

# Belief-Dependent Pricing Decisions

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  - ▶ Even with firms characteristics → No info. on firm's beliefs.
- ▶ Implications for Monetary Policy:
  - ▶ Presence of price-rigidities.
  - ▶ Transmission of monetary shocks to firms decisions.

## Takeaways

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- ▶ Are the effect of expectations on pricing decisions contemporaneous?
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- ▶ Are the effect of expectations on pricing decisions contemporaneous?
  - ▶ While beliefs affect adjustment decisions with **delay**, they have **immediate** consequences on future expectations.
- ▶ Does heterogeneity across firms matter?
  - ▶ Yes, different responses depending on firm's **sizes** and levels of attentiveness about inflation.

# Literature Review

- ▶ Micro evidence on price-adjustments decisions. [Klenow and Kryvtsov(2008), Nakamura and Steinsson (2008), Lein (2010), Gagnon et.al. (2013), Bachmann et.al. (2018), Wulfsberg (2016), Carlsson and Skans (2012)]
  - ▶ Besides time and state-dependent pricing → beliefs-driven pricing adjustments.
- ▶ Expectations and economic decisions [Nimark (2008), Clyone et.al. (2019), Coibion, Gorodnichencko, Ropele (2019)]
  - ▶ New evidence on the consequences of inflation and cost expectations on pricing decisions.
- ▶ Expectations formation at the firm level [Afrouzi et.al. (2015), Coibion, Gorodnichencko, Kumar (2018), Tanaka, Bloom and David (2018), Licandro and Mello (2014, 2015), Borraz and Orlik (2016), Borraz and Zacheo (2018) Frache and Lluberas (2019)]
  - ▶ Heterogeneous levels of accuracy → different implications for price revisions.

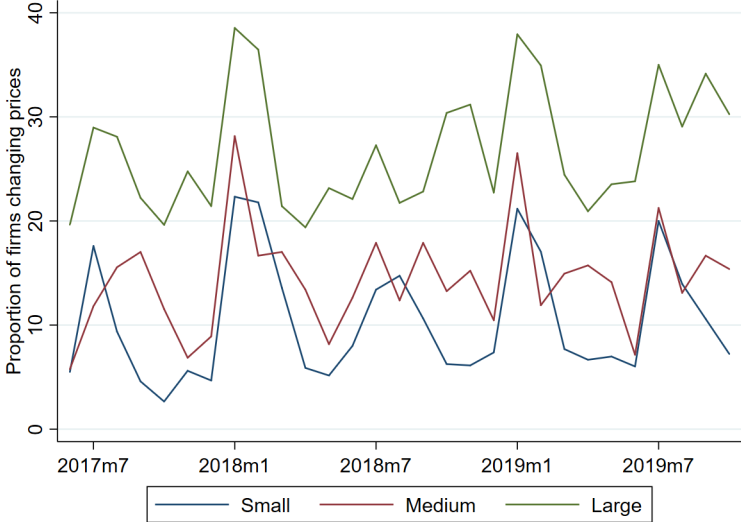
## Uruguayan survey: questionnaire

- ▶ Regular questions related to inflation and own costs expectations for different time horizons:
  - ▶ Current year,
  - ▶ Next 12 months and,
  - ▶ Next 24 months
- ▶ 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?*
- ▶ Questions about price adjustments:
  - ▶ Extensive margin.
  - ▶ Expected intensive margin.

## Uruguayan survey: questionnaire about prices

- ▶ **Extensive margin:** since June 2017 we ask firms when they changed their prices.
- ▶ It is a close-ended question with the following options:
  1. This month
  2. A month ago
  3. Two months ago
  4. Three months ago
  5. Four months ago
  6. Five months ago
  7. Six months ago
  8. Seven or more months ago.
- ▶ **Intensive margin:** for given months there are questions about **expected** change in own prices for the internal and external markets.

