Belief-Dependent Pricing Decisions*

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October 12, 2022

Abstract

This paper studies the effects of inflation and idiosyncratic cost expectations on firms' price-adjusting decisions. Evidence of price-settings frictions using micro data has been studied through the lens of both time-dependent and state-dependent models. Using data from a unique survey, we argue that price-adjustment decisions are also belief-dependent. While controlling for time- and state-dependent factors, we find that, for the extensive margin of price-changes, expectations of inflation do not play any role, but firms' beliefs about their overall costs do. The expectation channel is, however, heterogeneous across firms, driven exclusively by large companies, and operates with a delay. Nonetheless, when looking at firms' beliefs about the intensive margin of price-changes, besides costs, the relevance of current inflation expectations is recovered. Our evidence supports the presence of price rigidities at the firm level but is also consistent with theories of limited attention.

JEL: D22, D84, E31.

Keywords: inflation expectations, cost expectations, firm surveys, price adjustments.

*We are grateful for comments and suggestions from Mirko Wiederholt, Isaac Baley, Michael Weber, Peter Zorn, Ernesto Pastén, Alejandro Vicondoa, Federico Huneeus, Gerardo Licandro, Jorge Ponce, Fernando Borraz, Ana Balsa, Juan Dubra, Giorgio Chiovelli, Raphael Schoenle, Edward Knotek, Alberto Cavallo and Joseph Vavra. Special thanks to Agustin Barboza for excellent research assistantship. Turen is grateful to Fondecyt-Anid for funding (project *Fondecyt Iniciación N^o* 11190753). All errors and omissions are ours.

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1 Introduction

Economic decisions are forward-looking. Future expected changes are relevant as they should have an immediate effect on decisions. For price-setting decisions, any canonical New Keynesian Phillips Curve (NKPC) model would include an equation where the current optimal price is determined by a discounted sum of firms' future beliefs on the aggregate price level and the expected evolution of marginal costs. While most of the empirical evidence about the effects of expectations on pricing decisions are typically at the macro level, Gali and Gertler (1999), Gali et al. (2005) and Sbordone (2005), the evidence is scarcer at the micro-level, Carlsson and Skans (2012). Empirical evidence on forward-looking pricing is crucial as it directly speaks to the presence of price-setting frictions at the firm level. However, the lack of firm-level data on price-adjustment decisions *augmented* with firm's beliefs about future aggregate and idiosyncratic conditions challenges this task. This paper aims to fill this gap in the literature by using a long and unique survey of firms' expectations in Uruguay. Thus we aim to answer the following questions: do firm's expectations *matter* for price-adjustment decisions? Is the response to aggregate and idiosyncratic expectations similar? Is the effect of beliefs heterogeneous across firms?

Evidence of price-setting frictions using micro-data has been studied through the lens of both time-dependent and state-dependent models.[1] In this paper, we argue that price-adjustment decisions are also *belief-dependent*. We provide empirical evidence supporting this third channel as an important driver of price revisions. Through the survey, we collect firms' predictions about the expected evolution of inflation along with how much they expect their costs to change in the near future. Evidence about the extensive margin of price changes along with firms' time-invariant characteristics allows us to assess the role of aggregate and idiosyncratic beliefs separately on pricing decisions. We estimate a reduced-form version of the pricing equation used in any stylized NKPC model while controlling for both time- and state-dependent characteristics.

We find empirical support for forward-looking behavior at the firm level. We show that one year ahead expectations significantly *matter* for price-adjustment decisions. On the one hand, we show that idiosyncratic beliefs about the future evolution of costs matter for this decision. On the other hand, inflation expectations do not seem to play a significant role. The fact that inflation and costs growth expectations are conceptually

[1] See for example, Taylor (1980), Calvo (1983), Klenow and Kryvtsov (2008), Nakamura and Steinsson (2008) and Vavra (2013) among others.

distinct and different has been already pointed out by Coibion et al. (2020). Our results not only confirm the low correlation between the two expectations, but also show that they bring *different* implications for price adjustment decisions. While these results speak to the presence of price-rigidities, they also have implications for the effects of monetary policy. In particular, further evidence on the potential differential effects of inflation expectations vis-a-vis cost expectations on price-adjustment decisions can also shed light on the transmission mechanism and the timing of monetary shocks on firms' pricing decisions. Moreover, we document that the effect of expectations operates with a *delay*. We show that if firms believe their costs would increase by 1% a year in the future, this significantly increases the probability of adjusting prices by 0.6% after three months. We confirm this result and its timing by adding a special question for one month of the survey.

Besides studying the implications of firms' expectations on extensive margin decisions, we also assess how firms form their expectations in Uruguay and how expectations are related with firm's beliefs about future price changes. We show that both current inflation and cost expectations positively correlate with the expected intensive margin of price changes. These results complement recent findings by Andrade et al. (2020) studying how industry-specific and aggregate shocks shape firms' expectations about expected price changes. Our results suggest that while total cost expectations matter for the decision to actually change prices, the effect is different when we paired such expectations with *future* price decisions. Finally, we show that the expectations effect is highly *heterogeneous* across firms. In particular, the idiosyncratic belief channel of price revisions is only present for large firms. Small and medium sized firms do not seem to react to expectations. Moreover, the forward-looking behavior is present particularly for multi-product firms facing a large number of competitors. To the best of our knowledge, there is no empirical evidence studying the potential heterogeneous effects of beliefs on firms' decisions.

The effect of beliefs is significant while controlling for both time-dependent (fixed and exogenous price-adjustment plans at the firm level) and state-dependent variables. Exploiting the panel structure of our database, we can also control for unobserved time-invariant firm-level characteristics. One of the main challenges we face is that we do not have information about firms' costs. This could cause problems to our empirical pricing model as we are omitting an important variable. In accordance with Carlsson and Skans (2012), we construct a detailed cost index for each firm, using balance-sheet information where we keep the firm's production structure constant while varying its input prices. We construct a proxy for the growth rate of costs at the firm level through the cost index, which we add in our estimations to control for firms' costs.

While the existing literature has documented the central role of idiosyncratic costs to rationalize firms' pricing decisions and their dynamics, we see our belief-dependent channel as a natural extension of these results. Based on large idiosyncratic shocks, Midrigan (2011) argues that price-adjustment decisions are driven mostly by idiosyncratic rather than aggregate shocks. Midrigan (2011) also shows that the distribution of price changes does not change from low to high inflation periods. Our results speak to this evidence as current price-adjustment decisions respond to cost expectations, while they do not react to changes in beliefs about inflation. The delayed effect of costs on prices is documented by Nakamura and Zerom (2010). The authors report that while an increase in costs leads to a posterior increase in prices, the price adjustment occurs with a delay of at least one quarter. The presence of menu costs is essential to rationalize the short-run delayed pass-through of costs to prices. Similarly, Dias et al. (2011) finds significant evidence of short-run delays in price adjustments using a detailed survey of Portuguese firms. Our results support these findings since the estimated timing and reaction of cost expectations are in the same direction as the existing evidence.

Departing from price rigidity, the muted reaction of price revisions to aggregate expectations calls for further attention. It is not obvious why, in a country as Uruguay where inflation is stable but high, inflation expectations affect the future path of price changes but does not alter the decisions to change prices. Using our constructed cost index, we show that the volatility of costs relative to inflation is persistently higher over time. This is also true when we look at its expectations' counterpart. Thus, we argue that our results are also consistent with the theoretical predictions of "rationally inattentive" price setters as documented by Maćkowiak and Wiederholt (2009). As inflation is high but stable in Uruguay, we conjecture that this reduces firms' incentives to pay attention to its evolution, deciding to learn about and react more to idiosyncratic – and more volatile – costs. This interpretation thus reinforces theories of inattention as an important constraint faced by firms, which can help to understand further the process by which firms acquire information, consistent with recent evidence Coibion et al. (2018). Rather than framing our results within price or information rigidities specifically, we interpret them as evidence that both of these rigidities coexist at the firm level, supporting theories that combine these two frictions when modeling price-setting decisions such as Alvarez et al. (2011) and Angeletos and La'O (2009).

The paper also contributes to the vast literature on the micro evidence of price-adjustment decisions, Klenow and Kryvtsov (2008), Nakamura and Steinsson (2008), Midrigan (2011) to name a few. Concerning the determinants of price-adjustments decisions, Lein (2010) argues that besides time-dependent pricing rules, the evidence supports the presence of state-dependent price-adjusting decisions. Bachmann et al. (2019) argues that idiosyncratic business volatility positively affects the extensive margin of prices, allowing the volatility effect to dominate the potential "wait-and-see" effect. This paper complements this evidence by arguing that the expectation channel is also a relevant determinant behind the frequency of price changes.

While there is a growing literature on how expectations are formed, Coibion and Gorodnichenko (2012), Andrade and Bihan (2013), Frache and Lluberas (2019), and Giacomini et al. (2020), there is much less evidence on how expectations correlate with economic decisions. This is partly because most of the literature studying expectations relies on forecasts from professionals. How representative these forecasters are and the implications of their forecasts on the economy are at least questionable. Surveys asking for expectations from relevant economic actors such as firms or households are much scarcer. Coibion et al. (2022) studies how different forms of monetary policy communication affect households' inflation expectations while D'Acunto et al. (2019) shows how prices faced by households on their shopping behavior affect their inflation expectations. Relative to firms, Boneva et al. (2019) documents several stylized facts about how expectations across firms are formed. That paper found a significant relationship between past expected prices and wage increases. Coibion et al. (2020) shows that firms' higher inflation expectations have a significant effect on their pricing, hiring, and credit decisions. Our paper contributes to this literature by separating the effect of aggregate and idiosyncratic beliefs as well as stressing the heterogeneity in the effect of expectations on pricing decisions across firms.

The rest of the paper is organized as follows. In Section 2, we introduce the survey that we use throughout the paper. In Section 3, we discuss the main stylized facts of the survey. Section 4 introduces the estimation procedure and the main results of the empirical analysis regarding firms' expectations and pricing decisions. Section 5 studies the potential heterogeneous effect of expectations based on firm characteristics, and finally Section 6 concludes.

