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*using BCRAs' Survey of Business Economic Perspectives*

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# Firm's Price Expectations: An Empirical Analysis using BCRAs' Survey of Business Economic Perspectives [*]

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## Abstract

The Central Bank of Argentina (BCRA) implements a monthly Survey of Business Economic Perspectives to capture the business climate and economic perspectives. The survey, includes both qualitative and quantitative questions on past and expected change in different economic variables of the main companies in Argentina. This unique proprietary data is used to approximate the price setting behaviour of the firms in the domestic markets. We postulate an econometric model where the firms' dynamic on their expected domestic prices are based on (i) firm's past and expected information (prices, input costs and inventories) and (ii) macroeconomic variables (economic activity, foreign exchange rate, interest rate and inflation rate). The results indicate the importance of input costs (domestic and imported) and the macroeconomic variables (especially the exchange rate and the inflation rate) in the expected price dynamics of the analyzed companies and are in line with the literature analyzing price setting behaviour under macroeconomic uncertainty. Foreign exchange rate pass-through, markups on input prices and forward-looking behaviour in price setting generate important challenges for the anti inflationary monetary policy.

El Banco Central de Argentina implementa mensualmente la Encuesta de Perspectivas Económicas a fin de capturar información acerca del clima y perspectiva económica de las empresas. La encuesta incluye tanto preguntas cualitativas como cuantitativas acerca de los cambios observados y esperados en una serie de variables económicas de una muestra de empresas de Argentina. El trabajo utiliza esta base confidencial para aproximar los determinantes del proceso de determinación de precios para el mercado doméstico de las empresas. Se postula un modelo econométrico donde la dinámica de los precios esperados para el mercado doméstico de las firmas dependen de (i) información pasada y esperada de variables de las propias firmas

(precios, costos de insumos e inventarios) y (ii) variables macroeconómicas (actividad económica, tipo de cambio, inflación). Los resultados indican la importancia de los costos de insumos (domésticos e importados) y las variables macroeconómicas (especialmente el tipo de cambio y la inflación) en la dinámica de los precios esperados por las firmas analizadas, en línea con la literatura que analiza la formación de precios en contextos macroeconómicos inciertos. El traspaso del tipo de cambio, el markup de costos de insumos y el proceso de formación de precios de las empresas generan importantes desafíos para la política monetaria anti inflacionaria.

**JEL Classification**: E30, E50, D40.

**Keywords**: Survey data, Price setting, Firms Expectations.

# 1 Introduction

Since December 2016, the Central Bank of Argentina (BCRA) implements a monthly Survey of Business Economic Perspectives for non-financial companies. The survey incorporates firms from different economic sectors, including industrial, commercial, energy, construction and services sectors. As in many other Central Banks, the survey includes both qualitative and quantitative questions on observed and expected variables. The data set includes more than 50 non financial firms with monthly information from January 2017 up today.

In this paper we use this unique proprietary data base to analyze how these companies form the expectations on their domestic prices. It should be noted that inflation rate, inflation forecast and the formation of inflation expectations are three different but related aspects of companies pricing decisions making process. In the survey there is no question on inflation expectation by the firms, a question that is present in other business surveys as in Uruguay [Frache & Lluberas (2019)] or New Zealand [Cloyne et al. (2016)], among others. Also, we do not aim to analyze the inflation forecast properties of the data as in the paper by Richards & Verstraete (2016) on Canada. Instead, as an initial step in our research agenda, we focus the analysis in the main determinants of the quarterly firm's expected price variation in the domestic market.[1] We consider the survey question referred to the *"domestic market price variation for the next three months"* that firms answer every month. Indeed, we concentrate in the industrial sector where most of the firms are multi-products and the expectations refers to a weighted average price of their products.[2]

The chosen variable reflects the expectation that companies have about the future evolution of the domestic price of the products they produce and sell in the domestic market. In certain way the expected variation reflects their view on the future evolution of the domestic prices. The empirical strategy seeks to identify the variables that are relevant for companies when setting these expectations. The anchoring of firms price expectations constitutes a relevant aspect of monetary policy implementation especially in a volatile macroeconomic environment.

The unique database allows us to use observed and expected variation of variables that are considered relevant for the price setting of the industrial firms (including input costs and inventories). Also, we take into account, as suggested by the price setting literature, the potential influence of the main macroeconomic variables.

It should be noted that we have information both in the expected domestic market and foreign market price of the companies. However, the analysis focuses on the expected

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[1]As argued by Rudd (2021) the apparent correlation between survey measures of inflation expectation (based either in professional forecasters, households or firms) and actual inflation can not necessarily indicate a causal relationship as implied by the usual Phillip's curve forecasting inflation models. Therefore, the analysis of the formation of price expectations is relevant, especially considering that behind the changes in the general price level lie the decisions of innumerable firms adjusting prices in different markets. Precisely, the objective of our work is to contribute with a preliminary analysis to the empirical discussion of such behavior.

[2]As the sample include large companies their sales include several products and/or SKU (stock keeping units).

variation of the price in the domestic market. Although most companies focus their sales on the domestic market, there are several companies in the sample with sales to foreign markets. In general, prices in foreign markets are "taking as given" for the companies. Also, there is no information in the data set about the share of domestic and/or foreign market sales. Therefore, we focused the analysis in the expectations regarding domestic prices and the potential profits obtained by the firms in the foreign market is not included in our analysis.

In fact, we postulate an econometric model where the companies price expectations are based on (i) the variation of their own balance sheet observed and expected variables including input costs (domestics and foreign), inventories and sales as well as production and prices; (ii) the observed (and expected) evolution of macroeconomic variables (like economic activity, exchange rate, interest rate and inflation rate). The empirical analysis suggests the relevance of both observed and expected variation of domestic costs as well as the expected variation of labor unit costs and foreign inputs. Also, the change in macroeconomic variables (especially the exchange rate and the inflation rate) seems to have an impact in the firm's own price expectations. In addition, there is no evidence of a direct effect of the real interest rate and/on money growth. Results are robust when comparing different industrial sectors in the sample. The results for the considered sample seems to indicate the relevance of using domestic price expectation to approximate firm's pricing behaviour as well as the importance of the macroeconomic environment in the price decision making process.

The rest of the paper is organized as follows. Section 2 summarizes the related literature and empirical analysis in other economies. Section 3 introduces the Business Economic Perspective Survey, summarizes the surveying methodology and describes the variables used together with the main macroeconomic variables included in the analysis. Section 4 introduces the empirical approach and the estimation results. Finally, in Section 5, we introduce the main conclusions and the next steps of this research agenda.