# Stylized Fact 1: Different frequency of price-adjustments



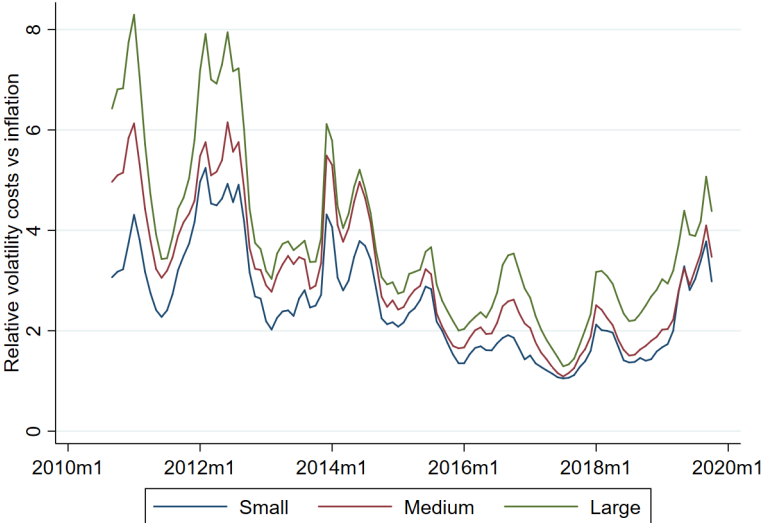
## Stylized Fact 2: Heterogeneous Accuracy (Inflation)

- ▶ Overall firms produce very accurate predictions for inflation.
  - ▶  $\overline{FE} = 0.7$ ,  $Stdv(FE) = 2.3$
  - ▶ At odds with existing evidence reporting inaccurate and highly dispersed forecasts for inflation, [Afrouzi et.al. (2015)]
- ▶ Firm  $i$  is labeled as “Accurate/Attentive” if:  $\sum_t |FE_{it}| \approx 0$

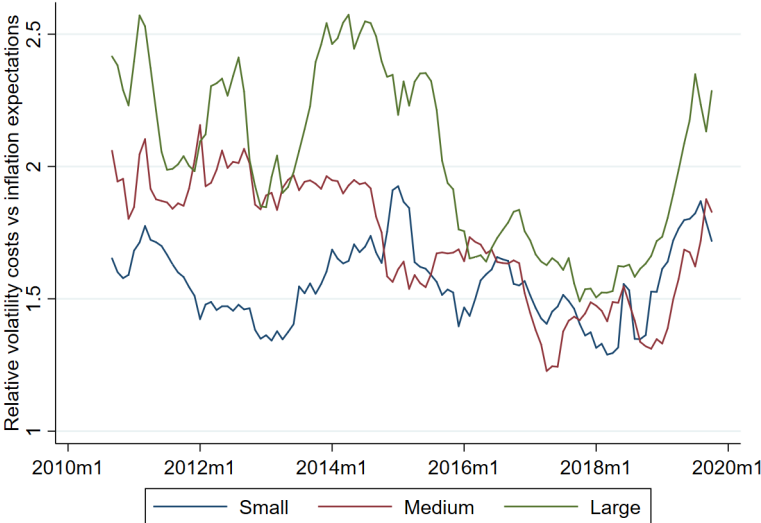
	Inaccurate	Accurate
Small	77.2	22.8
Medium	71.6	28.4
Large	59.4	40.6
Total	69.5	30.5

- ▶ Mild relationship between accuracy and size.

# Stylized Fact 3: Relative dispersion of variables



# Stylized Fact 3: Relative dispersion of beliefs





# The empirical model

- ▶ Monthly Linear Probability Model (LPM):

$$\begin{aligned}P(\Delta p_{it} = 1 | x_{it}, \mu_i, \eta_t, v_{it}) &= E(\Delta p_{it} = 1 | x_{it}, \mu_i, \eta_t) \\ &= x_{it}\beta_1 + \mu_i + \eta_t + v_{it}\end{aligned}$$

- ▶ **Explanatory variables:**

- ▶  $E_{i,t|t+12}(\cdot)$ : Firm  $i$  inflation and costs growth expectations (next 12 months).
- ▶  $Taylor_{i,t}$ : Time-dependent price adjustments.
- ▶  $\mu_i$ : Firm's FEs.
- ▶  $\eta_t$ : Time FEs (years/months): State-dependent price adjustments.