2 Data

Our firm expectations survey takes place in Uruguay. This country is characterized by having high but stable inflation, with an average of 8% over the past decade. The studied survey is carried out by the National Statistical Institute (INE), commissioned by the Central Bank of Uruguay (BCU), and was originally designed to track firms' inflation expectations. The firm panel is conducted monthly, and the survey is representative at both country and sector levels, which is not a common feature in these types of surveys. Every month, firms are asked about their inflation expectations, i.e., the expected annual change in the Consumer Price Index, along with their cost expectations, i.e., the expected change in their total production costs. These questions are asked for different time horizons: the current calendar year, the next 12 months, and the next 24 months. Every two months, all surveyed firms must also report the magnitude of expected price changes over the next 12 months. Thus, we also have information about the expected intensive margin of prices. The person answering the questionnaire is supposed to be responsible for the firm's pricing decisions but could also be the owner, a general, or an area manager.[2] For a more detailed comparison, in Appendix 7.1 we contrast the main features of our novel Uruguayan survey of firms with other surveys for other countries: the US, the UK, and New Zealand. Moreover, in Appendix 7.1 we also add more specific details about the survey and its representativeness.

Starting in June 2017, firms have also been asked whether and if so when they have changed the price of their main product. It is a closed-end question with the following options: this month, a month ago, two months ago, three months ago, four months ago, five months ago, six months ago, and seven or more months ago. We consider that a firm changed the price of its main product if they refer to "this month" as the last time they made a price change.

As the question regarding the extensive margin of price changes is only available since July 2017, our estimations for the extensive margin of price changes use data from this month until March 2020 (we exclude the Covid-19 pandemic). This period is characterized by a persistent increase in inflation with an average of approximately 8%. Hence, the empirical analysis throughout the paper is based on this specific time window. The *only* moment when we will use a longer time frame is when we study the effects of expectations on the expected price change - i.e., expected intensive margin - in Section 3.4. In this specific case, we have

[2]In March 2016, we asked the respondents about their role within the firm and found that 42% were directors, general managers, or area managers; 19% economic analysts; 12% consultants; and 28% had different roles within the firm.

data running back to 2010. As discussed, the questions about the expected price change have been asked irregularly since the start of our survey. Then we prefer to conduct these estimations by relying on a sample with more observations.

2.1 A firm-level cost proxy

Although we have rich monthly information about firms' expectations from the survey, we do not have specific information about their actual costs on a monthly bases. This is important not only to assess the quality of firms' expectations about their own costs but also as we do not want to omit such a relevant variable when we aim to understand firms' price adjustment decisions. For these reasons, we construct a firm-specific cost index.

Using the balance-sheet information taken from the 2012 "Annual Survey of Economic Activity," we compute the cost structure for each firm. In particular, we use granular information about salaries, inputs, expenses, and goods originally bought by each firm and then resold without transformation. To compute the cost structure for each firm, we collect information for more than 1,000 inputs that are assigned to a price index. We assign a different price index for *each* input, and when a suitable index is not available, we replace it with the general CPI. Given that we keep the 2012 cost structure for each firm fixed, the variation of the projected cost will be given by the evolution of input prices. Hence, our cost proxy is constructed by keeping each firm's production scale and thus total production constant. Thus, our projected costs index $C_{i,t}$ is defined as:

$$C_{i,t} = \sum_{j=1}^{J} PI_{jt} W_{ij2012} \tag{2.1}$$

Where $PI_{j,t}$ 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. We define $W_{ij2012} = C_{ij2012}/C_{i2012}$, 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. This index $C_{i,t}$ is later used as a proxy for the unobserved costs in Section 4.

3 Stylized Facts

Table 3.1 shows summary statistics for the entire sample and also by firm size. We divide the sample into three groups according to size and categorize firms into small, medium, and large.[3]

Table 3.1: *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
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

3.1 Stylized Fact 1: Forecast accuracy and reaction to information

An interesting initial question is how Uruguayan firms form their expectations and react to information. The panel structure of our database allows us to study how forecast errors relate to expectation revisions at the aggregate and at the firm level. Initially, we follow Coibion and Gorodnichenko (2015) and study if forecast errors are predictable from forecast revisions by running the following regression:

$$FE_t^X = \alpha + \beta Rev_t^X + \epsilon_t$$

Where FE_t^X is the average forecast error and Rev_t^X is the average forecast revision across firms. Specifi-

[3]We call the first group of firms *small*, but it is worth noting that the survey sample is representative of firms with more than 50 employees, and thus, we should not consider "small" firms as being literally small. The size variable is constructed after merging the expectation survey with information from the 2012 "Annual Survey of Economic Activity," which contains the firm's balance sheet information. We rely on total income sales at the firm level as a proxy for size in this particular year. Unfortunately, balance sheet information is only available yearly and, for most years, only for a sub-sample of firms. However, the 2012 wave contains detailed information for almost all the firms in our sample. Implicitly, we assume that the distribution of firm sizes does not change substantially over time.

cally, we define $FE_t^X = \frac{1}{N}\sum_{i=1}^{N}[X_{t+12} - E_{i,t}(X_{t+12})]$ where $X = [\pi, C^i]$. Although not flawless, we rely on the cost index $C_{i,t}$ to construct the accuracy of costs expectation (later, in Section 4.2.1, we judge the validity of such proxy). We define $Rev_t^X = \frac{1}{N}\sum_{i=1}^{N}[E_{i,t}(X_{t+12}) - E_{i,t-1}(X_{t+12})]$. If $\beta = 0$, forecast revisions do not predict forecast errors. In this case, then we can state that the full information rational expectations (FIRE) hypothesis holds and forecast errors are random. On the other hand, if $\beta < 0$, firms' consensus forecasts overreact relative to FIRE and if $\beta > 0$ it underreacts. Table 3.2 summarizes the results.

Table 3.2: *Forecast errors and forecast revisions*

	FE_t^π	FE_t^C	FE_t^π	FE_t^C
Rev_t^π	3.219***			
	(0.864)			
Rev_t^C		3.434***		
		(1.008)		
$E_t(\pi_{t+12})$			3.547***	
			(0.930)	
$E_{t-1}(\pi_{t+12})$			-3.031***	
			(0.892)	
$E_t(C_{t+12})$				3.357***
				(1.008)
$E_{t-1}(C_{t+12})$				-3.473***
				(1.023)
Const.	-0.820***	-1.342***	-5.500***	-0.144
	(0.137)	(0.197)	(1.557)	(2.791)
Obs.	114	114	114	114
R^2	0.135	0.084	0.190	0.085

Notes: This table reports OLS estimates associating mean forecast errors and mean forecast revisions. Each observation corresponds to a month. The dependent variable is the 12-month ahead forecast error. The table reports, in parentheses, robust standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

For both inflation and costs, β is statistically different from 0, suggesting that forecast errors are predictable from forecast revisions. As discussed by Coibion and Gorodnichenko (2015), using our estimated β, we can link the degree of information rigidity with the predictions of the "sticky information" model by Mankiw and Reis (2002) and the noisy information models. We can estimate the degree of information frictions in sticky information models as $\lambda = \frac{\beta}{1+\beta}$. Our estimations suggest that λ is equal to 0.763 for inflation and 0.774 for costs, which implies that firms update their information sets every nine months on average. With respect to noisy information models, Coibion and Gorodnichenko (2015) show that the Kalman gain in the noisy information model, G, can be estimated as $G = \frac{1}{1+\beta}$. In that case, G captures the weight that is given to new information when agents form their expectations. According to our estimations, G is equal to 0.237 for inflation and 0.226 for costs, suggesting that firms in Uruguay rely more on their previous forecasts than on new information. We can test additional predictions from the "sticky" and the "noisy" information model. In fact, both models predict that the coefficient attached to the current forecast and the lagged one should be equal in absolute value. This implies that the coefficient of the current forecast should be positive, the coefficient of the lagged forecast should be negative, and the sum of the two should be zero. These predictions are not rejected in columns (3) and (4) of Table 3.2.

As discussed by Bordalo et al. (2020), rejecting FIRE does not mean that rationality in expectations formation is rejected. It is possible to obtain $\beta > 0$ while individual forecasters behave rationally and update their expectations from noisy idiosyncratic signals. If this is the case, individual forecasts should be unpredictable. To test this, we rely on individual level regressions, either assuming common coefficients or running firm by firm regressions to obtain different coefficients for each firm. The first approach implies running the following regression pooling the firm level data to obtain a common coefficient β^P for all firms: $FE^X_{i,t} = \alpha^P + \beta^P Rev^X_{i,t} + \epsilon_{i,t}$, where $FE^X_{i,t} = X_{t+12} - E_{i,t}(X_{t+12})$ and $Rev^X_{i,t} = E_{i,t}(X_{t+12}) - E_{i,t-1}(X_{t+12})$. For the second approach, we obtain a coefficient for each firm $i = 1, 2, ..., N$ in our sample by running the following firm level regression: $FE^X_{i,t} = \alpha^i + \beta^i Rev^X_{i,t} + \epsilon_{i,t}$. At the individual level, rational expectations implies that $\beta^P = 0$ or, alternatively, $\beta^i = 0$. If $\beta^P < 0$, then the average firm overreacts to its own information and if $\beta^P > 0$ it underreacts. The interpretation of the results is the same for β^i. Estimations at the individual level reinforce the consensus forecast results shown in Table 3.2. The results confirm that for both inflation and costs $\beta^P > 0$, suggesting that, on average, firms underreact to new information.[4]

3.2 Stylized Fact 2: Expectation Volatility

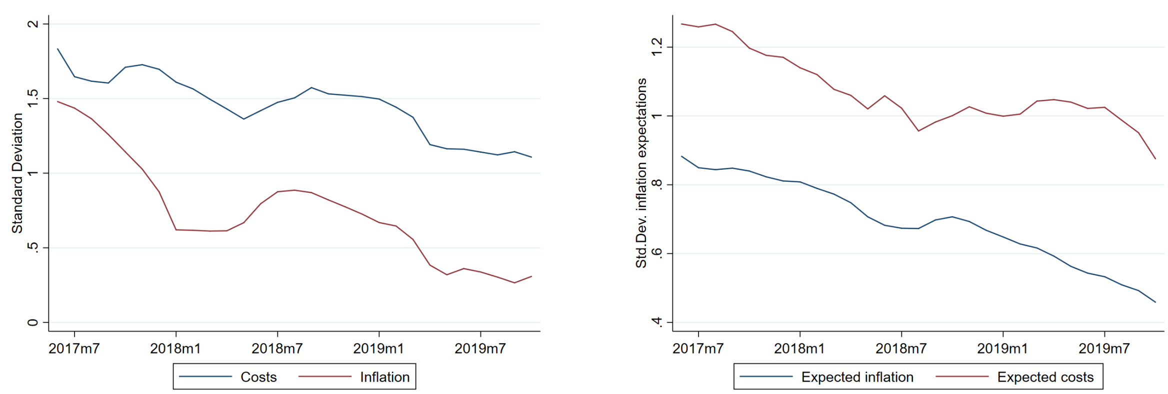
The second stylized fact is related to the firm-level volatility of aggregate and idiosyncratic expectations. As having information about both aggregate and idiosyncratic expectations in these surveys is rare, besides the mean, it is interesting to explore the relative volatility of these two variables. A highly volatile cost expectation for a specific firm can shed light on the idiosyncratic uncertainty surrounding firm's decisions, particularly about its price-setting (Vavra (2013), and Bachmann et al. (2019)).