## 2   Literature

The price setting behavior of companies is key to analyze price rigidity at the macroeconomic level. The latter is relevant to understand the potential impact of monetary policy on prices and real variables. In addition, the changes in the general price index (inflation) is the result of the (weighted) sum of price adjustment decisions of firms operating in different markets and sectors. Although the cause of inflation is, in general motivated by a combination of market and economic policy signals, *"those actions are the most direct 'cause'of inflation.* [3] However, due to the lack of micro data, firm's level empirical studies are relatively scarce comparing with the macroeconomic analysis of price's stickiness. The analysis of companies' expectations about the expected price of their products and services may allow

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[3]Heymann & Leijonhufvud (2002)

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inferring their price setting behavior. The determinants of firm's price setting behavior are especially relevant in economies with high inflation and substantial macroeconomic volatility. This study, within the framework of a more ambitious agenda aimed to analyze the expectation formation and price setting behavior of non-financial companies in highly volatile environments contributes and draws on various related literature.

There is an interesting literature with focus in the pricing decision making process in inflationary contexts. One of the seminal works by Frenkel (1979) refers precisely to Argentina and it is an important theoretical support to our empirical analysis. The author emphasizes the role of aggregate uncertainty in the firm's price setting process. The model assumes a time lag between $(i)$ the optimal price decision, $(ii)$ the actual price implementation in the market and, $(iii)$ the final sale of the product, the date when the firm finally recovers the invested working capital. Therefore, firms need to consider the potential changes in the relevant nominal variables between $(i)$ through $(iii)$. The model postulates that a company can achieve *normal* benefits setting a fixed cost markup price, decided under normal conditions, when it is possible to foresee the variation of prices and costs, even in high inflation contexts, to the extent that the latter can be considered "*normal*". However, the situation changes under macroeconomic volatility conditions, especially regarding inflation and input costs levels. In the model, any change in the interest rate (operating through a working capital and/or inventory channel) and/or in the foreign exchange rate (operating through the foreign inputs costs channel) and/or in the inflation rate (operating through domestic inputs and inventories channels) may increase the optimal expected price of the firm's product.[4] Under this setting, the so called "*normal*" markup behaviour may change together with macroeconomic uncertainty. Indeed, companies face two types of risks in setting their optimal price. On one hand there is a risk of setting a price that it is above the optimal level, which would lead to lower than expected sales and an unexpected inventories accumulation with its associated opportunity cost. On the other hand, there is a risk of setting a price below the optimal level, ending up with a cash flow not enough to recover all the incurred input costs. Depending on the interest rate and the inflationary uncertainty regarding domestic and/or foreign inputs, the second cost can be more important than the first one, ending up in an increasing indexation behaviour based on inflation expectations. Also, the uncertainty about the expected rate of inflation, the exchange rate and/or the interest rate tend to be more important in economies with high inflation and macroeconomic volatility. Therefore, the lack of a nominal anchor for expectations arising from the macroeconomic uncertainty may affect companies' pricing decisions.

In this regard, and not surprisingly, given the relevance of the subject in an economy with a rich history of persistent inflation, the contribution of argentine economists is remarkable. Beyond the aforementioned seminal work by Frenkel (1979), we can highlight

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[4]Firms are assumed not to be price takers in their markets.

the one by Calvo (1983), prior to the development of his famous *Calvo-pricing* model. The model introduces a "signal" factor preventing the firms to change nominal prices in a continuous "state dependent" fashion. The firm´s optimal prices are an increasing function of average price of competitors and the excess demand, but they would change only when a "signal" (associated with the cost of observing the change in the state of the economy) is received. The model generates non-synchronous price revisions, similar to a "time dependent" pricing behavior by firms, where firms do not instantly change prices following pure profit maximization decision making process. Meanwhile, the book by Heymann & Leijonhufvud (2002) analyzes in depth the role of uncertainty in high inflation environments. The authors consider not only the macroeconomic aspects and the possible roots of the inflationary problem, but also the complex dynamics of interaction between economic policies and private sector agents in high inflation regimes. In these contexts, even in stages of moderate inflation, economic actors *"have abnormal difficulties in calculating the future outcomes of present actions,"* and the uncertainty generate costs and impairs the ability to form accurate expectations. Information on past costs and prices may not be as relevant as the macroeconomic variables in deciding future market conditions and forming firms' pricing expectations. A more recent contribution, by Alvarez et al. (2019) analyzes the price setting behaviour of firms under both low or high inflation regimen in a menu cost model. The frequency and size of price changes and cost mark up is analyzed under different inflation environments with an application using product level data from the CPI of Argentina for the period 1988-1997. Their results for a high inflation regime indicates a behaviour where firms try to keep their target prices in line with the aggregate price level growth. In fact, in the model, the magnitude of price changes increases with the inflation rate as well as the frequency of price adjustment. [5]

Our empirical analysis relays in the economic literature that empirically study the price setting behaviour by firms. Those studies can be divided in two groups, depending on the basic information source. One group uses micro price data (from ticket sales) and the other is based in surveys of price-setting practices (completed by firm's managers). In the first case, the use of individual prices (tickets sales) allows to study several issues related to the underlying price frictions and price variations through the business cycle. For instance, it allows to analyze both, the frequency and the size of price changes. The work of Nakamura & Steinsson (2008) or the one by Bils & Klenow (2004), among others stand out as the main contributions. One interesting result from this approach, coming from the study of Nakamura et al. (2018) in the case of US, indicates that the *"frequency"* of price changes decreases as inflation goes down while the *"size"* of price changes remains basically the same.

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[5]The numerical analysis indicates that the elasticity of frequency of price changes is 2/3 as inflation increases and the dispersion of price changes across goods decreases with inflation. In fact, the authors indicates that the estimated frequency and the average size of price changes are highly correlated with inflation rate: *For instance, during the mid-1989 hyperinflation, the implied expected duration of a price spell is close to one week; after 1993 (with an inflation rate below 1% per month) the implied expected duration is close to half a year*. Another finding is the significant decline in dispersion of the frequency of price changes as inflation rises.

The result indicates that in an inflationary environment the "*frequency*" of the adjustment may dominate the "*size*." [6]

In the case of surveys on firms' price-setting practices, they are designed to be answered by managers and include questions on the actual company's pricing behavior. The seminal works of Blinder (1991) or Blinder (1994) for the United States and more recently, the work of Fabiani et al. (2005) for the European Union, that summarizes the findings as part of the Eurosystem Inflation Persistence Network are interesting examples, together with Fabiani et al. (2004) for Italy and Silva Correa Arnildo & Santos (2016) for Brazil. These surveys inquire about the price decision-making process at firms' level and analyze from that micro-economic data their possible macroeconomic implications. The survey on firms' price-setting practices is typically used to analyze different dimension of the price-setting behavior by firms including: ($i$) the relative importance of different economic theories of price rigidity, ($ii$) the type of information commonly used by companies to change their prices, and the ($iii$) the main factors driving their price changes. The evidence from Brazil[7] indicates that state-dependent behavior is more relevant than time-dependent behavior in inflationary environments. This result seems natural in developing economies, where inflation history and indexation is more important than in developed countries. In the case of Brazil it is found that the average number of price changes is three (3) times per year. [8] Also, the survey shows that in the face of changes in the economic environment, i.e. in inflationary contexts and/or in the face of strong variations in the exchange rate (that may impact costs or affect indexation mechanisms) price change decisions become more "state dependent" and may deviate from original ("*normal*") plans.