# Belief-Dependent price adjustments - Marginal Effects

	(1)	(2)	(3)	(4)
$E_{it}(Inf_{12m})$	-0.0010 (.0052)	0.0016 (.0054)	0.0019 (.0065)	0.0001 (.0055)
$E_{it-1}(Inf_{12m})$		0.0029 (.0048)	0.0054 (.0060)	0.0012 (.0051)
$E_{it-2}(Inf_{12m})$		-0.0035 (.0044)	-0.0034 (.0049)	-0.0042 (.0043)
$E_{it-3}(Inf_{12m})$		-0.0021 (.0053)	-0.0042 (.0056)	-0.0030 (.0054)
$E_{it-4}(Inf_{12m})$		-0.0029 (.0057)	-0.0031 (.0056)	-0.0038 (.0057)
$E_{it}(Costs_{12m})$	0.0021 (.0031)	-0.0034 (.0041)	-0.0007 (.0048)	-0.0044 (.0042)
$E_{it-1}(Costs_{12m})$		0.0019 (.0024)	0.0016 (.0031)	0.0021 (.0025)
$E_{it-2}(Costs_{12m})$		0.0015 (.0025)	0.0028 (.0025)	0.0021 (.0025)
$E_{it-3}(Costs_{12m})$		0.0058** (.0031)	0.0051 (.0028)	0.0059** (.0026)
$E_{it-4}(Costs_{12m})$		0.0034 (.0030)	0.0018 (.0031)	0.0033 (.0031)
Firm FE	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓
Taylor Dummies	✓	✓	×	✓
Time FE	✓	✓	✓	×
$R^2$	0.1484	0.1507	0.0287	0.1306
Observations	7,955	7,478	7,478	7,478

# Belief-dependent pricing

- ▶ Adjustment decisions respond to idiosyncratic rather than aggregate beliefs.
  - ▶ Stylized fact 3: Inflation expectations less volatile than costs.
  - ▶ Consistent with theories of information frictions, [Mackowiak and Wiederholt (2009)]

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- ▶ Evidence supports the presence of price adjustment frictions.
- ▶ A monetary shock should not affect the degree of price-stickiness.

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- ▶ Evidence supports the presence of price adjustment frictions.
- ▶ A monetary shock should not affect the degree of price-stickiness.
  - ▶ Similar distribution of price changes during periods of low and high inflation, [Midrigan (2011)]
  - ▶ Implications for MP non-neutrality.

# Belief-dependent pricing

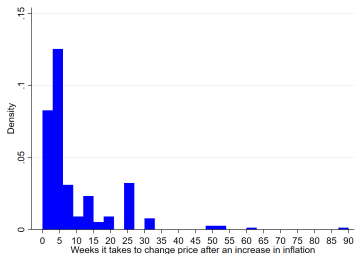
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- ▶ A monetary shock should not affect the degree of price-stickiness.
  - ▶ Similar distribution of price changes during periods of low and high inflation, [Midrigan (2011)]
  - ▶ Implications for MP non-neutrality.
- ▶ The estimated effect is however sluggish.
  - ▶ Delayed effect of cost on prices, [Nakamura and Zerom (2010)]

## Delayed Price Adjustments

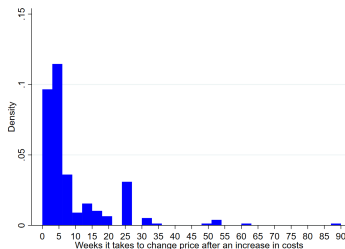
- ▶ In June 2019 we intervened the survey and added:
  - ▶ On average, how long does it take your firm to change prices when: (1) inflation increases and (2) costs increases?
  - ▶ Open answer for number of weeks.

