

# Belief-Dependent Pricing Decisions

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- ▶ Implications for Monetary Policy:
  - ▶ Presence of price-rigidities.
  - ▶ Transmission of monetary shocks to firms decisions.

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- ▶ Are the effect of expectations on pricing decisions contemporaneous?
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- ▶ Does heterogeneity across firms matter?
  - ▶ Yes, different responses depending on **firm's size, number of competitors and products**.

# 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 Expectation Survey

- ▶ Monthly firm panel survey (starting in 2009) with representativeness at both country and industry levels.
- ▶ Regular questions related to inflation and own costs expectations for different time horizons:
  - ▶ Current year,
  - ▶ Next 12 months and,
  - ▶ Next 24 months
- ▶ Questions asked:
  - ▶ *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?*

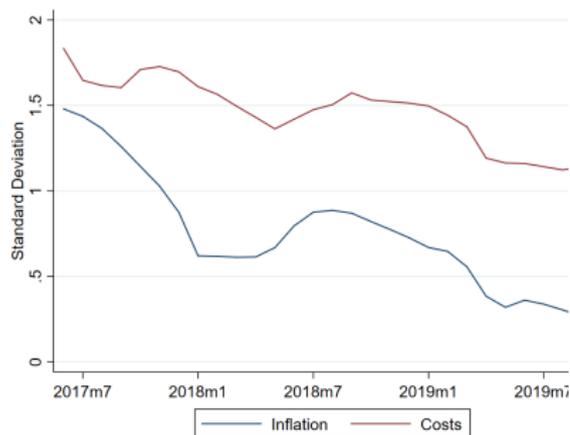
## Uruguayan survey: questionnaire about prices

- ▶ **Extensive margin:** since June 2017 we ask firms when they changed their prices.
- ▶ **Expected Intensive margin:** for given months there are questions about **expected** change in own prices for the internal and external markets.

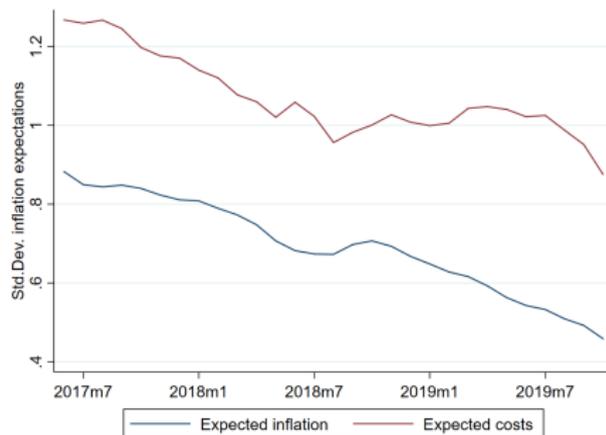
## Stylized Facts: Expectations and Price Changes

	Small	Medium	Large	All
Expectations				
Inflation expectations (in %)	9.0	8.7	8.5	8.7
Cost expectations (in %)	10.4	9.8	9.2	9.8
Forecast errors (abs. value)	2.5	2.2	2.0	2.2
Proportion of accurate firms (in %)	22.8	28.4	40.6	30.5
Prices				
Proportion of firms changing prices (in %)	10.5	14.3	27.1	17.3
Number of price changes	3.0	4.2	8.2	5.1
Expected price change (in %)	8.2	8.6	7.8	8.5
Firm characteristics				
Average number of products	2.6	3.7	4.6	3.6
Proportion of multiproduct firms (in %)	55.0	79.4	76.0	71.5
Average number of competitors	36.9	14.3	90.2	48.5
Average age (in years)	25.1	29.5	35.7	31.2
Costs proxy (in %)	8.1	8.1	7.7	8.0

# Stylized Facts: Expectation Volatility



(a) Observed



(b) Beliefs

- ▶ Proxy for overall cost of firms using Balance Sheet data. [▶ Cost](#)
- ▶ Costs are more volatile than inflation, same for firms' beliefs about idiosyncratic and aggregate conditions. [▶ SD](#)

## Panel Linear Probability Model (LPM)

$$AdjPrice_{it} = \mathbf{x}_{it}\beta + \mu_i + \eta_t + v_{it}$$

- ▶  $AdjPrice_{it}$ : dummy variable if firm  $i$  at month  $t$  adjust price of main product.
- ▶ Explanatory variables  $\mathbf{x}_{it}$ :
  - ▶  $E_{i,t}(\cdot)$ : **Current** and **lagged** values of firm's  $i$  inflation and cost growth expectations (next 12 months)
  - ▶  $Taylor_{i,t}$ : Time-dependent price adjustments (fixed-price adjustment plans)
  - ▶  $C_{i,t}$ : **Current** and **lagged** values of firm's  $i$  cost index proxy.
- ▶ Firm's and Time (years/months) FEs: State-dependent price adjustments.