However, in most of the cases the original plans are "time dependent". Another relevant aspect from the Brazilian survey is the relative importance of "price markup" behavior: one of the two main determinants of price adjustments are the changes in "input costs." In fact, for the manufacturing sector 85% of the firms consider that the price of intermediate inputs are a very important determinant of their change in price. Furthermore, the macroeconomic environment is another relevant independent variable: the firms underscore the role of "the inflation rate" and "exchange rate" changes as other important determinants of their price setting behavior. Indeed, the exchange rate and the inflation rate are considered as very important by 48 % and 44% of the manufacturing firms in the sample.

There is a difference between the our empirical analysis and the prevalent applied economic literature. Instead of using individual prices surveys (tickets) or specific price setting behavior surveys, the basic information in the analysis comes from the Business Economic Perspective Survey. The information analyzed has several attractive features: ($i$) it makes use of a unique proprietary data base on firm's price expectations and ($ii$) it covers an interesting and challenged period for the firms under analysis. Furthermore, there are some

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[6]Similar results are reported by Navajas (2017) and Alvarez et al. (2019) for the case of Argentina
[7]Silva Correa Arnildo & Santos (2016).
[8]Again, compatible results are reported by Navajas (2017) for the case of Argentina

precedents, in other countries, on the use of Business Surveys to analyze firms behaviour. Some of them focused in the analysis of firm's inflation expectations, an information that is not collected in BCRA's survey.

In a similar venue, the work by Anderson & Maule (2014) uses the Confederation of British Industry (CBI) Survey information of UKs companies to analyze the different channels through which aggregate inflation expectations affect actual inflation.[9] Also, the work by Cloyne et al. (2016), uses the same CBI Survey's information to analyze the forward looking pricing behaviour by firms in a standard New Keynesian Phillips Curve adapted to be estimated with firm data. They found that expectations matter for firms pricing decision in a way that seems to be consistent with the New Keynesian theoretical macroeconomic models and prices are also found to be affected by costs. In the case of Canada, Richards & Verstraete (2016) analyze the determinants of inflation expectations by firms. Interestingly, the authors find that firms significantly expect an increase in inflation if they anticipate an increase in their own output price. Also, the firms anticipate an inflation rate increased if they expect an acceleration in the growth rate of their wages, or in the cost of their inputs. Finally, their results indicate that macroeconomic variables are also relevant including, with a positive and statistically significant influence, the lagged inflation rate, the inter-bank interest rate and the real GDP growth.

In order to analyze the price setting behavior of the surveyed firms during this particular period we propose a slightly different methodology. In particular, we merge the survey information with macroeconomic information. As we shall see, the results indicate that aggregated variables are relevant for the price setting behavior of the firms in the sample in the period under analysis. In that sense, our results are coincidental with the results predicted by Frenkel (1979) for highly volatile and inflationary environments.

# 3 Business Economic Perspective Survey

## 3.1 Survey methodology

The Business Economic Perspective Survey of the BCRA is a monthly survey covering more than 100 non-financial Argentinean companies.[10] The survey includes both qualitative and quantitative questions regarding the past and expected (quarterly) variation of price, costs, production, inventories and sales variables. It is designed to be answered by qualified informants with access to internal balance sheet and company's planning information. The survey is complemented with direct interviews with designated and qualified informants

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[9]As can be seen in Anderson & Maule (2014), Table C, page 179, results indicate that companies' prices expectations positively depend on $(i)$ industry level price expectation and $(ii)$ the quarterly changes in input costs.

[10]The sample is not statistically significant but economically relevant. It includes approximately 6 % of the formal private employment on the included economic sectors. Also, in some of the sectors the included firms have a significant share of the domestic market.

from the companies. This *anecdotal* information complements and helps contextualize survey's monthly results. The information is upload through a secure external application designed by the Central Bank and it is processed and analyzed following strict confidential and secured procedures. A diffusion index on the economic conditions perspectives is calculated and included in a reserved report for the central bank authorities.

## 3.2 Dataset

The variable of interest is the expected variation of firm's domestic market price. It should be emphasized that the firms every month answer the qualitative [11] and quantitative [12] question regarding the price (or expected price) variation for the last (or next) three months every month. As noted before, this variable is a weighted average change of the prices of the goods sold by the company. For each month $t$ and for all companies $i$ the expected Domestic Market Price variation (for next 3 month) is given by $\Delta P_{i,t,t+3}^e$. Therefore, the observed price variation (for the last 3 months) is given by $\Delta P_{i,t-3,t}$. In our analysis we use the variation (observed and expected) of the following variables: $(i)$ domestic input costs, $\Delta Cn_{i,t,t+3}^e$ and $\Delta Cn_{i,t-3,t}$; $(ii)$ imported input costs, $\Delta Cm_{i,t,t+3}^e$ and $\Delta Cm_{i,t-3,t}$; $(iii)$ unit labor costs, $\Delta Cl_{i,t,t+3}^e$ and $\Delta Cl_{i,t-3,t}$. We also include, $(iv)$ inventories over sales $\Delta Is_{i,t,t+3}^e$ and $\Delta Is_{i,t-3,t}$. Finally, we include the last month variation of several macroeconomic variables, as the monthly inflation rate, foreign exchange rate (monthly variation) and the economic activity monthly index (EMAE).

The following Table 1 summarizes the descriptive statistics of the main variables for the entire sample period. It should be noted that the median value of the expected and observed variation of the price variable are not equal, with the expected value slightly lower than the observed value. On the other hand, the mean values are greater than the median indicating a positively (right) skewed distribution. In fact, for the whole period, the mean for the observed variation of price for the last three months was greater than the expected value for the next three months. Also, the annualized price level change for the firms sample is lower than a comparable (adjusted in terms of weights of the different sectors) CPI and MPI for the period. A similar feature, but in a sharply different environment, is registered by Cloyne et al. (2016) for UKs firms between 2008 and 2014. In fact, they reject the rational expectations hypothesis Rossi & Sekhposyan (2015) and point the difference out to *"information frictions"*. As pointed out by, Coibion et al. (2018). those frictions may arise from different *"beliefs"* about past and future macroeconomic and inflation conditions and would depend on the firm's incentives to collect and process information, especially in a volatile economic context.

In order to test the consistency between the expected and observed variable for each of the companies we analyzed the correlation between both variables by running an OLS

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[11]With a seven possible answers: high/low increase, none, or low/high decrease.

[12]The firms have to calculate and complete the answer with a numerical average for the last or the next three months.