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(a) Inflation



(b) Costs

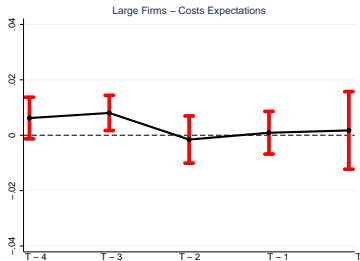
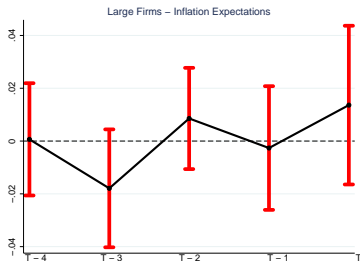
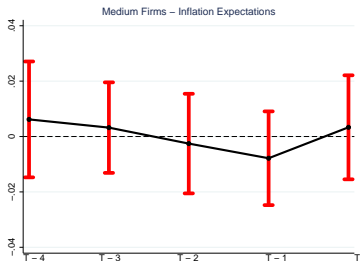
- ▶ Approximately 11 and 10.5 weeks respectively to adjust prices.
- ▶ Implications of current expectations on future beliefs?



# Interactions

- ▶ Let us now focus on potential heterogeneous effects of beliefs on pricing decisions.
- ▶ Study the interplay between inflation/cost expectations and firm's characteristics:
  1. Size.
  2. Multi-product firms.
- ▶ Extend the LPM to a *Correlated Random Effects* (CRE) approach.

# Forward-looking price adjustments - Size Heterogeneity



## Extension: Instrument for omitted variable $\Delta Cost_{i,t}$

- ▶ Build the instrument following [Carlsson and Skans (2012)] .
- ▶ For each firm  $i$ , we compute a measure of **projected** costs:

$$\widehat{C}_{i,t} = Pl_{j,t} CS_{i,j,2012}$$

- ▶  $Pl_{j,t}$ : price index for each spending category  $j$  at time  $t$ .
- ▶  $CS_{i,j,2012}$  is the cost structure for each category  $j$  fixed at 2012 for firm  $i$ .
- ▶ Prevent firms from adjusting the production scale.
- ▶ Hence,  $\widehat{C}_{i,t}$  affects pricing only via its effect on costs, which ultimately affects the expectation.
- ▶ **Main results hold.**

## Marginal Effects - $E(C_{12})$ Endogeneity

	(1)	(2)
$E_{it}(Inf_{12m})$	-0.0195 (0.0216)	0.0009 (.0049)
$E_{it-1}(Inf_{12m})$		0.0062 (.0053)
$E_{it-2}(Inf_{12m})$		-0.0035 (.0054)
$E_{it-3}(Inf_{12m})$		-0.0036 (.0053)
$E_{it-4}(Inf_{12m})$		-0.0021 (.0061)
$E_{it}(Costs_{12m})$	0.0224 (0.0220)	-0.0040 (.0027)
$E_{it-1}(Costs_{12m})$		0.0008 (.0030)
$E_{it-2}(Costs_{12m})$		0.00006 (.0031)
$E_{it-3}(Costs_{12m})$		0.0054* (.0029)
$E_{it-4}(Costs_{12m})$		0.0036 (.0029)
Sector FE	✓	✓
Taylor Dummies	✓	✓
Month FE	✓	✓
Years FE	✓	✓
R2	0.1626	
Observations	6,192	6,192