# Belief-Driven price adjustments

	(1)	(2)	(3)	(4)
$E_{it}(\pi_{12m})$	-0.0008 (0.0049)	0.0009 (0.0054)	0.0019 (0.0067)	-0.0008 (0.0055)
$E_{it-1}(\pi_{12m})$		0.0020 (0.0050)	0.0041 (0.0062)	0.0004 (0.0051)
$E_{it-2}(\pi_{12m})$		-0.0038 (0.0044)	-0.0030 (0.0050)	-0.0047 (0.0043)
$E_{it-3}(\pi_{12m})$		-0.0012 (0.0054)	-0.0033 (0.0057)	-0.0021 (0.0055)
$E_{it-4}(\pi_{12m})$		-0.0012 (0.0058)	-0.0017 (0.0056)	-0.0025 (0.0056)
$E_{it}(C_{12m})$	0.0014 (0.0029)	-0.0036 (0.0040)	-0.0020 (0.0048)	-0.0043 (0.0041)
$E_{it-1}(C_{12m})$		0.0028 (0.0024)	0.0029 (0.0031)	0.0028 (0.0025)
$E_{it-2}(C_{12m})$		0.0014 (0.0024)	0.0028 (0.0025)	0.0019 (0.0024)
$E_{it-3}(C_{12m})$		0.0059** (0.0024)	0.0047* (0.0027)	0.0060** (0.0025)
$E_{it-4}(C_{12m})$		0.0029 (0.0028)	0.0015 (0.0029)	0.0030 (0.0030)
Cost index proxy	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Taylor Dummies	✓	✓	×	✓
Time FE	✓	✓	✓	×
$R^2$	0.1511	0.1506	0.0276	0.1374
Observations	8,553	7,553	7,553	7,553

## Belief-Driven price adjustments

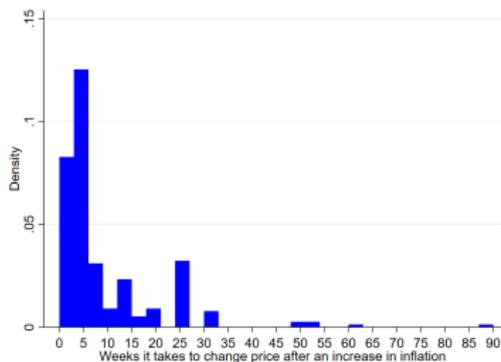
- ▶ Current beliefs do not affect the decision to change prices.
- ▶ A 1% increase in costs expectations, increases the prob. of a price adjustment by 0.6%, three months from that moment.
- ▶ The overall fit of the model decreases after removing time- and state-dependent variables, [Lein (2010)]
- ▶ Results are also consistent with theories of limited attention:
  - ▶ Firms allocate most of their limited attention to learning about idiosyncratic (and more volatile) shocks, relative to aggregate (less volatile) shocks, [Mackowiak and Wiederholt (2009)]
- ▶ We actively collect further evidence about the dynamic effect of idiosyncratic expectations through the survey.

## Delayed Price Adjustments

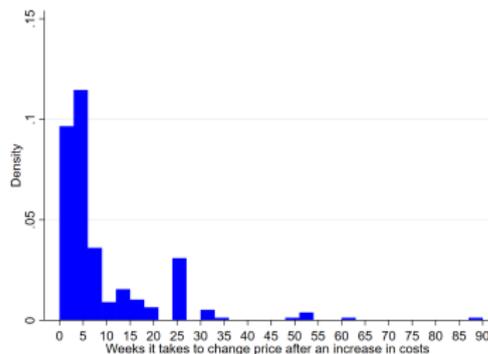
- ▶ In June 2019 we intervened the survey and added:
  - ▶ On average, how long does it take your firm to change prices when: (1) inflation increases and (2) costs increases?
  - ▶ Open answer for number of weeks.