Table 1: Descriptive statistics of main variables

| Variable | N | Mean | Standard Deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $\Delta P_{i,t-3,t}$ | 1682 | 0.075 | 0.080 | 0.060 | $-0.190$ | 0.620 |
| $\Delta P^e_{i,t,t+3}$ | 1682 | 0.056 | 0.051 | 0.050 | $-0.100$ | 0.240 |
| $\Delta Cn_{i,t-3,t}$ | 1682 | 0.085 | 0.068 | 0.070 | $-0.075$ | 0.310 |
| $\Delta Cn^e_{i,t,t+3}$ | 1682 | 0.072 | 0.058 | 0.060 | $-0.150$ | 0.450 |
| $\Delta Cm_{i,t-3,t}$ | 1682 | 0.101 | 0.117 | 0.080 | $-0.500$ | 1.000 |
| $\Delta Cm^e_{i,t,t+3}$ | 1682 | 0.078 | 0.074 | 0.060 | $-0.500$ | 0.680 |
| $\Delta Cl_{i,t-3,t}$ | 1682 | 0.074 | 0.066 | 0.068 | $-0.200$ | 0.468 |
| $\Delta Cl^e_{i,t,t+3}$ | 1682 | 0.070 | 0.063 | 0.060 | $-0.200$ | 0.450 |
| $\Delta Is_{i,t-3,t}$ | 1682 | $-0.005$ | 0.157 | 0.000 | $-0.990$ | 0.742 |
| $\Delta Is^e_{i,t,t+3}$ | 1682 | $-0.001$ | 0.120 | 0.000 | $-0.573$ | 0.869 |

Note: Information from Business Perspective Survey BCRA. From Jan -2017 to dec-2021.

regression between the expected variable and different leads of the observed variable.[13] The results are summarized in the following Table 2. As expected, the third lead of the observed variable presents a significant and positive correlation with the expected variable. The result indicates that the explained variable $\Delta P^e_{i,t,t+3}$ is a good proxy of the price setting behavior of the companies in the sample.

Table 2: Relationship between expected and observed leaded price variation

| Variable | $\Delta P_{i,t-3,t}$ | $F.\Delta P_{i,t-3,t}$ | $F2.\Delta P_{i,t-3,t}$ | $F3.\Delta P_{i,t-3,t}$ | $F4.\Delta P_{i,t-3,t}$ | $F5.\Delta P_{i,t-3,t}$ |
|---|---|---|---|---|---|---|
| $\Delta P^e_{i,t,t+3}$ | 0.4963* | 0.51677* | 0.5241* | 0.5164* | 0.4649* | 0.4158* |
| $Std.\,Dev.$ | [0.0108] | [0.0106] | [0.0102] | [0.0106] | [0.0112] | [0.0117] |

Note: * 1% significant.

Figure 1 below shows the evolution of the expected price compared with the observed value in each period. In fact, the expected price is lagged three period to be compared with the actual value realized in each period. The Figure also shows the 1 standard deviation bracket. It can be noted that the latter increases at the periods where the actual change in price exceeds the expected value for the period. This may be reflecting a shock on the variable that was unexpected three months before and indicates the underlying uncertainty surrounding the firm's price expectations decision making process.

Also, Figure 2 shows the significant dispersion in the variation of domestic price both observed and expected of firms. The observed dispersion is not only reflecting the heterogeneity among firms expectations but also the volatility between the periods. In

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[13]We also include fixed effects with temporal controls and we checked the consistency for different years. The results are informative about the companies that systematically over and/or under estimate their expected price variation.

Figure 1: Prices quarterly variation observed and expected (median)
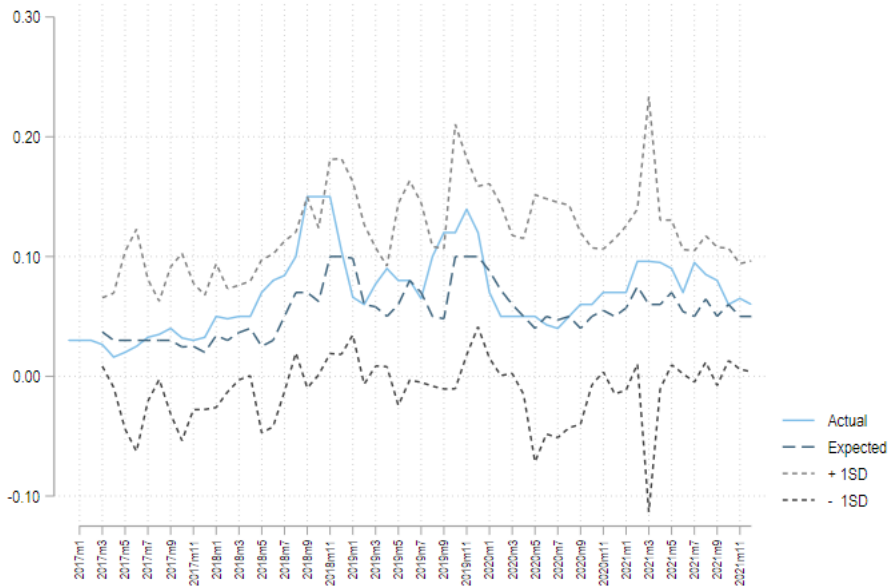


this volatile environment the dispersion between and the differences within firms may be reflecting what Cloyne et al. (2016) states as "genuine reasons for why firms inflation expectations differ," adding interesting variance to the regression analysis.

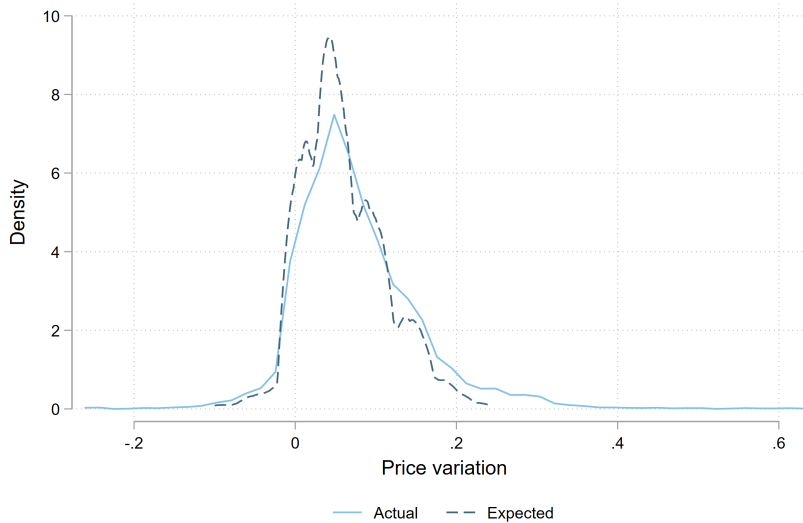Figure 2: Distribution of Observed and Expected Price Changes (quarterly)



Figure 3 summarizes the main macroeconomic variables used in the analysis. As mentioned before the period was particularly volatile. The exchange rate monthly variation during May and June 2018 was 20.6% and 15.7% respectively followed by a sharp 35.8% depreciation in August 2018. Then, the monthly depreciation rate in august 2019 reached

34.7%. As can be seen in the figure, sharp depreciation of the foreign exchange rate are associated with inflation rate peaks. Also, the volatility affected economic activity as showed by the EMAE economic activity index. As we will see, these macroeconomic variables had an independent and significant effect over the expected variation in domestic prices of industrial firms in the sample.

