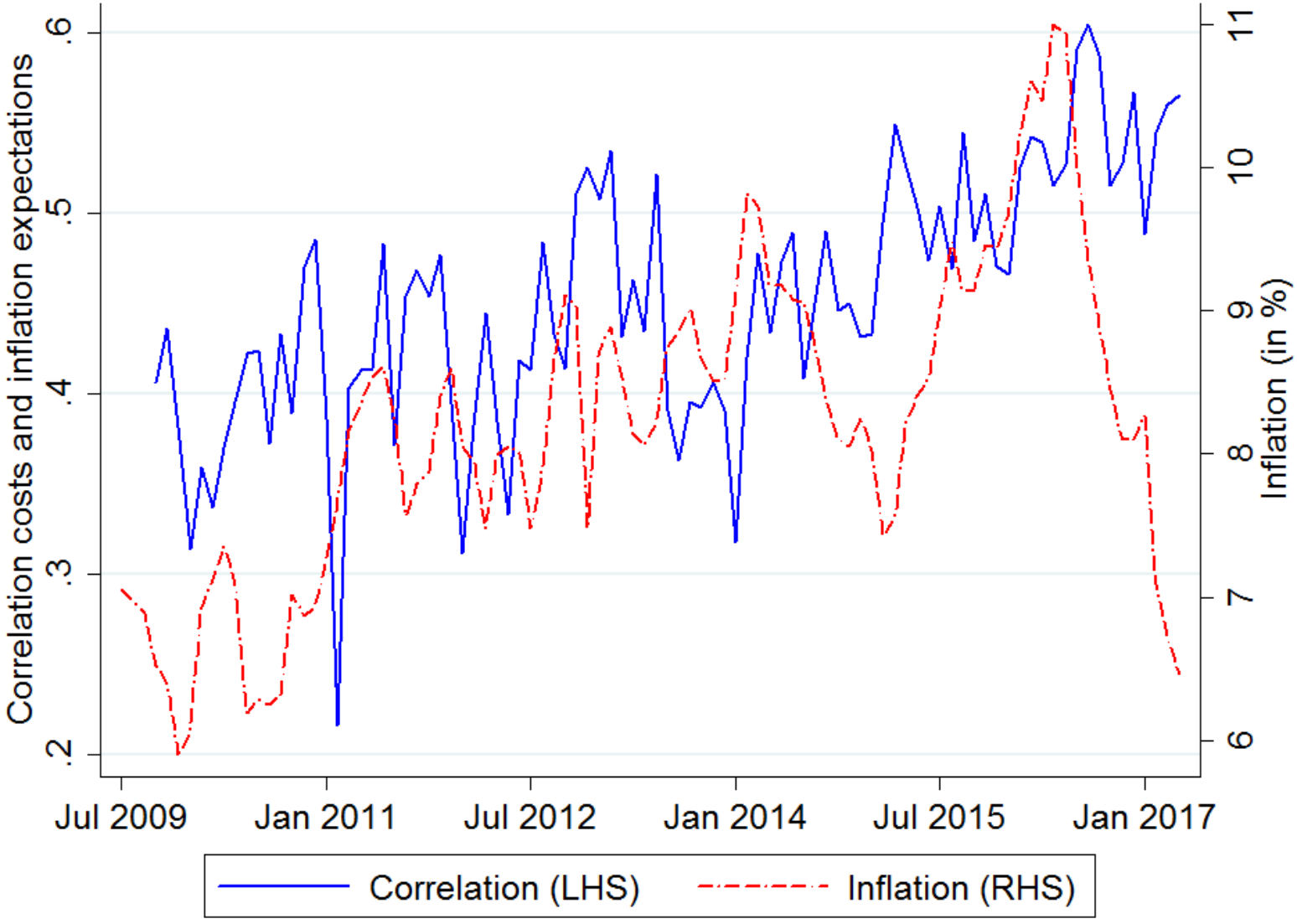
Stylized facts

Mean and median inflation expectations: next 12 months



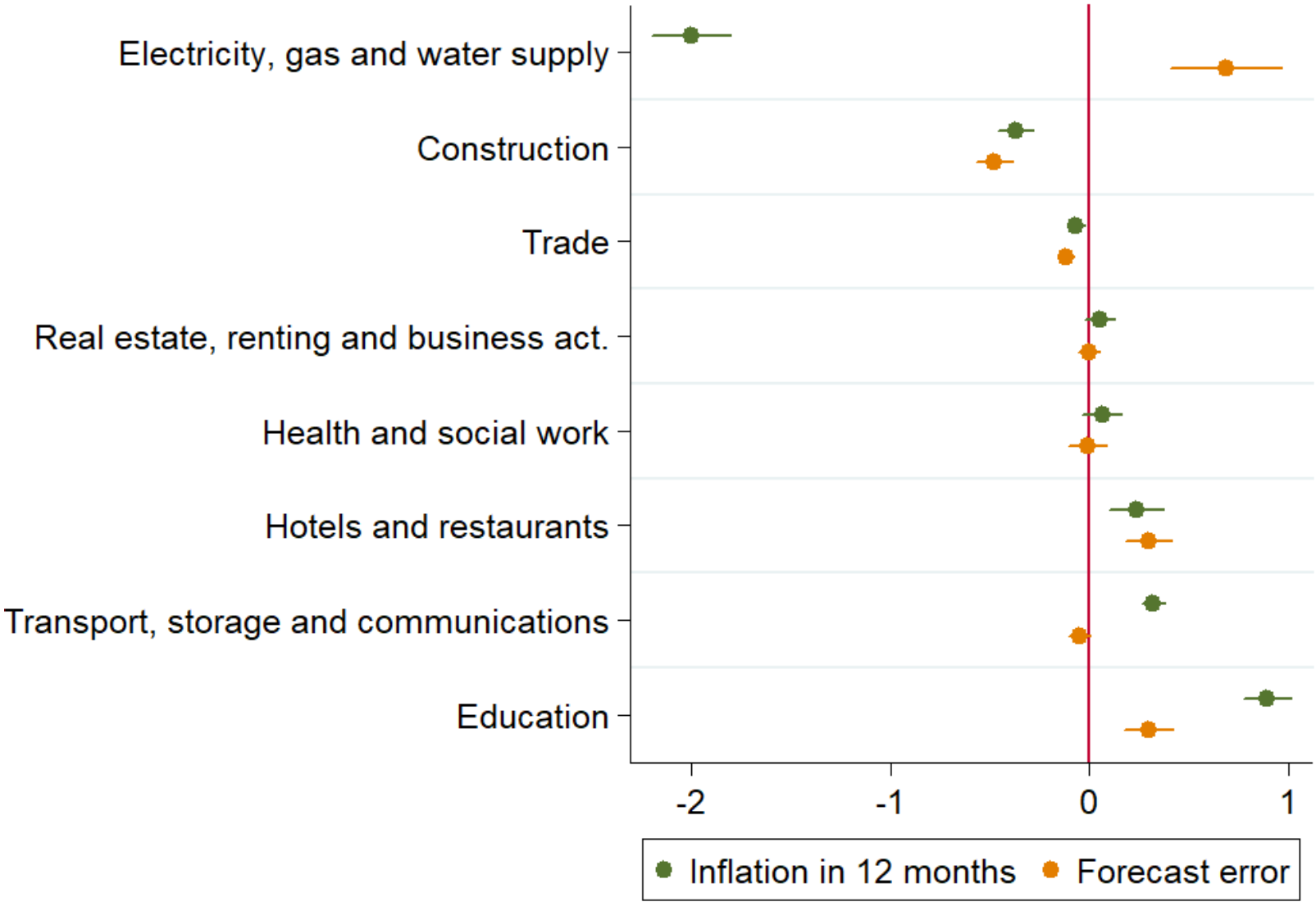
Own cost expectations and inflation

Correlation between own cost and inflation expectations increases with inflation

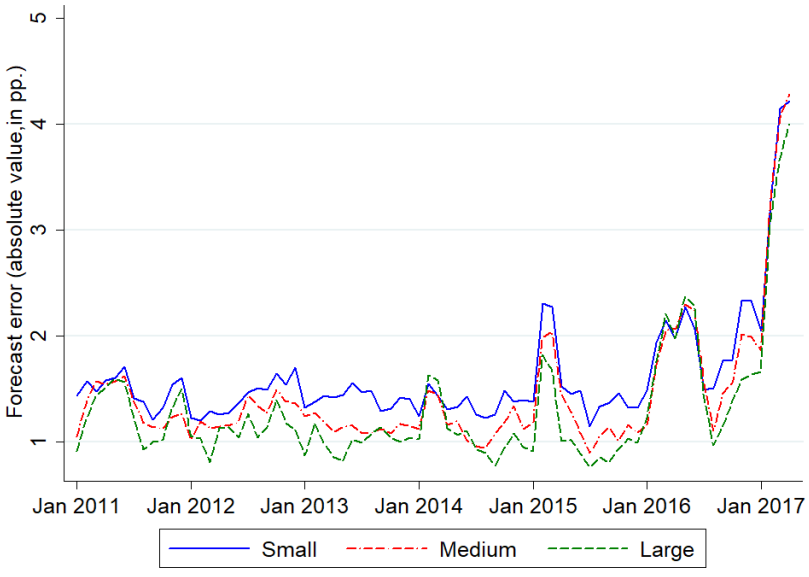