# Robustness: Probit CRE Model

	(1)	(2)	(3)	(4)
$E_{it}(Inf_{12m})$	0.0016 (.0053)	-0.0003 (.0058)	0.0050 (.0082)	-0.0028 (.0061)
$E_{it-1}(Inf_{12m})$		0.0078 (.0058)	0.0094 (.0067)	0.0078 (.0061)
$E_{it-2}(Inf_{12m})$		-0.0040 (.0056)	-0.0069 (.0061)	-0.0039 (.0058)
$E_{it-3}(Inf_{12m})$		-0.0047 (.0067)	-0.0060 (.0072)	-0.0047 (.0068)
$E_{it-4}(Inf_{12m})$		0.0020 (.0059)	-0.0012 (.0061)	0.0009 (.0059)
$E_{it}(Costs_{12m})$	-0.0006 (.0024)	-0.0036 (.0034)	-0.0023 (.0051)	-0.0036 (.0034)
$E_{it-1}(Costs_{12m})$		-0.0012 (.0028)	-0.0005 (.0034)	-0.0011 (.0030)
$E_{it-2}(Costs_{12m})$		0.0001 (.0030)	0.0021 (.0028)	0.0011 (.0031)
$E_{it-3}(Costs_{12m})$		0.0058** (.0025)	0.0035 (.0031)	0.0054** (.0026)
$E_{it-4}(Costs_{12m})$		0.0009 (.0029)	-0.0025 (.0032)	0.0002 (.0031)
Sector FE	✓	✓	✓	✓
Taylor Dummies	✓	✓	×	✓
Month FE	✓	✓	✓	×
Years FE	✓	✓	✓	×
$R^2$	0.4455	0.4474	0.0951	0.432
Observations	7,478	7,478	7,478	7,478

# Conclusions

- ▶ Novel evidence on forward-looking pricing decisions at the micro level.
- ▶ Besides time and state dependent pricing rules, the belief channel plays a relevant role for price-adjustment.
- ▶ Asymmetric and **delayed** effects once we leverage both aggregate and idiosyncratic beliefs.
- ▶ Heterogeneous effects of expectations across firms.
  - ▶ Size.
  - ▶ Multi-product.

## EXTRA SLIDES

# Questions

- ▶ Do firm expectations **matter** for price-adjustment decisions?
- ▶ Are these effects similar between aggregate and idiosyncratic expectations?
- ▶ Are the effect of expectations on pricing decisions contemporaneous?
- ▶ Does heterogeneity across firms matter?



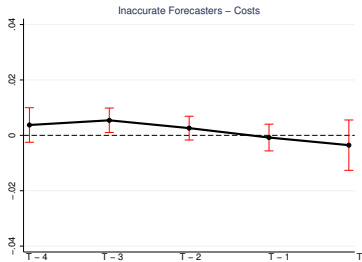
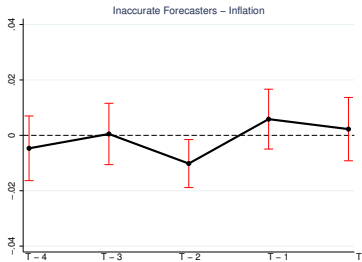
# This paper

- ▶ Answers these questions by:
  - ▶ Studying an unexplored survey of expectations across **firms** in Uruguay.
  - ▶ Documenting the effect of expectations on the extensive margin of price-adjustments.
  - ▶ Separating the effects of aggregate and idiosyncratic beliefs.
  - ▶ Controlling for firms' characteristics **and** time-dependent adjustment patterns.
- ▶ Based on granular firm-level information **construct** a cost index to deal with the price/cost endogeneity.
- ▶ New evidence that expectations **matter** for price-adjustment decisions.

## Descriptive statistics: inflation & costs 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
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
24 months	10.8	10.0	3.7	-10.0	80.0

# Marginal effects - Inaccurate



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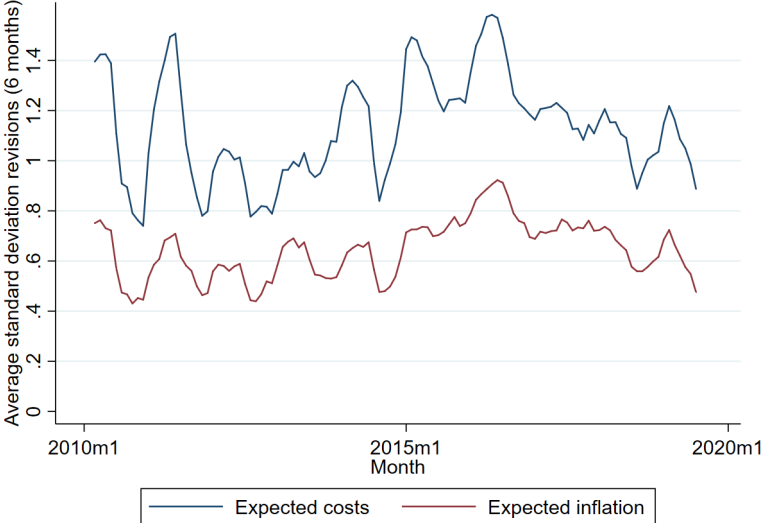
## Firm-level forecasts dispersion