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(a) Inflation



(b) Costs

- ▶ Approximately 11 and 10.5 weeks respectively to adjust prices.
- ▶ Delayed effect of cost on prices, [Nakamura and Zerom (2010)]

## Expected Intensive Margin

$$E(\Delta p_{it+12}) = \mathbf{x}_{it}\beta + \mu_i + \eta_t + \varepsilon_{it}$$

- ▶ Firms report an estimate of the magnitude by which they **expect** their main product's price will change (over the next 12 months).
- ▶ Expectation for local and external markets (exporting firms).
- ▶ Same set of explanatory variables, industries, firm fixed effects and state-dependent variables.

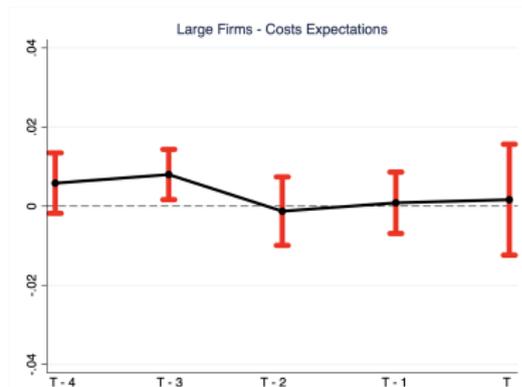
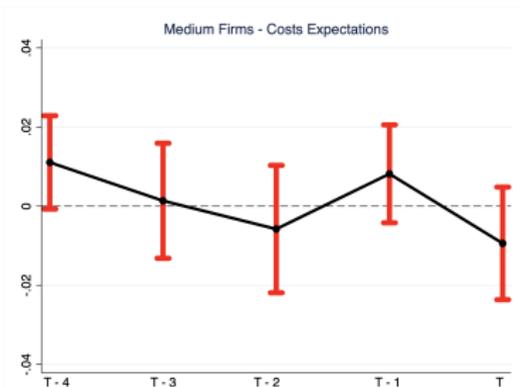
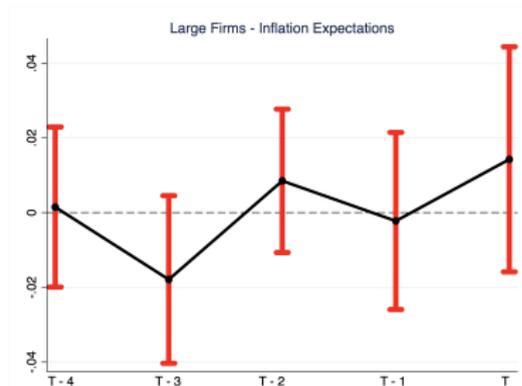
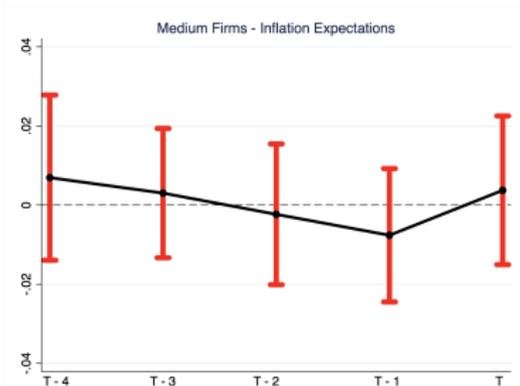
# Expected Intensive Margin

	Internal Prices		External Prices	
$E_{it}(\pi_{12m})$	0.2059*** (0.0612)	0.2034*** (0.0544)	-0.0943 (0.1082)	0.0764 (0.1082)
$E_{it-1}(\pi_{12m})$		0.0511 (0.0507)		-0.1422* (0.0786)
$E_{it-2}(\pi_{12m})$		-0.0069 (0.0459)		-0.0888 (0.0792)
$E_{it-3}(\pi_{12m})$		-0.0216 (0.0386)		-0.0083 (0.0930)
$E_{it-4}(\pi_{12m})$		-0.0339 (0.0381)		-0.0782 (0.0766)
$E_{it}(C_{12m})$	0.5328*** (0.0511)	0.4792*** (0.0468)	0.4219*** (0.0857)	0.2679*** (0.0427)
$E_{it-1}(C_{12m})$		0.0077 (0.0315)		0.1391** (0.0575)
$E_{it-2}(C_{12m})$		0.0370 (0.0241)		0.0695*** (0.0262)
$E_{it-3}(C_{12m})$		0.0281 (0.0222)		0.0416 (0.0298)
$E_{it-4}(C_{12m})$		-0.0081 (0.0275)		-0.0379 (0.0289)
Cost Index Proxy	✓	✓	✓	✓
Taylor Dummies	✓	✓	✓	✓
Firms FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓
Years FE	✓	✓	✓	✓
Observations	18,417	14,322	7,390	5,829