Figure 3: Macroeconomic Variables
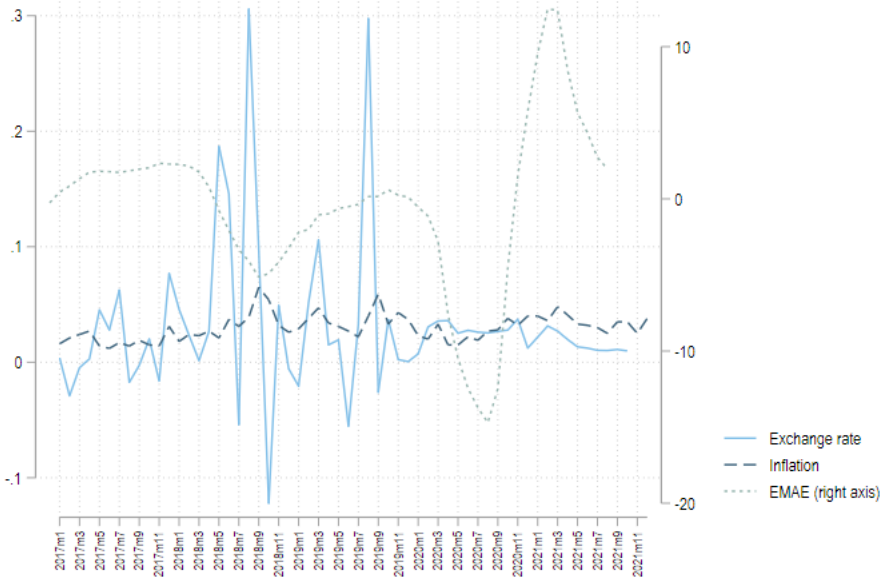


It should be noted that the sample size with an average of 51 industrial companies is rather small. However, most of the firms are large companies and the sample explains more than 6 percent of total industrial employment. Also, most of them are the main companies in their respective markets. For instance, two of firms have more than 60% of their respective domestic markets (basic industrial inputs), other two companies together hold more than 70% share of the market in personal care segments. The two main companies in the food production sector (with more than 5000 employees each) are also included in the sample. As mentioned before, most of the companies producing consumption goods, specially in the case of Food and Beverages sector, were subject to administrated priced regulation during the period.[14]

The Appendix A shows the Figure 4 and 5 with the variation of observed and expected costs, domestic and foreign inputs costs as well as unit labor costs. As can be noted, the months with sharp depreciation in the exchange rate are associated with considerable foreign input costs volatility. Again, as in the case of depreciation of exchange rate and inflation rate, observed domestic costs also increased in the same period.

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[14]Indeed, the number of goods collected by INDEC for the Consumption Price Index included in the program *"precios cuidados"* increased from 2% in 2017 to 6% in 2021. Also, for consumption goods and some other industrial products, a maximum price agreement was in place during part of 2020 and 2021.

# 4 Regression on Price Setting Behaviour

## 4.1 Econometric Model

We consider a regression model that includes both information (expected and observed) from the firms and macroeconomic information, closely following Richards & Verstraete (2016). The macroeconomic or aggregate effect is fixed and exogenous for all firms. Therefore, we first postulate a model with temporal dummy variables in order to capture the months with statistically significant anomalies. Then, we introduce the macroeconomic variables in the regression aiming to approximate the nature of the shocks captured by the time fixed effects. The complete model is given by the equation (1) below:

$$\Delta P^e_{i,t,t+3} = \beta_0 + \beta_1 \Delta P_{i,t-3,t} + \beta_2 \Delta B_{i,t-3,t} + \beta_3 \Delta B^e_{i,t,t+3} + \beta_3 \Delta X_{i,t-1,t} + \epsilon_{it}, \tag{1}$$

For each month $t$ and for all companies $i$ the expected domestic price variation (for next 3 month), $\Delta P^e_{i,t,t+3}$ is modelled as a function of the observed firm's domestic price variation (for the last 3 month) $\Delta P_{i,t-3,t}$ and a set of controls variables including balance sheet information both observed $\Delta B_{i,t-3,t}$ and expected $\Delta B^e_{i,t,t+3}$. Finally, the $\Delta X_{i,t-1,t}$ are the macroeconomic control variables.

As mentioned before, in the $\Delta B$ variables we include the (quarterly) variation of domestic input costs, imported input costs and labor unit costs as well as other variables, such as, the variation of inventories as percentage of sales and/or volume and production variables.[15]

The $\Delta X$ macroeconomic control variables include, the inflation rate (monthly variation), the exchange (rate monthly variation) and an economic activity index (EMAE) (monthly variation). The macroeconomic variables were introduced in the model with their last month variation, between $(t-1,t)$ allowing a time lag association with the dependent variable that is referred to the next quarter, $(t, t+3)$. Longer time lags for the macroeconomic variables were also considered in the regressions showing no statistical significance. Also, other macroeconomic variables were included in the model showing no statistical significant. For instance, the nominal and real interest rate as well as the monetary base variation were included. In order to capture a potential impact of uncertainty, the standard deviation of the dependent variable (from the Business Perspective Survey) and the standard deviation of the expected inflation rate from the REM survey (collected by the BCRA from professional consultant firms) were introduced. All of them with no statistical significance.

The econometric model includes an error component structure that varies by firm $i$ and time $t$. The model is estimated using a Fixed Effect (FE) regression. As detailed before, we also include monthly dummy variables to control for fixed temporal effects. As we shall see, the dummies capture the macroeconomic impact due to the economically turbulent months during the analyzed period.

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[15]The variation of production and sales where not statistically significant.

## 4.2  Results

The estimations results can be seen in Table 3. We initially introduced a baseline Fixed Effect panel data model with price and cost variations for the industrial companies. In the subsequent columns, time effects dummies controlling for month significant variations are introduced. The Table also include columns showing the setup by industrial sector: Food & Beverage, Basic Industrial Inputs and the Rest of Industries. Note that the Table only include a set of selected dummy variables identifying the months with statistically significant effects.