- ▶ Difficulty of forecasting inflation relative to own costs could be different given the Uruguayan context.
- ▶ A measure of dispersion of beliefs at the firm level:

$$Std_{i,t}^y = \sqrt{\frac{1}{6} \sum_{j=0}^5 (E(X_{i,t-j+12}) - \bar{E}(X_{i,t-5+12}))^2}$$

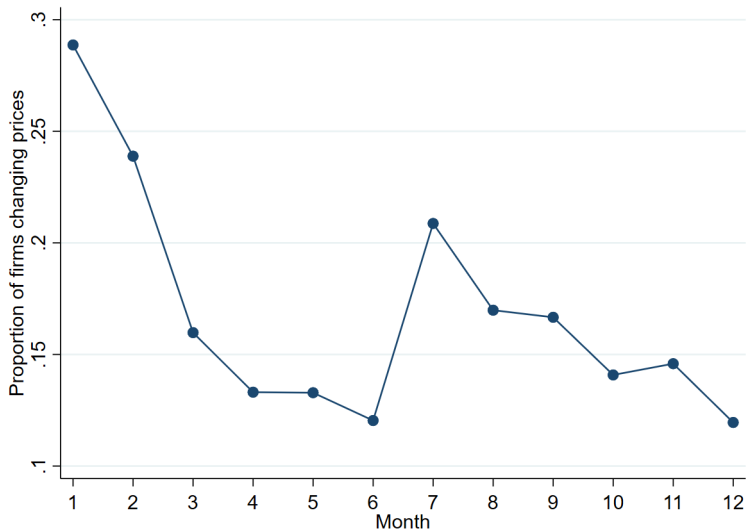
- ▶  $\bar{E}(\cdot)$ : average forecast of firm  $i$  for variable  $y$  between  $t$  and  $t - 5$  (**rolling window**).
- ▶  $y$ : inflation, costs.
- ▶ Assess the time-varying patterns of adjustments.

# Stylized Fact 3: dispersion of beliefs



# Seasonality in pricing decisions

Figure: Proportion of firms changing prices: seasonality

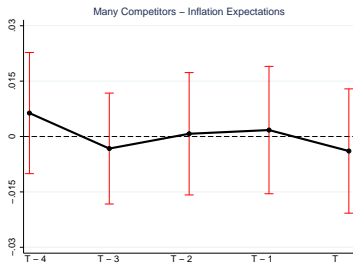
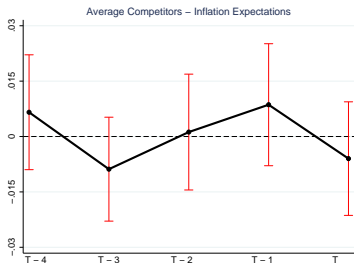


## Marginal effects - Multiproduct firms



- ▶ Mild evidence that lagged cost expectations matter for pricing decisions among multiproduct firms.
- ▶ Results consistent with evidence found by [Yang \(2019\)](#) for New Zealand.