[4]The pooled and individual regressions' results are available upon request.

While we anticipate that inflation expectations will be relatively stable given the overall stability of inflation in Uruguay, the volatility of cost expectations is less obvious. We then measure cost ($Std^{C}_{i,t}$) using our cost proxy $C_{i,t}$, and inflation volatility ($Std^{\pi}_{i,t}$) as the standard deviation computed on a 6-month rolling window.[5]

The time-series for the two volatility measures are shown in Figure 3.1(a). For the cost volatility, the figure shows the average of $Std^{C}_{i,t}$ across firms. Consistently across the sample, the idiosyncratic conditions are more volatile than the aggregate ones. As conjectured, this is not surprising due to the stability of inflation in Uruguay. In Figure 3.1(b), we compute the same standard deviations but for inflation and costs expectations. [6] According to the results, the persistent higher volatility of idiosyncratic conditions relative to inflation, translates into similar patterns for firms' beliefs.

Figure 3.1: *Average Volatility of Own Costs and Aggregate Inflation*



(a) Observed *(b) Beliefs*

With respect to firms' specific characteristics, Figure 7.1(a) in Appendix 7.2 shows the ratio of the average volatility of own costs to inflation, conditioning on the three firm sizes. We show that idiosyncratic conditions are more variable than inflation for all firm sizes, but the ratio is larger for large firms. A very similar pattern is also found when we look at the volatility in firms' beliefs about idiosyncratic and aggregate conditions, see Figure 7.1(b) in Appendix 7.2.

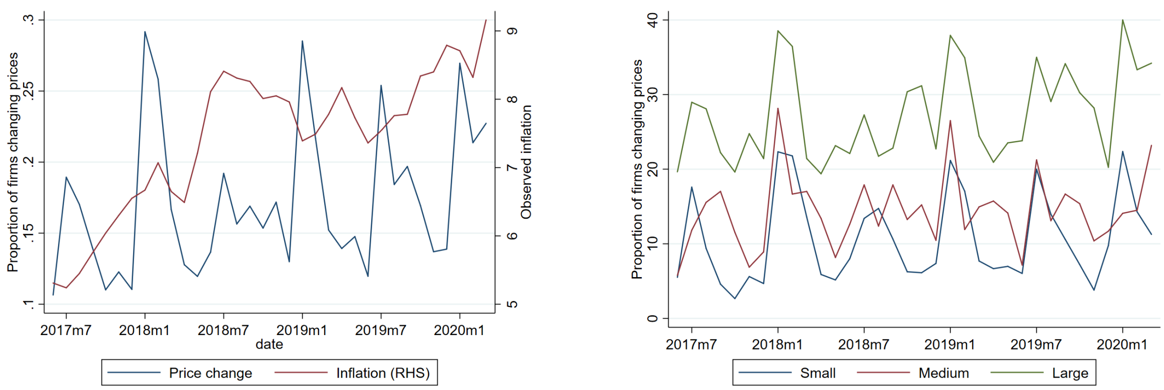
[5] Further details on how we compute the volatility measures are presented in Section 7.2 in the Appendix.

[6] We use the same formulas as in (7.1) and (7.3) but replacing $C_{i,t}$ and π_t with the 12 months ahead expectation for costs $E_{i,t}(C_{12m})$ and inflation $E_{i,t}(\pi_{12m})$, respectively.

3.3 Stylized Fact 3: Frequency of Price Adjustments

Turning to pricing decisions at the extensive margin, each month, around 17% of firms are changing their prices, see Table 3.1. Figure 3.2(a) shows the evolution of inflation and the proportion of firms changing their prices every month. We notice a slight positive correlation between price adjustment and inflation. As inflation increased in the second semester of 2018, the proportion of firms changing prices also increased. In that line, when inflation sharply increased in March 2020, that group of firms also increased substantially. There is also a clear pattern of seasonality as a significant proportion of price adjustments are concentrated during January and July, consistent with findings for other countries (see for example Nakamura and Steinsson (2008)), and related to wage indexation, and utility price adjustments as documented by Frache and Lluberas (2019). As shown in 3.2(b), pricing-adjustment decisions are also heterogeneous across firm sizes as large firms are the ones that are changing prices more frequently.[7]

Figure 3.2: *Proportion of Firms Changing Prices (By Month)*



(a) All firms

(b) Sizes

The middle block of Table 3.1 shows the proportion of firms that change their prices, the average number of price changes, and the expected price change according to firm size. On average, 27% of large firms change their prices every month, but only 14% and 10% of medium and small firms do. Over a 34 month period, on average large firms changed their prices eight times, medium firms changed their prices four times, and

[7]Regarding seasonality, Appendix 7.3 shows the proportion of price changes for each month of the year. This is shown for all firms and also conditioning on size.

small firms only three times. This finding is consistent with results shown in Lein (2010) which finds that the probability of price change increases with firm size measured by the number of employees. On the other hand, using the information on the expected intensive margin question, we find that large firms anticipate smaller price changes compared to medium and small firms. Hence, while large firms are changing prices more frequently, the expected magnitude of revision is smaller compared to the rest of the firms in the sample.

3.4 Stylized Fact 4: Expected Intensive Margin

Although the focus of the paper is on studying the possible effects of expectations on actual pricing decisions, we end this Section by documenting a new fact about the correlation between expectations and the magnitude by which firms *expect* will adjust their prices in the future. As discussed in Section 2, every two months, firms provide an estimate of the magnitude by which they think their main product's price will change, on average, over the next 12 months in their local and external markets. Hence, we will study the potential effects of current and lagged beliefs on the expected magnitude of price changes. Using the panel structure of the survey, we estimate:

$$E(\Delta p_{it+12}) = \mathbf{x}_{it}\boldsymbol{\beta} + \mu_i + \eta_t + \varepsilon_{it} \tag{3.1}$$

Where $E(\Delta p_{it+12})$ is the expected magnitude by which firm i will adjust the price of its main product a year from now. The independent variables $\mathbf{x}_{it}$ include both current and lagged values of firm i inflation and cost growth expectations for the next 12 months. We also control for current and lagged values of the cost proxy and add firm and time fixed effects. Table 3.3 shows the results of model (3.1) for the domestic and the external markets.[8]

Related to internal prices, *current* expectations for both inflation and costs positively correlates with the expected intensive margin. Both aggregate and idiosyncratic expectations play an important role in determining the expected magnitude of price adjustments once the decision to revise prices has (hypothetically) been made. However, the current cost expectation is more relevant as its marginal effect is more than twice that of the expectations of inflation. Lagged expectations for either inflation or cost do not seem

[8] As a significant number of firms does not export their products, the sample size decrease considerably when estimating the results for the external prices.

Table 3.3: ***Expected Intensive Margin***

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

Notes: This table reports panel fixed effects OLS estimates associating aggregate and idiosyncratic expectations on the expected magnitude of the price adjustment. The dependent variable is the expected intensive margin of the price adjustment. In columns (1)-(2) the price adjustment is for local markets and columns (3)-(4) for external ones. All specifications include a time t and four lags of a cost index proxy at the firm level, firm, month and year fixed effects. The table reports, in parentheses, robust and clustered (by firm) standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

to play a role in determining the expected intensive margin. This fact speaks to the findings of Andrade et al. (2020) on the determinants of expected price changes at the firm level. Using a French survey of firms, Andrade et al. (2020) shows that firms' expectations about their future price changes respond more rapidly to industry-level inflation than aggregate inflation. These authors claim that after an industry-specific shock, firms immediately anticipate they will increase prices. In contrast, the adjustment in expectations is muted and delayed after an aggregate shock takes place. In line with these findings, the results of model (3.1) suggest that expected prices also respond to aggregate and idiosyncratic beliefs besides shocks. Rational Inattention models of price setting suggest that firms should choose to allocate more of their limited attention toward more volatile variables. Using the same rationale and consistent with the results in 3.2, we can rationalize the larger effect of cost expectations relative to inflation in determining the expected magnitude of price changes. The results of Andrade et al. (2020) are also interpreted through the lens of Rationally Inattentive price setters, which confirms our results.

Interestingly, comparing the results between internal and external prices, we find that expectations about inflation in the home country are not relevant in explaining the expected intensive margin of external prices. In terms of expectations, only the internal cost is significant for expected price increases in external markets. This result suggests that firms can actually distinguish between the potential irrelevance of the aggregate expected growth rate of internal prices to further explain the future path of prices set to foreign customers.

4 Belief-Dependent Pricing Decisions

We start by describing the empirical baseline specification that we estimate by a linear panel data model.

$$AdjPrice_{it} = \mathbf{x}_{it}\boldsymbol{\beta} + \mu_i + \eta_t + v_{it} \tag{4.1}$$

The dependent variable is an indicator variable that takes the value of one if firm i at time t decided to adjust the price of their main product. The independent variables include $\mathbf{x}_{it}$, which corresponds to a vector of explanatory variables including current and lagged values of firm's i inflation and cost growth expectations (for the next 12 months) $E_{i,t}(.)$, actual inflation at time t and its first lag, the time t and four lags of the cost index proxy at the firm level (described in Section 3.2), and a set of Taylor variables, which controls for time-dependent price adjustments.[9] These variables account for the fact that some firms may adjust their prices following predetermined pricing plans. In particular, the variable $Taylor_{j,it}$ takes the value of one if at time t, firm i changed its price for the last time j months ago and zero otherwise. We construct 12 different Taylor dummies in order to capture any fixed price-adjustment schedule, i.e. $j = 1, \ldots, 12$. In the regression, we also include firm and time (month and year) fixed effects, μ_i and η_t respectively, as well as observed annual inflation. The idea is to capture any state-dependent pattern in price adjustments.

4.1 Belief-Driven Price Adjustments

We next address the effects of both aggregate and idiosyncratic expectations on price-adjustment decisions. Table 4.1 shows the marginal effect of firm's expectations on the probability of price adjustment. Relying on the linear probability model (LPM), we control for firms' fixed effects. Column (1) uses only current expectations about inflation and costs, while (2) controls for lagged values of these two expectations to capture potential dynamic belief patterns on adjustment decisions. The two specifications control for time-dependent and state-dependent effects.