Table 3: Estimations of Alternative Models - Temporal dummies

|  | (1) Baseline $\Delta P^e_{i,t,t+3}$ | (2) Industry $\Delta P^e_{i,t,t+3}$ | (3) Food and Beb. $\Delta P^e_{i,t,t+3}$ | (4) Basic Inputs $\Delta P^e_{i,t,t+3}$ | (5) Rest Industry $\Delta P^e_{i,t,t+3}$ |
|---|---|---|---|---|---|
| $\Delta P_{i,t-3,t}$ | 0.0464 | 0.0405 | 0.0012 | 0.0493 | 0.0382 |
|  | [0.0478] | [0.0440] | [0.0507] | [0.0577] | [0.0657] |
| $\Delta Cn_{i,t-3,t}$ | 0.0893*** | 0.0865*** | 0.0848** | 0.0129 | 0.1390** |
|  | [0.0252] | [0.0264] | [0.0360] | [0.0305] | [0.0555] |
| $\Delta Cm_{i,t-3,t}$ | 0.0167 | -0.0095 | -0.0136 | 0.0083 | -0.0094 |
|  | [0.0156] | [0.0142] | [0.0418] | [0.0160] | [0.0213] |
| $\Delta Cl_{i,t-3,t}$ | -0.0111 | -0.0170 | 0.0103 | -0.0060 | -0.0299 |
|  | [0.0217] | [0.0213] | [0.0760] | [0.0428] | [0.0330] |
| $\Delta Is_{i,t-3,t}$ | 0.0063 | 0.0059 | 0.0210 | -0.0048 | 0.0175 |
|  | [0.0099] | [0.0098] | [0.0221] | [0.0124] | [0.0143] |
| $\Delta Cn^e_{i,t,t+3}$ | 0.1727*** | 0.1513*** | 0.1866* | 0.3158*** | 0.0334 |
|  | [0.0555] | [0.0544] | [0.0841] | [0.0786] | [0.0769] |
| $\Delta Cm^e_{i,t,t+3}$ | 0.1053** | 0.0653* | 0.0114 | 0.0209 | 0.1356*** |
|  | [0.0418] | [0.0359] | [0.0758] | [0.0374] | [0.0466] |
| $\Delta Cl^e_{i,t,t+3}$ | 0.0615** | 0.0654** | 0.0384 | 0.0373 | 0.1166** |
|  | [0.0253] | [0.0272] | [0.0616] | [0.0239] | [0.0422] |
| $\Delta Is^e_{i,t,t+3}$ | 0.0025 | 0.0048 | 0.0243 | 0.0252 | -0.0395** |
|  | [0.0118] | [0.0108] | [0.0143] | [0.0220] | [0.0151] |
| dic-17 |  | 0.0083 | -0.0144** | 0.0218*** | 0.0144 |
|  |  | [0.0136] | [0.0058] | [0.0048] | [0.0223] |
| aug-18 |  | 0.0163 | 0.0059 | 0.0496*** | 0.0063 |
|  |  | [0.0142] | [0.0371] | [0.0112] | [0.0237] |
| sep-18 |  | 0.0376** | 0.0253 | 0.0558*** | 0.0343 |
|  |  | [0.0170] | [0.0302] | [0.0185] | [0.0296] |
| aug-19 |  | 0.0405** | 0.0474** | 0.0668*** | 0.0243 |
|  |  | [0.0169] | [0.0199] | [0.0154] | [0.0292] |
| sep-19 |  | 0.0273* | 0.0398* | 0.0447** | 0.0144 |
|  |  | [0.0154] | [0.0201] | [0.0166] | [0.0280] |
| Constant | 0.0189*** | 0.0188* | 0.0421*** | 0.0023 | 0.0118 |
|  | [0.0034] | [0.0111] | [0.0086] | [0.0057] | [0.0180] |
| Observations | 1605 | 1605 | 381 | 481 | 743 |
| Firms | 44 | 44 | 9 | 15 | 20 |
| R-squared | 0.197 | 0.240 | 0.381 | 0.419 | 0.233 |

Robust standard errors in brackets. * p<0.10 ** p<0.05 *** p<0.01

The results in Table 3 indicate a positive and significant statistical effect of the variation of Domestic costs both observed (last quarter) and expected (next quarter). Apparently, changes in domestic costs are the most relevant variables used by the firms to form their expectation on their expected domestic market price variations. In the baseline model, the expected variation of unit labor costs and foreign inputs are also relevant and statistically significant with a positive sign. In the first case, the potential impact of the expected variation in unit labor costs on price expectations can be explained by the role of the labor unions in establishing a negotiated and mandatory wage adjustment path in each economic sector. In the case of the foreign inputs, their impact may be related to the expected exchange rate depreciation.

In the second column the time effects dummies are added to the baseline model. It should be noted that the main explanatory variables of the baseline model maintained their statistic and economic significance. Also some of the dummy variables, those that are included in the Table, are statistically significant. In fact, these variables identify the months in which a significant change in the expected price variation rate (for the next three months) is detected above the effect explained by the baseline model. Except for December 2017,[16] the rest of the cases they coincide with the months with important changes in the main macroeconomic variables (like, the foreign exchange rate). In particular, during the months of September and August 2018[17] as well as September 2019,[18] the volatility of the foreign exchange rate seemed to have an independent and significant impact in the firms expectations formation. [19]

In columns (3) to (5) we analyze the baseline regression with the time effect variables dividing the sample in three industrial sectors. Column (3) indicates the results for the Food and Beverages sector. This sector is composed by large companies with main focus in domestic market (none of them are relevant exporters) and most of them mainly uses domestically produced inputs. As result, only domestic costs and expected unit labor costs

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[16]In December $28^{th}$ of 2017 the government announced an unexpected change in the inflation target for the 2018-2020 period.

[17]In the Monetary Policy Report of October 2018 the Central Bank stated that foreign exchange rate instability initiated in April and accelerated in August 2018. "The episodes generated a risk of further misalignment of public expectations. In response, the BCRA introduced a new monetary policy framework based on a strict control of the monetary base. The new regime pursues the objective of recovering the nominal anchor for inflation expectations."

[18]Again, as can be seen in the Monetary Policy Report of October 2019, during August 2019 there was an important depreciation of the foreign exchange rate.

[19]The relevance of the exchange rate depreciation rate in the price setting behaviour of the firm can be related to the fact that some of the firms sell in both foreign (as price takers) and domestic markets (with some market power) and have incentives to *"pass-through"* the exchange rate depreciation in the domestic market beyond any change in prices of imported and domestic inputs. See Dvoskin et al. (2020) for a dual model with tradable and non-tradable sector leading to such behavior. In their model, an exchange rate depreciation benefits not only the tradable sector but also the non-tradable sector with an impact on domestic prices through competition. In addition, the works by Navajas (2017) emphasized the important link between the exchange rate and the public service tariffs during a period characterized by sharp adjustments in relative prices. For the author, the relevance of the relationship between tariffs and inflation should not be neglected. We plan to test this hypothesis in future extensions of the analysis.

are statistically significant. Whereas the potential foreign exchange rate change affecting imported inputs costs may be absorbed by the dummy variables. The latter result statistically significant in several month of 2019 in coincidence with several adverse macroeconomic episodes. In contrast, in the case of column (4), that includes industrial inputs producer firms, the main determinants of expected prices are foreign inputs costs. In this industry, foreign inputs are the main component in the production process. Therefore, the dummy variables are significant in (almost) all the periods with important changes in the foreign exchange rate during the period. Finally, the last column include the rest of the industrial sectors. As in the previous case, both observed domestic input costs and expected unit labor costs are statistically significant. Also, expected foreign input costs are significant in this sector. However, none of the dummies result statistically significant.

