

Belief-Dependent Pricing Decisions

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Motivation

- ▶ *“Information on the price expectations of businesses who are, after all, the price setters in the first instance (...) is particularly scarce. ... How do changes in various measures of inflation expectations feed through actual pricing behavior?” Ben Bernanke (2007).*

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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?
 - ▶ 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 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?*

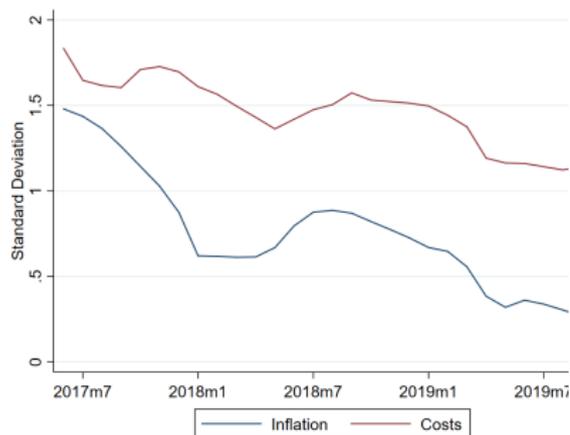
Uruguayan survey: questionnaire about prices

- ▶ **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.

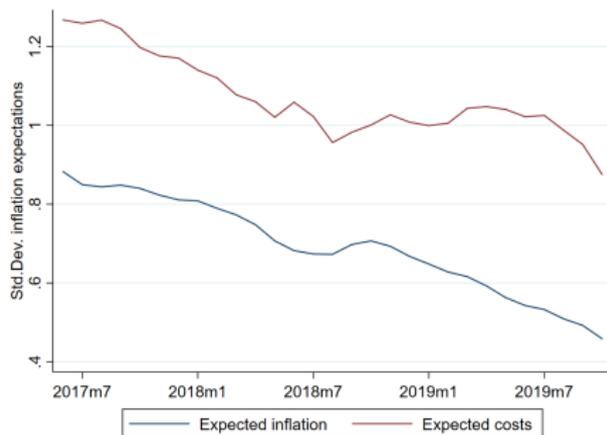
Stylized Facts: Expectations and Price Changes

	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

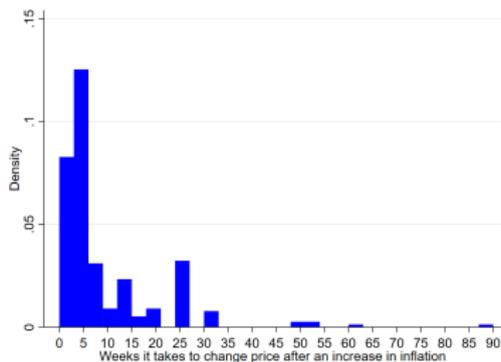
- ▶ Current beliefs do not affect the decision to change prices.
- ▶ A 1% increase in costs expectations, increases the prob. of a price adjustment by 0.6%, three months from that moment.
- ▶ The overall fit of the model decreases after removing time- and state-dependent variables, [Lein (2010)]
- ▶ 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

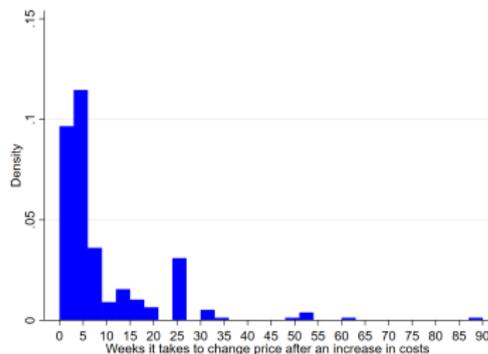
- ▶ In June 2019 we intervened the survey and added:
 - ▶ On average, how long does it take your firm to change prices when: (1) inflation increases and (2) costs increases?
 - ▶ Open answer for number of weeks.

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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.

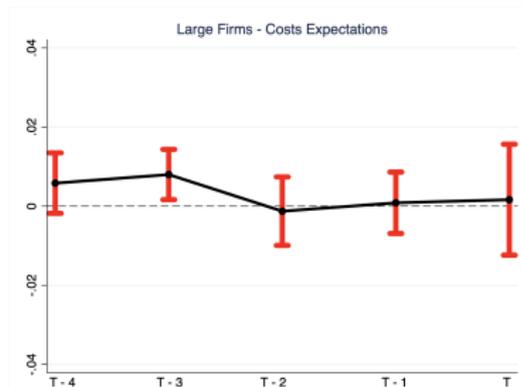
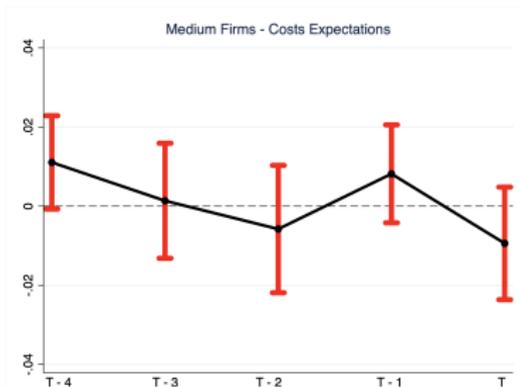
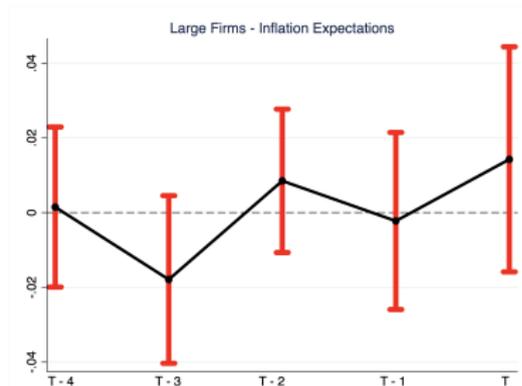
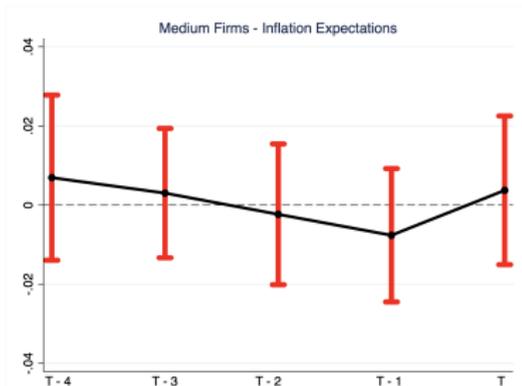
Expected Intensive Margin