According to the results, current expectations about inflation or costs do not significantly influence the decision to change prices. When we add lagged expectations, we observe that, while inflation expectations still do not correlates with this decision, there is a significant effect of lagged cost expectations. If firms expect a 1% increase in their costs, this increases the probability of a price adjustment by approximately 0.6% three months from that moment. The magnitude is meaningful as the unconditional probability of a price adjustment was approximately 17% as discussed in Section 3.3. To get an idea of the long run effects of cost expectations, we calculate the sum of the coefficients on lagged cost expectations, from $t-1$ to $t-4$. The sum is equal to 0.013 and statistically different to zero (with a p-value of 0.002), which further supports the relevance of cost expectations of firm decisions. Moreover, the results are consistent with the existing empirical evidence studying the relevance of beliefs to understanding pricing decisions. Relying on a survey of firms in Italy, Coibion et al. (2020) report that firm expectations effectively cause price adjustment decisions. Using the ifo Survey in Germany, Enders et al. (2022) shows that an increase in production expectations positively affects current production and prices.[10] While confirming their importance, we provide further

[9] We include only one lag of actual inflation given that Uruguayan inflation persistence is 0.95.

[10] In a similar fashion other papers have found a significant effect of expectations on firms decisions, such as Bachmann and Zorn (2020) or Gennaioli et al. (2016). See Born et al. (2022) for a more detailed survey.

Table 4.1: ***Probability of Price Adjustments***

	(1)	(2)	(3)	(4)
$E_{it}(\pi_{12m})$	-0.0008	0.0009	0.0019	-0.0008
	(0.0049)	(0.0054)	(0.0067)	(0.0055)
$E_{it-1}(\pi_{12m})$		0.0020	0.0041	0.0004
		(0.0050)	(0.0062)	(0.0051)
$E_{it-2}(\pi_{12m})$		-0.0038	-0.0030	-0.0047
		(0.0044)	(0.0050)	(0.0043)
$E_{it-3}(\pi_{12m})$		-0.0012	-0.0033	-0.0021
		(0.0054)	(0.0057)	(0.0055)
$E_{it-4}(\pi_{12m})$		-0.0012	-0.0017	-0.0025
		(0.0058)	(0.0056)	(0.0058)
$E_{it}(C_{12m})$	0.0014	-0.0036	-0.0020	-0.0043
	(0.0029)	(0.0040)	(0.0048)	(0.0041)
$E_{it-1}(C_{12m})$		0.0028	0.0029	0.0028
		(0.0024)	(0.0031)	(0.0025)
$E_{it-2}(C_{12m})$		0.0014	0.0028	0.0019
		(0.0024)	(0.0025)	(0.0024)
$E_{it-3}(C_{12m})$		0.0059**	0.0047*	0.0060**
		(0.0024)	(0.0027)	(0.0025)
$E_{it-4}(C_{12m})$		0.0029	0.0015	0.0030
		(0.0028)	(0.0029)	(0.0030)
Cost index proxy	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Taylor Dummies	✓	✓	×	✓
Time FE	✓	✓	✓	×
R^2	0.1452	0.1460	0.0224	0.1374
Observations	8,553	7,553	7,553	7,553

Notes: This table reports panel fixed effects OLS estimates associating aggregate and idiosyncratic expectations on price-adjustment decisions. The dependent variable in all columns is an indicator variable that takes the value of one if firm i in month t decided to adjust its price. Column (1) uses only current inflation and cost expectations, and column (2) includes up to four lags of those variables. Columns (1)-(2) include firm-, month- and year fixed effects (constants not reported). Columns (3) and (4) explore the time- and state-dependent channel by removing the Taylor group of variables (which controls for time-dependent price adjustments), or the time fixed effects, respectively. All specifications include inflation at time t and its first lag, and a time t and four lags of a cost index proxy at the firm level, not reported. The table reports, in parentheses, robust and clustered (by firm) standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

evidence about which *type* of expectation is relatively more important for these decisions. The results confirm why it is important to collect information about inflation and cost expectations separately. The fact that inflation and cost growth expectations are conceptually distinct and different has been already suggested by

Coibion et al. (2020). Our results confirm the lack of correlation between the two expectations by showing that they bring different implications for price adjustment decisions.

While we cannot claim causality, our findings hold after controlling for firms and time fixed effects, the cost proxy, Taylor dummies, and further macro controls. To stress the importance of time- and state-dependent channels, in column (3), we repeat the previous specification but remove the Taylor dummies, while in (4) we remove the state-dependent controls instead. Consistent with Lein (2010), the overall fit of the model decreases when we omit either of these two. In particular, the worsening of the R^2 coefficient in column (3) supports time-dependent rules being a central component behind firms' price-adjustment decisions. We follow Lein (2010) in interpreting the fact that the estimated coefficients on the Taylor dummies are statistically significantly different from zero together with the seasonality in price changes shown in Table 7.5 in the Appendix as suggesting that time-dependent factors are important in explaining firms' price changes [11]. The fact that the belief-dependent channel is present even when we control for time- and state-dependent variables confirms and highlights the relevance of this third channel as an additional driver of such decisions.

Our results are interesting since we can connect further existing results in the pricing literature with the expectation channel. Using detailed micro-level price data, Midrigan (2011) highlights the critical role that large idiosyncratic shocks play to rationalize price adjustments. Midrigan (2011) also shows that the probability of price revisions stays constant independently of whether the economy is in a low or a high inflation state. Our results support the relevance of idiosyncratic relative to aggregate expectations to understand the extensive margin of prices. Moreover, our findings suggest that the decision to adjust prices is orthogonal to firms anticipating either a low or high growth in the price level. Although evidence about firms' forward-looking behavior underscores the importance of price rigidities, it is not easy to detangle the potential reasons behind the different responses of the two expectations. As shown in Figures 3.1 and 7.1, the cost volatility is persistently larger than the inflation one. Maćkowiak and Wiederholt (2009) argues that a rationally inattentive price-setter will dedicate most of his limited attention to learning about the idiosyncratic (and more volatile) shocks, at the expense of dedicating less attention to any aggregate shocks before setting prices. Our results can therefore be also interpreted through the lens of this theory, and

[11] As shown in Table 7.5 in the Appendix, after controlling for monthly dummies, the sign and value of the Taylor coefficients suggest an increasing price hazard rate, consistent with results obtained by Borraz and Zipitria (2012) using Uruguayan data. This would be inconsistent with both Calvo and Taylor time-dependent pricing models. Our Taylor dummies aggregate firms from different sectors and then heterogeneous patterns of price adjustment, resulting in a hazard function that might not be constant.

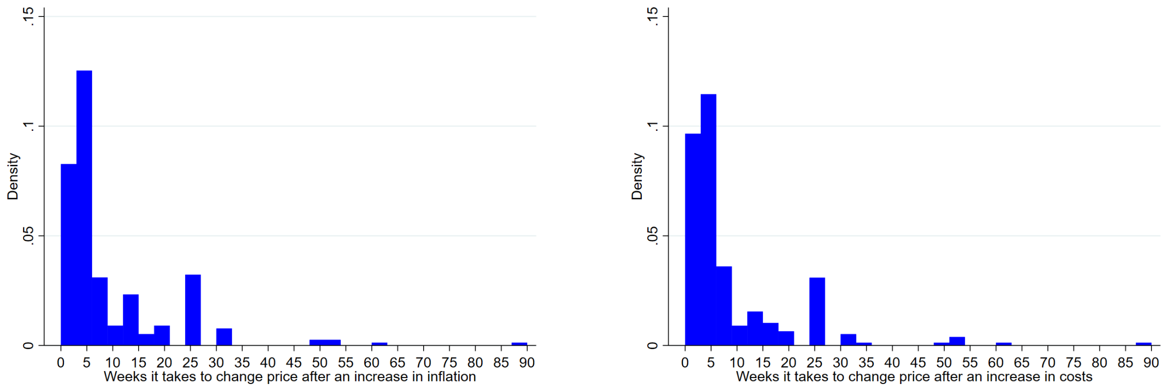
suggest the concurrent presence of both rigidities – prices and information – as relevant constraints that firms face when deciding whether to change their prices or not.[12] We cannot rule out that our result may be driven by firms reacting to news about future cost changes that materialize later. We further explore this in Section 5.4.

Besides the heterogeneous effects of inflation and cost expectations on pricing decisions, a second novel fact is the evidence of the delayed effect of this latter expectation. As we mentioned, we interpret the delayed effect of costs expectations as further evidence suggesting the presence of price-adjustment frictions at the firm level. Nakamura and Zerom (2010) emphasize the critical role of price rigidities in explaining the sluggish reaction of prices to changes in marginal costs. Using granular data from the coffee industry, these authors show that an increase in commodity costs leads to an increase in prices that will materialize over the subsequent six quarters, where more than half of the price adjustments happen with a delay of one quarter or more. Motivated by this evidence and with the intention of further validating the delayed effect of expectations, we decided to actively collect additional evidence to test this result in our data. In June 2019 we were allowed to add two additional questions to the survey. Specifically, we asked: *"On average, how long does it take your firm to change prices when: (1) inflation increases and (2) costs increase?"* Firms were asked to provide an open answer measured in number of weeks. Our goal was to get a clearer insight into how quickly firms can effectively adjust their prices without explicitly referring to the expectation channel. The results of the additional questions are presented in Figure 4.1.

The results of our special questions speak directly to these findings and allow us to extend the dynamic considerations of this reaction through the expectation channel. The majority of the surveyed firms responded that a price adjustment will happen approximately 11 (10.5) weeks following a change in inflation (costs). As firms report their expectations for the next 12 months, the significant reaction suggests that the expected cost adjustment can be interpreted as permanent. Hence, while leveraging short-run dynamics, a forward-looking firm facing price rigidities will choose to adjust its prices in the near future.

[12] We also computed a correlated random effects probit model as an alternative specification that allows us to control for firm's fixed effects. All the described results remain under this model and are available upon request.

Figure 4.1: *Sluggish Price Adjustments (added questions)*



Inflation *Costs*

Notes: The figure shows the results of special, one-time, questions added to the survey. The left figure shows the histogram of the number of weeks that it takes a firm to change prices after an increase in inflation, while the right figure shows the same but after an increase in costs. Firms' answers were specifically the number of weeks they need to effectively change prices.