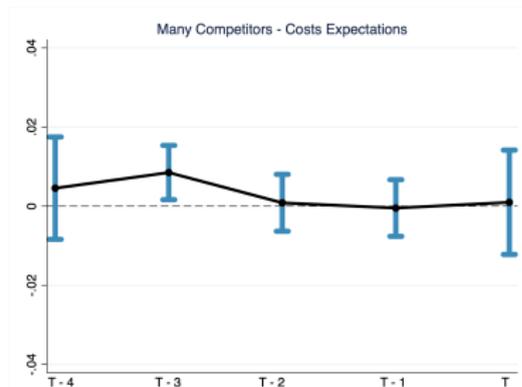
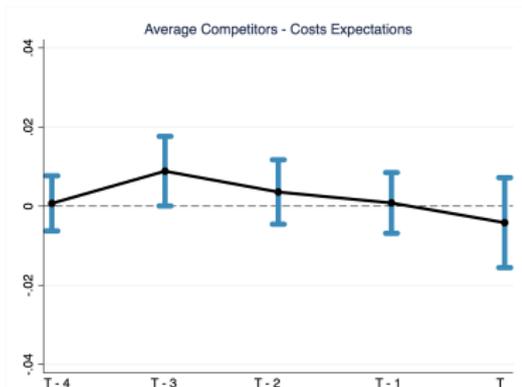
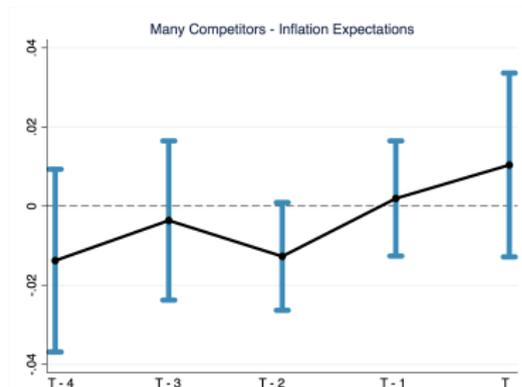
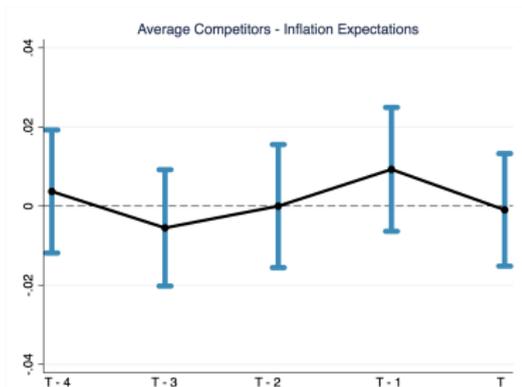
# Heterogeneity

- ▶ Study the delayed effect of cost expectations and possible connection with sources of ex-ante heterogeneity
  1. Firm Size.
  2. Number of Competitors.
  3. Multi-product firms.
- ▶ Using balance-sheet data we construct time-invariant dummy for each of these categories and we interacted with firms expectations.

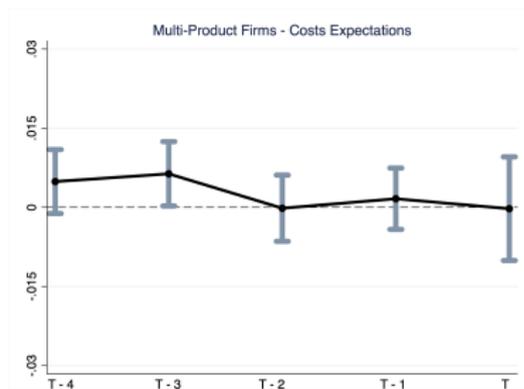
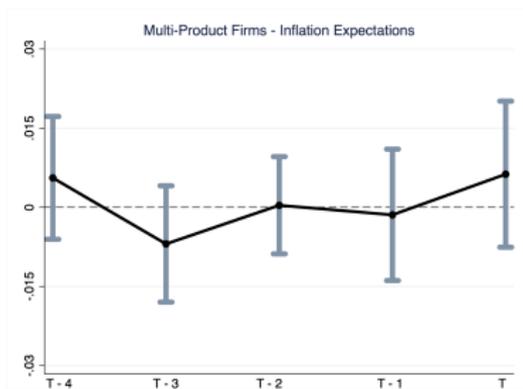
# Firm Size