Firms characteristics: industrial sector

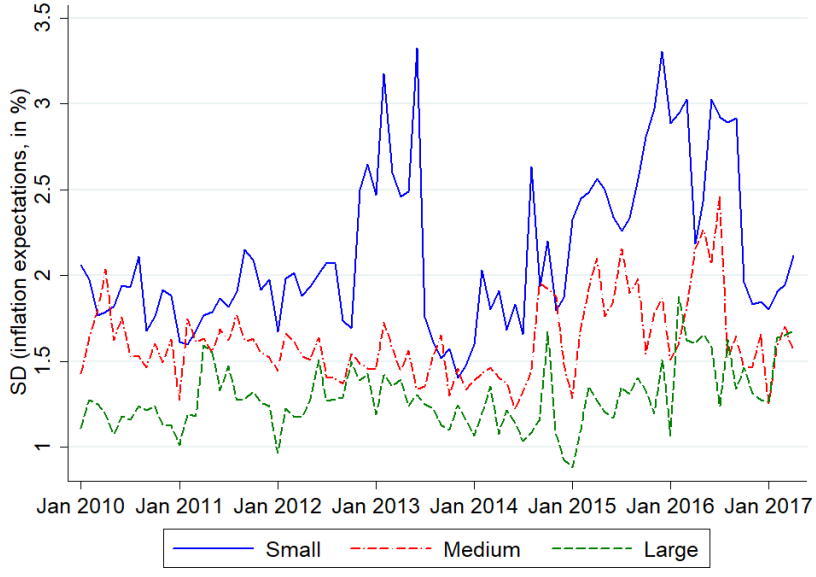
Inflation expectations and forecast error by industrial sector (relative to Manufacturing)



Firms characteristics: size



(a) Forecast error



(b) Disagreement

More disagreement and larger forecast error among small firms

Correlation inflation and own cost expectations by firm size

	Small	Medium	Large
12m	0.5420	0.4408	0.3655
18m	0.5150	0.4449	0.3745
24m	0.5250	0.5870	0.4502
Year	0.5167	0.3233	0.2833

For each time horizon, except for 24 months, the correlation between inflation and own cost expectations decreases with firm size.