4.2 Robustness

In light of the previous results, we now present some robustness exercises to further evaluate the extent of our findings.

4.2.1 Validity of the Cost Proxy

In the specifications, we rely on the constructed cost proxy $C_{i,t}$ as an additional covariate. As our proposed cost measure is not flawless, it could raise concerns about its validity in capturing the actual monthly costs at the firm level. Although total costs information at this frequency is not available outside the firm, we use balance sheet information from the Annual Survey of Economic Activity to compute firms' actual total costs at a yearly frequency and find the correlation between our cost proxy and the annual cost is 0.63. Moreover, while the annual costs increased by 8.55% on average during the analyzed years, our cost proxy increased by 8.05%. In addition, there could be concerns about the extent to which cost expectations are capturing something different from actual costs. In this sense, cost expectations could be a projection of current costs, and therefore, the two series will share a high correlation. In Appendix 7.4 we discuss this possibility and show that the correlation between $C_{i,t}$ and $E_{i,t}(C_{i,t+12})$ is negligible in our sample. Meanwhile, the correlation between the cost proxy and inflation is high and significant. This is not surprising as the measure builds on the evolution of input prices while leveraging firms' specific production functions. We will refer to Appendix 7.4 for a more detailed explanation and further evidence to support our measure as a valid proxy of actual costs.

4.2.2 Firms' fixed effects

The lack of significance of current and lag expectations may raise concerns about the variability of these two variables, which could then affect the precision of the estimation. Coibion et al. (2018) shows that firms' fixed-effects capture a significant part of the variability of the one year ahead expectations of inflation. To address this potential concern, we regress each expectation on time and firm fixed-effects only for our analyzed sample. Then, we compute the residual variation of these two auxiliary models, which are 1.89 and 3.28 for inflation and cost expectations, respectively. If we contrast these numbers with the unconditional standard deviation of these two expectations: 1.93 and 3.31, respectively, we notice that unobserved firms' characteristics do not absorb the variation in the covariates of interests, supporting the relevance of expectations on the probability of price revisions.

4.2.3 Additional exercises

For further robustness, we also compute our baseline estimation with a two-way cluster-robust standard error at the firm and month level, along with adding fixed-effects interactions between sectors and time. Our results are robust to all these alternative specifications. On top of that, we also confirmed that our results are robust to the exclusion of statistically not significant variables in the baseline specification and to the omission of month or Taylor dummies. These additional exercises are shown in Table 7.6 in Appendix 7.6.

5 On the Heterogeneity of Belief-Driven Price Adjustments

We now explore the delayed effect of cost expectations by studying potential sources of heterogeneity that could be behind this effect. For this purpose, we interact the current and lagged values of the inflation and cost expectations with firm's time-invariant characteristics. In line with table 3.1, those characteristics are a dummy for each firm size (small, medium, and large), the number of competitors, a variable that accounts for whether the firm has to price one or more products, and a variable that accounts for the accuracy of firms' expectations. We explore each possibility, one by one, while controlling for the remaining explanatory variables as in our baseline model.

5.1 Firm Size

The three time-invariant categories for firm size are interacted with the current and lagged values of the two expectations. When adding the interactions, the baseline model is estimated with the small firms as the omitted category. The first two columns of Table 5.1 shows the marginal effects and standard errors for medium and large firms, separated between aggregate and idiosyncratic expectations.

The null effects of current and lagged inflation expectations remain even when we condition on medium and large firms. However, while cost expectations do not seem to play a significant role for medium firms, large firms are concentrating the forward-looking pricing behavior. The marginal probability of adjusting prices significantly increases by an average of 0.77% after a 1% revision in cost expectations for large firms. As in the baseline scenario, the effect is again delayed. While all types of firms face frictions in the price-adjustment process, the evidence of forward-looking behavior holds only across large firms. As shown in Figure 3.1, the costs of larger firms is more volatile than small and medium firms over time. A low cost persistence should translate in prices that change more frequently on average. Thus, with the intention of anticipating to highly volatile costs in the near future, the expectations of bigger firms tend to affect more today's price adjustment decision, in line with our findings. In Section **??** of the Appendix, we present the specific estimated coefficients and alternative versions of the model where we again shut down the time and state-dependent channels.[13]

5.2 Number of Competitors

In a similar spirit as the previous exercise, we now split the sample based on the number of direct competitors reported by each firm. Using quantiles we ended up with three categories: "few" (< 5) , "average" (between 5 and 10), and "many" (> 10) competitors. We interact these categories with the expectations, omitting the "few" category. The results are shown in the third and fourth column of Table 5.1. Although the number of

[13] We also try with alternative measures, such as production costs and total costs, to define the size of firms and the results are quantitatively similar.

Table 5.1: *Marginal Effects: Size, Competitors and Multi-product firms*

	Firm Size		Number of Competitors		
	Medium	Large	Average	Many	Multi-Product
$E_{it}(\pi_{12m})$	0.0030	0.0132	-0.0013	0.0101	0.0062
	(0.0094)	(0.0153)	(0.0073)	(0.0118)	(0.0071)
$E_{it-1}(\pi_{12m})$	-0.0066	-0.0031	0.0093	0.0019	-0.0014
	(0.0085)	(0.0119)	(0.0080)	(0.0074)	(0.0064)
$E_{it-2}(\pi_{12m})$	-0.0033	0.0090	-0.00003	-0.0126	0.0003
	(0.0090)	(0.0096)	(0.0080)	(0.0070)	(0.0047)
$E_{it-3}(\pi_{12m})$	0.0016	-0.0155	-0.0056	-0.0037	-0.0071
	(0.0084)	(0.0112)	(0.0075)	(0.0103)	(0.0056)
$E_{it-4}(\pi_{12m})$	0.0084	0.0017	0.0039	-0.0137	0.0057
	(0.0105)	(0.0109)	(0.0079)	(0.0118)	(0.0059)
$E_{it}(C_{12m})$	-0.0078	0.0020	-0.0043	0.0011	-0.0003
	(0.0072)	(0.0072)	(0.0058)	(0.0067)	(0.0050)
$E_{it-1}(C_{12m})$	0.0080	0.0006	0.0007	-0.0005	0.0016
	(0.0061)	(0.0039)	(0.0039)	(0.0037)	(0.0029)
$E_{it-2}(C_{12m})$	-0.0051	-0.0016	0.0035	0.0007	-0.0003
	(0.0080)	(0.0044)	(0.0041)	(0.0037)	(0.0032)
$E_{it-3}(C_{12m})$	0.0007	0.0077**	0.0088**	0.0085**	0.0064**
	(0.0074)	(0.0033)	(0.0045)	(0.0035)	(0.0031)
$E_{it-4}(C_{12m})$	0.0096	0.0057	0.0007	0.0046	0.0049
	(0.0061)	(0.0039)	(0.0035)	(0.0066)	(0.0031)
Firm FE	✓		✓		✓
Taylor Dummies	✓		✓		✓
Month FE	✓		✓		✓
Year FE	✓		✓		✓
N	7,553		7,553		7,553
R^2	0.1344		0.1332		0.1336

The table show the marginal effects of both inflation and cost expectations on the probability of price adjustments conditioning on: firm size, number of competitors and multi-product firms. Each column shows the estimated coefficients with the corresponding standard error below in parenthesis.

competitors is highly correlated with firm size, all of the results control for firms' fixed effects along with all the remaining explanatory variables as in the baseline specification.

Facing a large number of competitors is related with the presence of forward-looking behavior. As before, the effect only exists for cost not for inflation expectations. Based on this evidence, we can further rationalize the reasons behind the dynamic responses of prices to cost expectations. Strategic complementarities in pricing among firms can contribute to the delay in price adjustments given price rigidity. Using the same survey as we do, Frache and Lluberas (2019) gives evidence of the existence of strategic complementarities among Uruguayan firms, though at a lower degree than firms in New Zealand reported by Afrouzi (2020). While firms expect to experience a persistent change in their marginal costs, the effect on actual price revisions is delayed due to the incentives to coordinate the timing of price adjustments given competitors. The complexity in the coordination task rises as the number of competitors increases, which further contributes to the adjustment delay.[14]

5.3 Multi-Product Firms

In the case of multi-product firms, we define a dummy variable to identify firms that sell more than one product. As before, the dummy variable is interacted with both inflation and cost expectations. The estimated coefficients are reported in the last column of Table 5.1. As in all the previous cases, we keep the same set of explanatory variables while controlling for time-invariant characteristics.

According to the results, lagged cost expectations for multi-product firms are positively and significantly related with the probability of price adjustments. In line with the empirical evidence, price changes tend to be synchronized across firms that sold several products, Lach and Tsiddon (1996). This is also implied in a model with a multi-product firm that faces a menu cost as the one proposed by Alvarez and Lippi (2014). They conclude that the frequency of price adjustments increases with the number of products. As the costs of adjusting prices can rise exponentially with the number of products produced, this type of firm has further incentives to behave in a forward-looking fashion consistent with our results. In addition, the fact that the probability of price adjustment is higher across multi-product firms is also consistent with other surveys of firm expectations such as Yang (2022) who finds similar results based on pricing information from firms in

[14]Kano (2013) studies a state-dependent pricing model under different market structures. The results suggest that prices in an oligopolistic market could be much more rigid than a monopolistically competitive framework. Strategic interaction among different brands in the oligopolistic version could distort the estimations of menu costs and, with this, the implications for price rigidity.

New Zealand. Finally, our results are compatible with findings by Bhattarai and Schoenle (2014) who find that the frequency of price changes increases but the size decreases with the number of products sold by the firm.

5.4 Accuracy of Expectations and News

Up to this point, we have assessed the implications of the belief channel only across observable characteristics of the firm. However, the relation between expectations and pricing decisions could be a consequence of the "quality" or precision of the forecast. Suppose a subset of firms produces more accurate predictions about their future cost evolution than the rest. In that case, the observed average reaction of cost expectation may be simply driven by the natural reaction of this set of firms. In this Section we further explore this possibility. For doing so, we aim to classify firms based on their forecasting accuracy. We compute the forecast error FE^i_{t+h} for cost expectations as the difference between the expected value in time t and the realization in $t+12$. In line with the discussion in 4.2.1, we use the cost proxy $C_{i,t}$ to compute the FE^i_{t+h} to have an accuracy measure across all firms and months over the entire sample. Following Bachmann and Elstner (2015) we then run regressions at the firm level of the cost forecast errors on a constant, and given the sign of the predicted constant, we classify firms among: "Realists", "Optimists" and "Pessimists". Realists correspond to firms whose estimated constant is not statistically different from zero at the 95% confidence level, i.e., on average, their forecast error is zero. The Optimists group includes firms with a negative average for the error, i.e., those that expect lower than realized cost changes over the next year. Finally, the Pessimists group is composed of firms that expect higher than observed costs. While controlling for all the aforementioned variables, we interact the current and delayed costs expectations with a dummy variable that accounts for each of the three groups. The coefficients associated with the interaction for each group are presented in Table 5.2.