Therefore, the results in Table Table 3, indicate that domestic costs and expected unit labor costs are consistently significant in the sub-samples. Also, the dummy variables captured significant time effects related to adverse macroeconomic episodes. The costs of foreign inputs and the monthly dummies are more relevant in the industrial inputs producer sectors.

In Table 4 we introduce the macroeconomic variables that can help explaining the fixed temporal effects captured by the temporal dummies. In the model for all the industry (column (1)), the observed domestic costs are statistically significant together with the expected domestic input costs, the expected foreign input costs and the expected unit labor costs. In this baseline regression with macroeconomic variables, both foreign exchange monthly depreciation rate and the monthly inflation rate are statistically significant and have a positive relationship with expected change in firms domestic market prices (for next three months). These variables seem to capture the fixed effects detected in the previous model with the monthly dummies.

In the case of Food & Beverage industry (column (2)) the domestic observed and expected input costs are statistically relevant after controlling for the macroeconomic impacts. In particular, the inflation rate dominates as explanatory variable between the macroeconomic set of variables. Again, the results may be reflecting a sector that is dominated (in the sample) by firms that produce mainly for domestic market with domestic inputs.

Unlike the previous sector, in the case of the industrial inputs sector (column (3)) the statistically significant variables are the expected domestic costs together with the expected inventories over sales. Also, as we expected, the foreign exchange depreciation rate together with the inflation rate play significantly affect firms changes in domestic price expectation for the next three months. Also, the activity index variable is statistically significant and with a negative sign, reflecting the potential returns of scale usually characterizing the sector. For the rest of the industrial sector (column (4)) included in the sample, the results shows an intermediate mixture in between the previous two sectors, with an emphasis in firms own

costs (both observed and expected) and a negative effect of the activity index among the macroeconomic variables.

Table 4: Estimations of Alternative Models - Macroeconomic Variables

| | (1) Industry $\Delta P^e_{i,t,t+3}$ | (2) Food and Beb. $\Delta P^e_{i,t,t+3}$ | (3) Basic Inputs $\Delta P^e_{i,t,t+3}$ | (4) Rest Industry $\Delta P^e_{i,t,t+3}$ |
|---|---|---|---|---|
| $\Delta P_{i,t-3,t}$ | 0.0410 | 0.0425 | 0.0451 | 0.0348 |
| | [0.0447] | [0.0654] | [0.0538] | [0.0667] |
| $\Delta Cn_{i,t-3,t}$ | 0.0910*** | 0.0884* | 0.0243 | 0.1465*** |
| | [0.0251] | [0.0454] | [0.0267] | [0.0407] |
| $\Delta Cm_{i,t-3,t}$ | -0.0079 | 0.0104 | 0.0059 | -0.0060 |
| | [0.0143] | [0.0316] | [0.0145] | [0.0173] |
| $\Delta Cl_{i,t-3,t}$ | -0.0163 | 0.0222 | 0.0169 | -0.0458 |
| | [0.0231] | [0.0695] | [0.0315] | [0.0358] |
| $\Delta Is_{i,t-3,t}$ | 0.0036 | 0.0205 | -0.0125 | 0.0105 |
| | [0.0100] | [0.0214] | [0.0123] | [0.0160] |
| $\Delta Cn^e_{i,t,t+3}$ | 0.1538*** | 0.2006* | 0.2901*** | 0.0156 |
| | [0.0541] | [0.1009] | [0.0797] | [0.0685] |
| $\Delta Cm^e_{i,t,t+3}$ | 0.0844** | 0.0317 | 0.0534 | 0.1570*** |
| | [0.0375] | [0.0889] | [0.0422] | [0.0526] |
| $\Delta Cl^e_{i,t,t+3}$ | 0.0612** | 0.0458 | 0.0239 | 0.1086** |
| | [0.0262] | [0.0258] | [0.0276] | [0.0418] |
| $\Delta Is^e_{i,t,t+3}$ | -0.0000 | 0.0207 | 0.0336* | -0.0549*** |
| | [0.0123] | [0.0193] | [0.0164] | [0.0121] |
| $\Delta ER_{t-1,t}$ | 0.0552** | 0.0097 | 0.1037** | 0.0436 |
| | [0.0218] | [0.0377] | [0.0391] | [0.0252] |
| $\Delta \Pi_{t-1,t}$ | 0.5254*** | 0.5176* | 0.5490* | 0.3857 |
| | [0.1592] | [0.2272] | [0.2849] | [0.2600] |
| $\Delta AI_{t-1,t}$ | -0.0005 | 0.0004 | -0.0009*** | -0.0006 |
| | [0.0003] | [0.0008] | [0.0002] | [0.0005] |
| Constant | 0.0073 | 0.0130* | 0.0007 | 0.0094 |
| | [0.0051] | [0.0066] | [0.0089] | [0.0077] |
| Observations | 1495 | 355 | 451 | 689 |
| Firms | 44 | 9 | 15 | 20 |
| R-squared | 0.226 | 0.264 | 0.357 | 0.214 |

Robust standard errors in brackets. * p<0.10 ** p<0.05 *** p<0.01

Therefore, the macroeconomic environment has a key role, through the impact of the foreign exchange rate variations and the inflation rate over firm's price expectations. The results are consistent for all the industrial companies with some differences between

industrial sectors. In fact, the months with stronger foreign exchange rate variation are the ones that resulted with statistically significant dummy variables.[20]

# 5 Conclusion

In this article we use a unique proprietary data set from the Argentinean Central Bank Business Economic Perspective Survey to analyze the price setting behaviour of a sample of industrial companies during the 2017-2021 period. The period was characterized as a highly inflationary and volatile environment, with several foreign exchange rate depreciation episodes. The data set allows us to analyze the relative importance of the firms balance sheet variables (past and expected information) and the aggregated economic variables on the firm's price setting behaviour approximated by the expected variation of their domestic price.

We find evidence indicating that expected prices are influenced by domestic input prices (both past and expected), expected foreign input and unit labor costs as well as macroeconomic variables. In particular, the monthly change in the nominal foreign exchange rate and the monthly inflation rate have an independent, statistically significant and positive effect on the expected variation of firm's domestic prices. Also, when we consider the monthly fixed effects we found relevant impacts during especially turbulent months (those with large foreign exchange rate depreciation).

It should be considered that our results arises from an economically representative but not statistical significant sample of non financial firms. Therefore results only apply to the sample and period analyzed and can not be further generalized. Also, our findings may be improved by using individual price information and by conducting a price setting behavior survey for non financial firms. Both are pending tasks in Argentina.

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[20]Indeed, the results are similar to Anderson & Maule (2014) analysis of UKs companies.