# Number of Competitors



# Multi-Product firm



## Conclusions

- ▶ We assess the role of aggregate and idiosyncratic expectations on firms' price-adjustment decisions.
- ▶ Novel evidence on forward-looking pricing decisions at the micro level.
- ▶ Belief channel plays a relevant role for price-adjustment.
- ▶ Cost expectations affect pricing decisions with a few months delay.
- ▶ Delayed effect of beliefs on pricing actions is absent when studying the role of beliefs on expected price revisions.
- ▶ Heterogeneous effects of cost expectations across firms.

Thank you!

## Projected Cost Index

- ▶ The projected cost  $C_{i,t}$  is defined as:

$$C_{it} = \sum_{j=1}^J P_{jt} W_{ij2012} \quad (1)$$

- ▶ Where  $P_{j,t}$  is the price index of input  $j$  at time  $t$  and  $W_{ij2012}$  is the weight of input  $j$  in total costs for firm  $i$  in 2012.
- ▶  $W_{ij2012} = C_{ij2012}/C_{i2012}$ , where  $C_{ij2012}$  is the cost of input  $j$  for firm  $i$  in 2012, and  $C_{i2012}$  is total production cost of firm  $i$  in 2012. [▶ Back](#)

## Cost and Inflation Volatility

- ▶ **Cost volatility:** standard deviation of idiosyncratic conditions defined as:

$$Std_{i,t}^C = \sqrt{\frac{1}{6} \sum_{j=0}^5 (C_{i,t-j} - \bar{C}_{i,t-5})^2}$$

where  $C_{i,t-j}$  is our *projected* cost index constructed for firm  $i$  at time  $t - j$  and  $\bar{C}(\cdot)$  is the average cost for firm  $i$  between  $t$  and  $t - 5$ .

- ▶ **Firm level inflation volatility:**

$$Std_t^\pi = \sqrt{\frac{1}{6} \sum_{j=0}^5 (\pi_{t-j} - \bar{\pi}_{t-5})^2}$$

where  $\pi_{t-j}$  is the inflation rate in Uruguay at time  $t - j$  while  $\bar{\pi}_{t-5}$  is the average inflation between months  $t$  and  $t - 5$ . [▶ Back](#)

## Validity of Cost Proxy

	Dependent variable				
	(1)	(2)	(3)	(4)	(5)
	$C_{i,t+12}$	$C_{i,t+12}$	$C_{i,t+12}$	$FE_{i,t}^C$	$\pi_{t+12}$
$E_{i,t}(C_{i,t+12})$	0.0929** (0.026)		0.0657** (0.023)		
$\pi_{t+12}$		0.975** (0.087)	0.969** (0.086)		
$FE_{i,t}^\pi$				0.931** (0.052)	
$E_{i,t}(\pi_{t+12})$					0.200** (0.030)
No. Obs	9,267	9,267	9,267	8,502	9,267
Firm FE	✓	✓	✓	✓	✓

Notes: This table reports panel fixed effects OLS estimates. The table reports, in parentheses, robust and clustered (by firm) standard errors. \*\*, and \* indicate statistical significance at the 5% and 10% level, respectively.

# Baseline Specification Robustness

	Probability of Price Adjustments			
	(1)	(2)	(3)	(4)
$E_{i,t-3}(C_{i,t+12})$	0.0059	0.0059	0.0055	0.0055
Std. Dev.	(0.0024)	(0.0026)	(0.0030)	(0.0033)
p-value	0.015	0.024	0.066	0.093
Firm FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Month-Sector FE			✓	✓
Year-Sector FE			✓	✓
Clustered errors at firm level	✓		✓	
Clustered errors at firm-month level		✓		✓
No. Obs	7,553	7,553	7,443	7,443