The delayed effect of costs expectations on price adjustments is present across firms that produce non-accurate or biased predictions. Firms that are either pessimistic or optimistic about the evolution of their costs are the ones that tend to revise their prices with a delay as a consequence of their expectations. While we conjecture that prices are revised upward (downward) for pessimist (optimist) firms, we cannot confirm our intuition without knowing the actual sign of the price revision. Nevertheless, the evidence does not support the presence of the belief-dependent channel for the more accurate firms.

Table 5.2: *Marginal Effects: Accuracy of Expectations*

	Realists	Optimist	Pessimists
$E_{it}(C_{12m})$	-0.0093	-0.0068	0.0019
	(0.0052)	(0.0085)	(0.0057)
$E_{it-1}(C_{12m})$	0.0050	0.0025	0.0024
	(0.0058)	(0.0071)	(0.0030)
$E_{it-2}(C_{12m})$	-0.0002	0.0017	0.0024
	(0.0050)	(0.0057)	(0.0030)
$E_{it-3}(C_{12m})$	0.0102	-0.0037	0.0070**
	(0.0081)	(0.0050)	(0.0025)
$E_{it-4}(C_{12m})$	0.0036	0.0131**	-0.0008
	(0.0048)	(0.0059)	(0.0040)
N		7,553	
R^2		0.1474	

Grounded on our special question about the delayed effect of cost and inflation on prices, we interpret the lagged effect of costs expectation as evidence of price rigidities. However, the decision to change current prices could be explained by an adjustment in cost that materialized over the last three months, which was correctly anticipated by firms when they reported their cost expectations three months ago. Hence, the observed reaction is also consistent with firms having genuine information about cost changing in the near future. Through the lens of our results, and in a similar spirit as Enders et al. (2022), we can rely on firms' forecast errors to infer whether cost expectations are actually carrying news about the future evolution of costs. More than testing for rationality in the expectation formation process of firms, we interpret the realists' firms as the ones that hold news about the future evolution of costs, which explains their higher precision. If this is the case, and based on the null effect of cost expectations for the more accurate firms, it does not seem that the delayed effect is related to a reaction to news. The significant pricing reaction for the other two groups could be either a consequence of the unforecastable noise that they experience or could be explained by a persistent bias at the firm level. Unfortunately, our results do not allow us to split these two results apart.[15]

To better understand which elements may be driving our results, either beliefs or news, we conduct the following exercise. Like many other countries, Uruguay is a crude oil importer with no domestic production

[15] After showing that firms' expectations about future production matter for firms' current production and pricing decisions, Enders et al. (2022) argue that this result holds for expectations that turn to be correct ex-post *and* also for incorrect predictions. Hence, they conclude that while expectations can act as a source of news transmission, it is still possible that they bring a noise component that causes a firm to react. Given our different accuracy classification, our results extend these findings regarding the effect of idiosyncratic cost expectations.

and a strongly regulated fuel market. Retail prices are administered by the government, which sets them. What is important for our exercise is that the timing of the price adjustments is not fixed, and, usually, public opinion starts to speculate when prices will be adjusted. However, the specific date is only known a day or two in advance.

For this additional exercise, we take the specification of the second column of Table (4.1) and augment it with the change in the regulated gasoil price, and the oil supply news shocks from Kanzig (2021).[16]; both in time t and up to four lags. The idea is that the monthly growth in gas-oil price captures the moment a relevant component of firm costs changes. Indeed, according to the 2012 balance sheet information, approximately 60% of firms in the sample report expenses on fuel and/or oil derivatives. The second variable aims to account for the surge of news that may be affecting oil crude price in the near future. Results of this augmented regression are shown in Table (5.3)

The first result to highlight is that even after controlling for the price of a key input for firms and for news about the supply shock associated with it, the coefficient of lagged cost at t-3 remains significant, suggesting the belief channel is still present. The coefficients associated with the change in the retail price of fuel are not significant. The second result is that news about future oil supply conditions are significant at time t. This is interesting as it suggests that the probability of changing current prices decreases when future conditions are expected to improve. We interpret this evidence as firms responding more cautiously to the news, leading them to delay a potential price adjustment decision. Hence, having news about this relevant input price seems to matter in an intuitive way, and, importantly, the belief-channel is still present.

6 Conclusion

We assess the role of aggregate and idiosyncratic expectations on firms' price-adjustment decisions. Our results suggest that besides time-dependent and state-dependent pricing rules, decision on price adjustments are also related by firms' beliefs. According to our results, cost expectations matter for pricing decisions but they operate with a few months delay. While firms' forward-looking behavior suggests the presence of price rigidities at the firm level, the muted reaction to inflation expectations, especially in a country with high

[16]Similar to high-frequency identification of monetary policy shocks, e.g., Gertler and Karadi (2015), Kanzig (2021) identifies oil supply surprise from changes in oil future prices in a tight window around OPEC announcements. A positive shock means a negative effect on oil price and a decrease in oil inventories.

Table 5.3: *Marginal Effects: News and Beliefs*

	Baseline	News
$E_{it}(\pi_{12m})$	0.0009	0.0009
	(0.0054)	(0.0048)
$E_{it-1}(\pi_{12m})$	0.0020	0.0028
	(0.0050)	(0.0053)
$E_{it-2}(\pi_{12m})$	-0.0038	-0.0037
	(0.0044)	(0.0054)
$E_{it-3}(\pi_{12m})$	-0.0012	-0.0007
	(0.0054)	(0.0051)
$E_{it-4}(\pi_{12m})$	-0.0012	-0.0017
	(0.0058)	(0.0051)
$E_{it}(C_{12m})$	-0.0036	-0.0039
	(0.0040)	(0.0028)
$E_{it-1}(C_{12m})$	0.0028	0.0028
	(0.0024)	(0.0029)
$E_{it-2}(C_{12m})$	0.0014	0.0015
	(0.0024)	(0.0026)
$E_{it-3}(C_{12m})$	0.0059**	0.0066**
	(0.0024)	(0.0027)
$E_{it-4}(C_{12m})$	0.0029	0.0028
	(0.0028)	(0.0025)
$\Delta GasOil_t$		0.0150
		(0.0169)
$\Delta GasOil_{t-1}$		-0.0081
		(0.0108)
$\Delta GasOil_{t-2}$		0.0114
		(0.0123)
$\Delta GasOil_{t-3}$		0.0115
		(0.0126)
$\Delta GasOil_{t-4}$		0.0005
		(0.0129)
$News_t$		-0.0243**
		(0.0111)
$News_{t-1}$		0.0008
		(0.0135)
$News_{t-2}$		-0.0052
		(0.0265)
$News_{t-3}$		0.0284
		(0.0195)
$News_{t-4}$		0.0191
		(0.0179)
N	7,553	7,426
R^2	0.1460	0.1344

Notes: Column (1) reproduces the second column of Table (4.1). Column (2) adds the change in gas oil prices and oil supply news shock. All specifications include firm-, month- and year fixed effects (constants not reported), inflation at time t and its first lag, and a time t and four lags of a cost index proxy at the firm level, not reported. The table reports, in parentheses, robust and clustered (by firm) standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

inflation as Uruguay, calls for further attention. Our findings of a different reaction towards costs relative to inflation is also consistent with theories on information rigidity. Regardless of which of the two rigidities plays a more prominent role in the decision to change prices, our results suggest that the belief-dependent channel is an essential mechanism to explain price revisions.

This paper aimed to provide further empirical evidence on forward-looking pricing. In particular, we try to understand the degree to which firms' expectations shape actions. However, the absence of specific information about the sign of the price change and the actual magnitude of price revisions limits the extent of our conclusions. We conjecture that the belief-dependent channel's importance could be even more pronounced if we could collect such information. We leave these questions for future work. Nonetheless, the evidence presented in this paper justifies adding questions that further explore the relevance of the belief-dependent channel in expectation surveys.

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7 Appendix

7.1 Description of the firms' survey

In this section we first highlight the main features of the Survey in Uruguay and compare it with similar surveys from other countries. Then, we provide further details about the data used in the empirical analysis of this paper. An even broader description about the survey can be found in Frache and Lluberas (2019).

Our data is quite unique in several dimensions. Table 7.1 compares the Uruguayan survey with other common surveys of firms' expectations. The most distinct feature of our survey is the possibility of having quantitative information on inflation expectations *and* idiosyncratic costs for different time horizons paired with data on price decisions with a monthly frequency. Using the New Zealand survey, the existing literature has found several interesting results regarding the process of how firms form their expectations and the policy implications of such process, see for example Coibion et al. (2018) or Kumar et al. (2015). This survey, however, is not conducted on a regular basis as in Uruguay and does not have periodic information on beliefs about inflation or the firms' own costs together combined with information on their economic decisions. The monthly panel structure of the Uruguayan survey is a relevant feature that we exploit to assess the belief-dependent channel. The Atlanta FED Business Inflation Expectation (BIS) survey also collects information monthly, but it is only representative of six states in the US. Finally, besides being muted about cost expectations, both the UK and the Italian survey collect only quarterly information about yearly inflation.[17] Another important survey, which has been used extensively for this type of analysis, is the *Ifo Business Climate Survey* in Germany, see Bachmann and Elstner (2015), and Bachmann et al. (2019). However, as in this paper we focus on the quantitative implications of expectations, we prefer to omit this Survey from Table 7.1 due to the qualitative nature of the responses.

Table 7.1: *Common Surveys of Firms' Expectations*

	Uruguay	USA	New Zealand	United Kingdom	Italy
First Survey	2009	2011	1987	2008	1999
Frequency	M	M	Q	Q	Q
Inflation expectations	✓	×	✓	✓	✓
Cost expectations	✓	✓	×	×	×
Forecasted horizon	Year, 12m, 24m	12m	3m, 12m	12m	12m
Bins	Open	5	Open	4	Open
Institution	Central Bank	Atlanta Fed	Central Bank	CBI	Central Bank

Notes: The table compares the main features of different surveys of firms used by the literature. Relative to *Frequency*, M stands for monthly while Q is for quarterly frequency. *Forecasted horizon* stands for the different time horizons for the different expectations asked of in each survey. Finally, Bins represents whether the answers are closed or open ended. In the former case the number of bins is given.