# References

Alvarez, F., Beraja, M., Rosada, M. G., & Neumeyer, P. A. (2019). From hyperinflation to stable prices: Argentina´s evidence on menu cost models. *The Quarterly Journal of Economics*, 12, 451–505.

Anderson, G. & Maule, B. (2014). Assessing the risk to inflation from inflation expectations. *Bank of England Quarterly Bulletin, Bank of England*, 54(2), 148–162.

Bils, M. & Klenow, P. J. (2004). Some evidence on the importance of sticky prices. *Journal of Political Economy*, 112(5).

Blinder, A. (1991). What makes prices sticky? preliminary results from interview study. *American Economic Review Papers and Proceedings*, 81(2), 89–96.

Blinder, A. (1994). On sticky prices: Academic theories meet the real world. *Mankiew. N. G. (ed).Monetary Policy, Chicago and London*, 81.

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics*, 12, 383–398.

Cloyne, J., Boneva, L., Weale, M., & Wieladek, T. (2016). Firm´s expectations and price setting: Evidence from micro data. *Bank of England Working Paper, Bank of England*.

Coibion, O., Gorodnichenko, Y., & Kumar, S. (2018). How do firms form their expectations? new survey evidence. *American Economic Review*, 108(9), 2671–2713.

Dvoskin, A., Feldman, G., & Ianni, G. (2020). New-structuralist exchange-rate policy and the pattern of specialization in latin american countries. *Metroeconomica - International Review of Economcis*, 71(1), 22–48.

Fabiani, S., Gattulli, A., & Sabbatini, R. (2004). The pricing behaviour of italian firms: New survey evidence on price stickiness. *European Central Bank - Working Papers Series*, April(333).

Fabiani, S., Gattulli, A., & Sabbatini, R. (2005). The pricing behaviour of firms in the euro area. new survey evidence. *European Central Bank - Working Paper Series*, ""(535).

Frache, S. & Lluberas, R. (2019). New information and inflation expectations among firms. *BIS Working Papers*, 781.

Frenkel, R. (1979). Decisiones de precio en alta inflación. *Desarrollo Económico*, 19(75), 291—-330.

Heymann, D. & Leijonhufvud, A. (2002). High inflation. *Clarendon Press - Oxford*, "".

Nakamura, E. & Steinsson, J. (2008). Five facts about prices: A reevaluation of menu cost models. *Quarterly Journal of Economics*.

Nakamura, E., Steinsson, J., Sun, P., & Villar, D. (2018). The elusive costs of inflation: Price dispersion during the u.s. great inflation. *Quarterly Journal of Economics*.

Navajas, F. (2017). Tarifas, subsidios e inflación. *CEA - FIEL*.

Richards, S. & Verstraete, M. (2016). Understanding firms' inflation expectations using the bank of canada's business outlook survey. *Staff Working Paper/Document de travail du personnel*, 7.

Rossi, B. & Sekhposyan, T. (2015). Forecast rationality tests in the presence of instabilities, with applications to federal reserve and survey forecasts. *Journal of Applied Econometrics*, 31.

Rudd, J. B. (2021). Why do we think that inflation expectations matter for inflation? (and should we?). *Finance and Economics Discussion Series - Washington: Board of Governors of the Federal Reserve System*, September(062).

Silva Correa Arnildo, M. B. P. & Santos, R. (2016). Price-setting behavior in brazil: survey evidence. *Banco Central do Brazil - Working Papers Series*, 7(422).
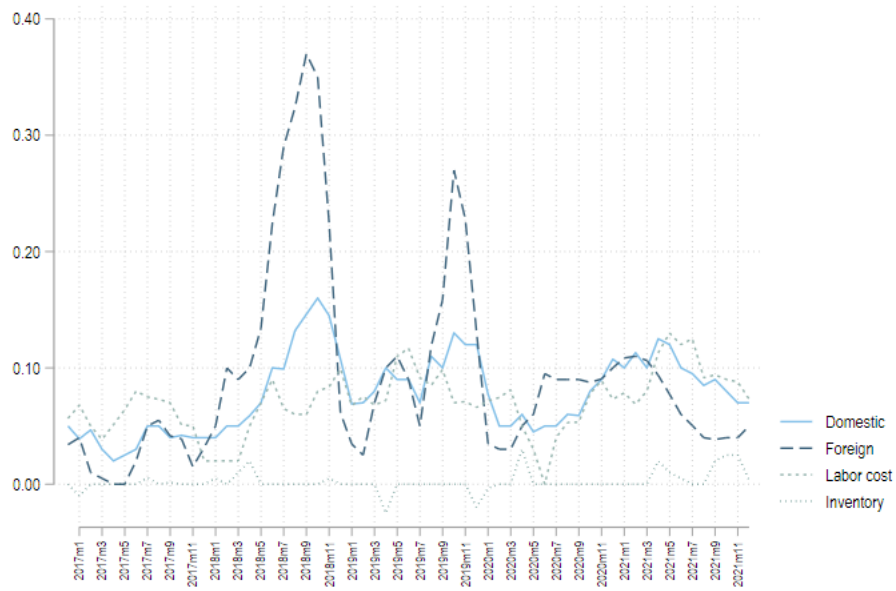
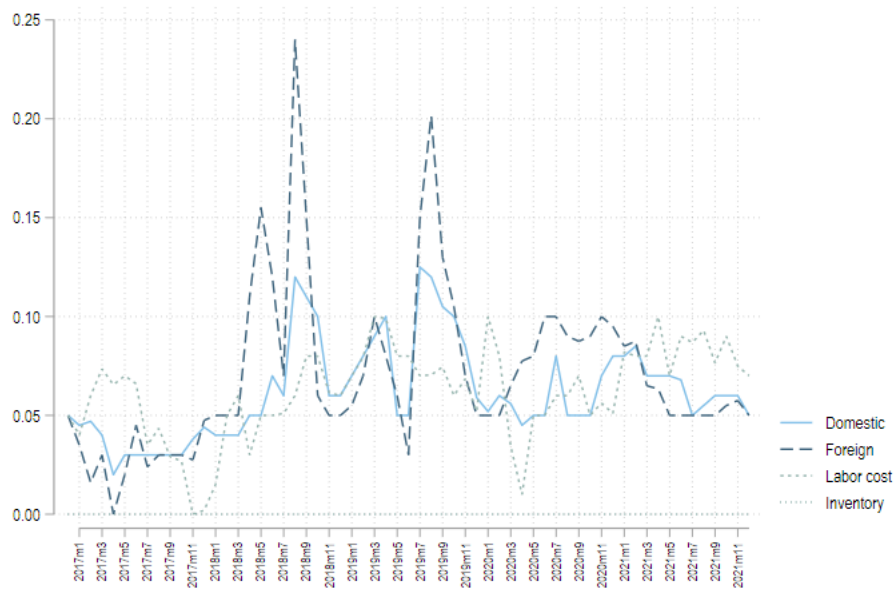# A   Additional Figures



Figure 4: Past 3 months



Figure 5: Next 3 months