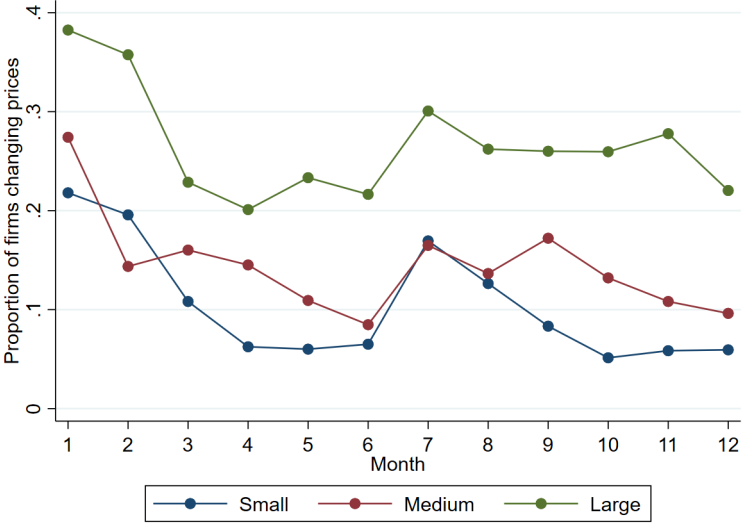
# Marginal effects - Number of competitors





# Seasonality in pricing decisions by firm size

Figure: Proportion of firms changing prices: seasonality by firm size



# Marginal Effects - Control Function

	(1)	(2)	(3)	(4)	(5)	(6)
$E_{it}(\pi_{12m})$	0.0012 (0.0049)	-0.0033 (.0062)			-0.0195 (0.0216)	-0.0205 (.0201)
$E_{it-1}(\pi_{12m})$		0.0075 (.0054)				0.0049 (.0058)
$E_{it-2}(\pi_{12m})$		-0.0039 (.0053)				-0.0036 (.0054)
$E_{it-3}(\pi_{12m})$		-0.00002 (.0063)				-0.0049 (.0068)
$E_{it-4}(\pi_{12m})$		0.0023 (.0054)				-0.0002 (.0061)
$E_{it}(C_{12m})$			0.0151 (0.0150)	0.0126 (0.0156)	0.0224 (0.0220)	0.0216 (.0022)
$E_{it-1}(C_{12m})$				-0.0003 (.0023)		-0.0011 (.0027)
$E_{it-2}(C_{12m})$				-0.0013 (.0028)		-0.0003 (.0029)
$E_{it-3}(C_{12m})$				0.0046* (0.0023)		0.0059** (.0026)
$E_{it-4}(C_{12m})$				0.0009 (0.0023)		0.0015 (.0029)
$\hat{u}_{it2}$	-	-	-0.1171 (0.1116)	-0.1184 (-0.1131)	-0.1574 (0.1623)	-0.1795 (0.1641)
Sector FE	✓	✓	✓	✓	✓	✓
Taylor Dummies	✓	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓	✓
Years FE	✓	✓	✓	✓	✓	✓
R2	0.444	0.446	0.1537	0.444	0.443	0.445
Observations	6,067	6,067	5,886	5,886	5,886	5,886

## Uruguayan Survey: sample design

- ▶ Monthly longitudinal survey of firms' inflation and own cost expectations.
- ▶ Every month since October 2009. Sampling in 2 phases.
- ▶ Original sample (1st phase) from Annual Economic Activity Survey (*Encuesta Anual de Actividad Económica*)
- ▶ Sample design (2nd phase): random, stratified according to economic activity and size.
- ▶ Size defined by employment, with 3 groups:
  - ▶ 50 to 99,
  - ▶ 100 to 199, and,
  - ▶ 200 or more.
- ▶ Large firms (200+): probability 1 of being included.

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## Uruguayan Survey: sample design

- ▶ Sample size: about 500 firms, representative of the population of firms with at least 50 employees (relatively large firms in Uruguay).
- ▶ Sample weights calibrated every month by the National Statistical Office (NSO) using regression methods and auxiliary variables: gross value of production, gross value added, among others.
- ▶ Firms have no obligation to answer the survey but they are used to receive mandatory surveys from the the NSO so they regularly answer it. [Back](#)

## Uruguayan survey: logistics

- ▶ Logistics are arranged by the National Statistical Office.
- ▶ Firms receive the questionnaire electronically by e-mail the first day of each month and have until the end of the month to answer it.
- ▶ Several reminders are sent if the firm does not answer the survey.
- ▶ 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. [Back](#)

## Quick Survey Details

- ▶ 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.
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