	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

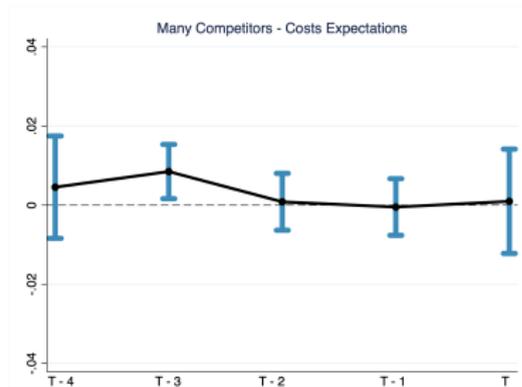
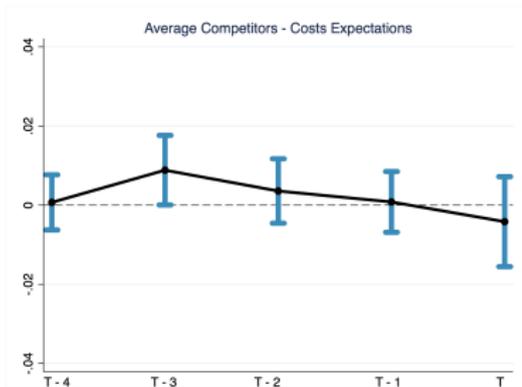
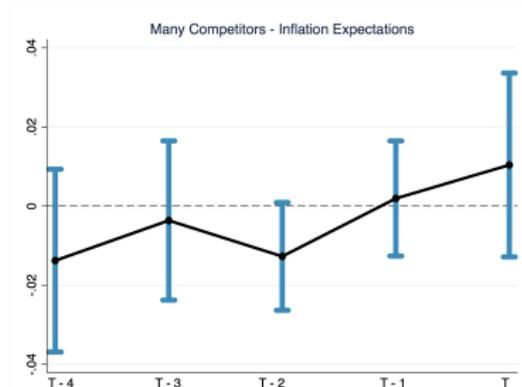
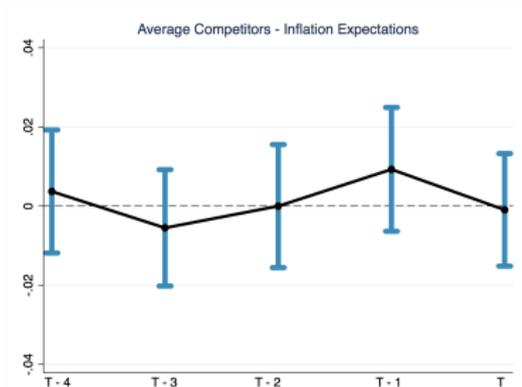
Heterogeneity

- ▶ 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.

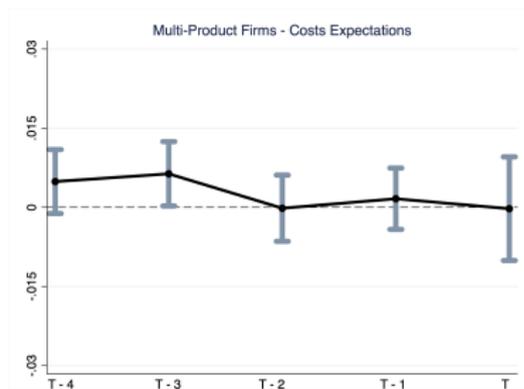
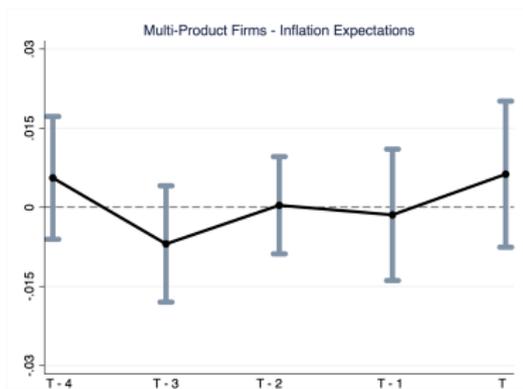
Firm Size



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 π_{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)
	$C_{i,t+12}$	$C_{i,t+12}$	$C_{i,t+12}$	$FE_{i,t}^C$	π_{t+12}
$E_{i,t}(C_{i,t+12})$	0.0929** (0.026)		0.0657** (0.023)		
π_{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