The survey is carried out by the National Statistics Institute (INE) and commissioned by the Central Bank of Uruguay (BCU). The logistics of the survey are arranged by INE. Each month since October 2009 a representative sample of around 500 firms with at least 50 employees are asked about their expectations for these two variables. The 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. If there are doubts about an answer, it is followed-up by a telephone call by members of the INE. Even though it is not compulsory to answer the

[17] The UK survey has been recently studied by Boneva et al. (2019) while see Coibion et al. (2020) for evidence using the Italian survey.

questionnaire, the response rate ranges between 54% and 88%. The resulting sample is an unbalanced panel which is representative of all the sectors in the economy, except for the financial, agricultural, and public sectors. Table 7.2 shows the proportion of firms in each sector together with a comparison with the sectoral composition of the population of firms with 100 or more employees. As can be inferred from the Table, there are no substantial differences in the sectoral structure of the sample vis-a-vis the population of firms in Uruguay.

Table 7.2: *Proportion of firms by sector: sample and population (in %)*

	Sample	Population
Manufacturing	30.9	25.0
Electricity, gas and water supply	0.1	3.0
Construction	1.8	2.3
Trade	20.5	16.2
Hotels and restaurants	3.0	2.3
Transport, storage and communications	9.0	12.8
Real estate, renting and business activities	16.3	17.4
Education	11.1	10.2
Health and social work	7.4	10.9

Firms are asked about their expected annual change in the Consumer Price Index (CPI) for the current year, for the next 12 months, and for the monetary policy horizon, which was 18 months until July 2013 and has been 24 months since then. The specific wording of the question is: *What do you believe is going to be the change in the CPI?*. The original wording in Spanish is: *¿Cuál cree usted que será la variación del IPC (Indice de Precios al Consumo)?*. From the wording of the question we interpret that firms are asked about their expectations about the general CPI and not their specific prices.

Moreover, the questionnaire also digs into the expected change of firms' own costs for the same time horizons. Then, firms are also asked *What do you believe is going to be the average change in your firm's costs in local currency?* The original wording in Spanish is: *¿Cuál cree usted que será la variación promedio de los costs de su empresa en pesos uruguayos?*.

On top of the regular questions about inflation and own cost expectations, firms are asked special questions in given months. In these special questionnaires we asked firms about their financial decisions, the access to credit, price setting decisions, uncertainty about inflation expectations, and currency of invoicing, among other topics.

7.2 Rolling Volatility

We measure cost volatility as the standard deviation of idiosyncratic conditions defined as:

$$Std^{C}_{i,t} = \sqrt{\frac{1}{6}\sum_{j=0}^{5}(C_{i,t-j} - \overline{C}_{i,t-5})^2} \tag{7.1}$$

Where $C_{i,t-j}$ is our *projected* cost index constructed for firm i at time $t-j$ and $\overline{C}(.)$ is the average cost for firm i between t and $t-5$. By computing equation (7.1) through a rolling window, we get a firm level time-series for cost volatility. Without any specific information about firms' costs, the projected cost $C_{i,t}$ is defined as:

$$C_{i,t} = \sum_{j=1}^{J} PI_{jt}W_{ij2012} \tag{7.2}$$

Where $PI_{j,t}$ 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. We define $W_{ij2012} = C_{ij2012}/C_{i2012}$, 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.

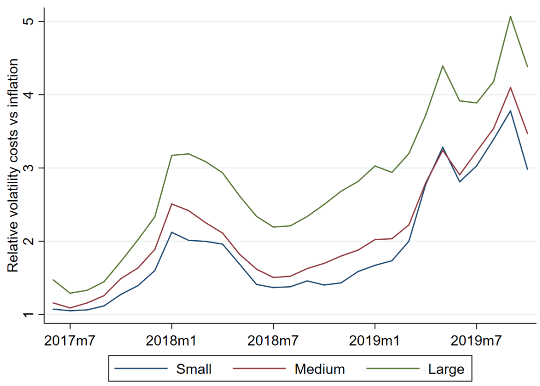
As in (7.1), we define the firm level inflation volatility as:

$$Std^{\pi}_{t} = \sqrt{\frac{1}{6}\sum_{j=0}^{5}(\pi_{t-j} - \overline{\pi}_{t-5})^2} \tag{7.3}$$

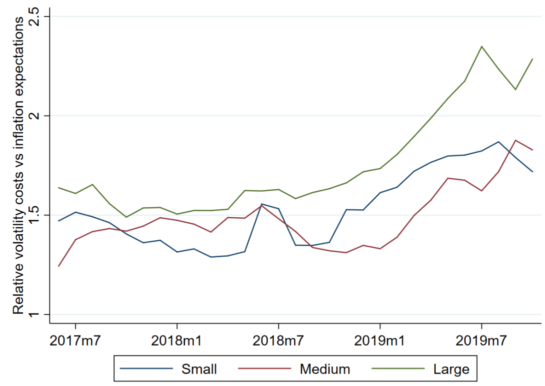
Where π_{t-j} is the inflation rate in Uruguay at time $t-j$ while $\overline{\pi}_{t-5}$ is the average inflation between months t and $t-5$.

Besides the results discussed in Section 3.2, we compute the ratio of firm level volatility for own costs and inflation separating between firm size. This is shown in Figure 7.1(a). In addition, Figure 7.1(b) shows the evolution of the relative volatility but for expectations. The results suggest that either costs or its expected value are more volatile that actual or expected inflation. Moreover, the relative dispersion if higher for larger firms for the two measures and throughout the sample.

Figure 7.1: *Relative Dispersion in Own Costs and Inflation by Firm Size*



(a) Observed

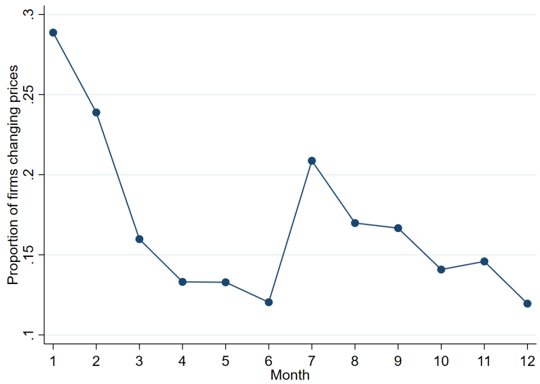


(b) Beliefs

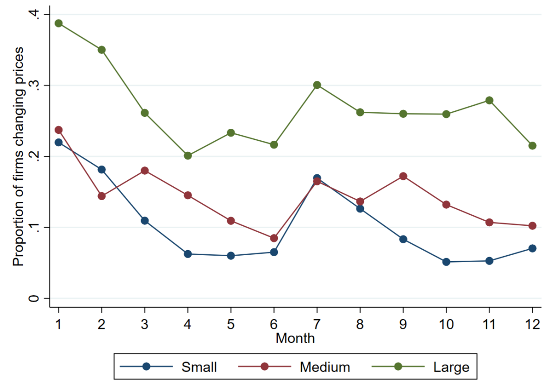
7.3 Seasonality by Firm Size

The average proportion of firms changing prices over the sample period masks large heterogeneity in seasonality in pricing decisions. As shown in Figure 7.2a, firms are more likely to change their prices in January, February, and July. About 30% of the firms change their prices in January, 25% in February, and just below 20% in July. Meanwhile, just above 10% of the firms change their prices between April and June and in December each year. Seasonality patterns in price adjustment decisions are not new and have been studied by previous literature, Nakamura and Steinsson (2008). The heterogeneity in pricing decisions across firm sizes is also present when we look at the seasonality of price changes, Figure 7.2b. These results confirm that there is high seasonality in price adjustment in Uruguay.

Figure 7.2: *Proportion of Firms Changing Prices (by Month)*



(a) All firms



(b) Sizes

7.4 Validity of Cost Proxy

A potential concern is the validity of our measure of costs, introduced in section 3.2, to resemble unobserved costs at the firm level. The underlying survey data used to compute the cost structure in 2012 for each firm was carried out by the National Statistical Institute of Uruguay. Moreover, it is used as the basis to update the base year for the National Accounts. If the measure of actual costs is not accurate, this could raise concerns that the effect captured by cost expectations on price changes is actually reflecting the effect of an increase in total costs.

To check the validity of our measure of costs, we show that: (1) it is positively and significantly correlated with expected costs, (2) the measure is also positively correlated with observed inflation, and (3) that there is a positive correlation between the forecast errors of inflation and costs. The results of these analyses are summarized in Table 7.3 below.

Table 7.3: *Correlation of costs*

	Dependent variable				
	(1)	(2)	(3)	(4)	(5)
	$C_{i,t+12}$	$C_{i,t+12}$	$C_{i,t+12}$	$FE^C_{i,t}$	π_{t+12}
$E_{i,t}(C_{i,t+12})$	0.0929**		0.0657**		
	(0.026)		(0.023)		
π_{t+12}		0.975**	0.969**		
		(0.087)	(0.086)		
$FE^\pi_{i,t}$				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.

First, if our cost proxy captures actual costs, it should be positive correlated with costs expectations. Column (1) in Table 7.3 shows the β coefficient after running the following regression:

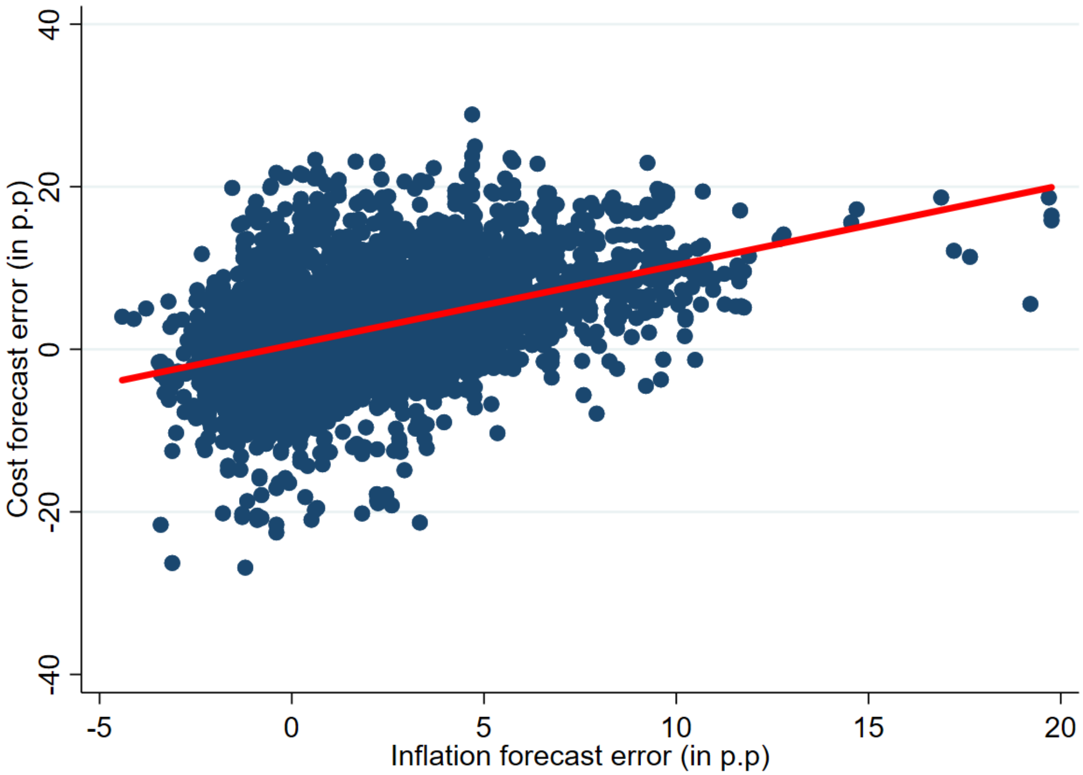
$$C_{i,t+12} = \alpha_i + \beta E_{i,t}(C_{i,t+12}) + \epsilon_{i,t}$$

Where α_i controls for firm fixed-effects and the rest of the variables are defined as in the main text. The coefficient on expected cost is positive and significantly different from zero, suggesting a positive correlation at the firm level between cost expectations and our measure. Similar results are found if we run that same regression but for inflation and expected inflation instead of costs. This is presented in Column (5).

Secondly, as shown in column (2) and column (3) of Table 7.3, our cost proxy is also positively correlated with observed inflation.

Finally, Figure 7.3 shows a scatter plot of $FE^\pi_{i,t} = \pi_{t+12} - E_{i,t}(\pi_{t+12})$ against $FE^C_{i,t} = C_{i,t+12} - E_{i,t}(C_{i,t+12})$ and the corresponding fitting line, where $C_{i,t+12}$ is our proxy measure of actual costs. The correlation between inflation and costs forecast errors is positive and significant. We arrive to the same conclusion after controlling for firms' fixed effects, column (4) Table 7.3).

Figure 7.3: *Inflation and costs forecast errors*



Thus, albeit imperfect, we can claim that our constructed proxy of costs using granular firm-level data can be interpreted as a valid proxy for actual costs.

7.5 Probability of Price Adjustments: Full Table

Table 7.4: ***Probability of Price Adjustments: All Effects***

	(1)	(2)	(3)	(4)
$E_{it}(\pi_{12m})$	-0.0008	0.0009	0.0019	-0.0008
	(0.0049)	(0.0054)	(0.0067)	(0.0055)
$E_{it-1}(\pi_{12m})$		0.0020	0.0041	0.0004
		(0.0050)	(0.0062)	(0.0051)
$E_{it-2}(\pi_{12m})$		-0.0039	-0.0030	-0.0047
		(0.0044)	(0.0050)	(0.0043)
$E_{it-3}(\pi_{12m})$		-0.0012	-0.0033	-0.0021
		(0.0054)	(0.0057)	(0.0055)
$E_{it-4}(\pi_{12m})$		-0.0012	-0.0017	-0.0025
		(0.0058)	(0.0056)	(0.0058)
$E_{it}(C_{12m})$	0.0014	-0.0036	-0.0020	-0.0043
	(0.0029)	(0.0040)	(0.0048)	(0.0041)
$E_{it-1}(C_{12m})$		0.0028	0.0029	0.0028
		(0.0024)	(0.0031)	(0.0025)
$E_{it-2}(C_{12m})$		0.0014	0.0028	0.0019
		(0.0024)	(0.0025)	(0.0024)
$E_{it-3}(C_{12m})$		0.0059**	0.0047*	0.0060**
		(0.0024)	(0.0027)	(0.0025)
$E_{it-4}(C_{12m})$		0.0029	0.0015	0.0030
		(0.0028)	(0.0029)	(0.0030)
$CostsProxy_{it}$	0.0020	0.0028	0.0050*	0.0030
	(0.0019)	(0.0026)	(0.0026)	(0.0025)
$CostsProxy_{it-1}$		0.0021	-0.0005	0.0010
		(0.0032)	(0.0034)	(0.0031)
$CostsProxy_{it-2}$		-0.0057*	-0.0054*	-0.0077**
		(0.0030)	(0.0032)	(0.0030)
$CostsProxy_{it-3}$		0.0006	0.0001	0.0041
		(0.0033)	(0.0036)	(0.0035)
$CostsProxy_{it-4}$		0.0017	0.0033	0.0012
		(0.0032)	(0.0032)	(0.0031)
$Inflation_t$	0.0098	0.0090	-0.0010	0.0028
	(0.0103)	(0.0108)	(0.0112)	(0.0091)
$Inflation_{t-1}$	-0.0209**	-0.0127	-0.0094	0.0182*
	(0.0091)	(0.0100)	(0.0101)	(0.0096)
$Taylor_{1,it}$	-0.2215***	-0.2314***		-0.2268***
	(0.0203)	(0.0223)		(0.0222)
$Taylor_{2,it}$	-0.2402***	-0.2393***		-0.2435***
	(0.0148)	(0.0156)		(0.0158)
$Taylor_{3,it}$	-0.2148***	-0.2133***		-0.2211***
	(0.0133)	(0.0140)		(0.0143)
$Taylor_{4,it}$	-0.2075***	-0.2037***		-0.2095***
	(0.0129)	(0.0137)		(0.0140)
$Taylor_{5,it}$	-0.1935***	-0.1892***		-0.1954***
	(0.0127)	(0.0135)		(0.0139)
$Taylor_{6,it}$	-0.1358***	-0.1297***		-0.1244***
	(0.0150)	(0.0164)		(0.0166)
$Taylor_{7,it}$	-0.1177***	-0.1170***		-0.1167***
	(0.0242)	(0.0244)		(0.0242)

Table 7.5: ***Probability of Price Adjustments: All Effects (continuation)***

	(1)	(2)	(3)	(4)
$Taylor_{8,it}$	-0.1381***	-0.1377***		-0.1380***
	(0.0219)	(0.0218)		(0.0219)
$Taylor_{9,it}$	-0.1196***	-0.1182***		-0.1259***
	(0.0241)	(0.0243)		(0.0240)
$Taylor_{10,it}$	-0.1388***	-0.1370***		-0.1418***
	(0.0246)	(0.0244)		(0.0243)
$Taylor_{11,it}$	-0.0857***	-0.0846***		-0.0834**
	(0.0312)	(0.0312)		(0.0316)
$Taylor_{12,it}$	0.0300	0.0329		0.0444
	(0.0426)	(0.0427)		(0.0428)
Month_1	0.1071***	0.1100***	0.1392***	
	(0.0198)	(0.0202)	(0.0238)	
Month_2	0.0676***	0.0735***	0.0852***	
	(0.0174)	(0.0181)	(0.0195)	
Month_3	0.0434***	0.0479***	0.0374**	
	(0.0143)	(0.0152)	(0.0165)	
Month_4	0.0143	0.0222	-0.0007	
	(0.0136)	(0.0151)	(0.0163)	
Month_5	0.0155	0.0231*	0.0033	
	(0.0123)	(0.0137)	(0.0142)	
Month_7	0.0698***	0.0700***	0.0861***	
	(0.0146)	(0.0157)	(0.0184)	
Month_8	0.0435***	0.0550***	0.0637***	
	(0.0131)	(0.0137)	(0.0149)	
Month_9	0.0532***	0.0600***	0.0559***	
	(0.0135)	(0.0145)	(0.0158)	
Month_{10}	0.0259*	0.0328**	0.0263*	
	(0.0132)	(0.0137)	(0.0151)	
Month_{11}	0.0337**	0.0391***	0.0287**	
	(0.0135)	(0.0141)	(0.0146)	
Month_{12}	0.0181	0.0201	0.0134	
	(0.0140)	(0.0149)	(0.0153)	
Firm FE	✓	✓	✓	✓
Taylor Dummies	✓	✓	×	✓
Month FE	✓	✓	✓	×
Year FE	✓	✓	✓	×
R^2	0.1452	0.1460	0.0224	0.1374
Observations	8,553	7,553	7,553	7,553

Notes: This table reports panel fixed-effects OLS estimates associating aggregate and idiosyncratic expectations with price-adjustment decisions. The dependent variable in all columns is an indicator variable that takes the value of one if firm i in month t decided to adjust its price. Column (1) only uses current inflation and cost expectations, and column (2) include up to four lags of those variables. Columns (1)-(2) include firm, month and year fixed effects (constants not reported). Columns (3) and (4) explore the time- and state-dependent channel by removing the Taylor group of variables (which controls for time-dependent price adjustments), or the time fixed effects, respectively. All specifications include inflation at time t and its first lag, and at time t and four lags of a cost index proxy at a firm level. The table reports, in parentheses, robust and clustered (by firm) standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

7.6 Baseline Specification Robustness

Table 7.6: *Baseline Specification Robustness*

	Probablity of Price Adjustments							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$E_{i,t-3}(C_{i,t+12})$	0.0059	0.0059	0.0055	0.0055	0.004	0.005	0.007	0.007
Std. Dev.	(0.0024)	(0.0026)	(0.0030)	(0.0033)	(0.003)	(0.003)	(0.002)	(0.002)
p-value	0.015	0.024	0.066	0.093	0.085	0.053	0.001	0.001
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓				✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Month-Sector FE			✓	✓				
Year-Sector FE			✓	✓				
Clustered errors at firm level	✓		✓		✓	✓	✓	✓
Clustered errors at firm-month level		✓		✓				
Taylor dummies	✓	✓	✓	✓			✓	✓
Inflation expectations	✓	✓	✓	✓		✓		
Only $E_{it-3}(C_{12m})$							✓	✓
No. Obs	7,553	7,553	7,443	7,443	7,779	7,778	7,778	7,778

Notes: This table reports panel fixed effects OLS estimates. The table exhibits, in parentheses, cluster-robust at different levels standard errors.