Price Setting when Expectations are Unanchored[*]

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Abstract

We present evidence that the state of inflation expectations matters for individual pricing decisions and provide the first set of facts about price setting when expectations are unanchored. In such an environment, wholesailers increase passthrough of exchange rate movements into prices. They also make fewer mistakes when trying to anticipate how they will set their own prices in the future. To establish these and other novel facts, we exploit various micro datasets over a 15-year time period during which the degree of anchoring of inflation expectations varied significantly in Brazil. Finally, we show our main empirical findings are consistent with a simple model in which expectations can become unanchored.

JEL Classification: E53, E65.

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"...[H]ow do changes in various measures of inflation expectations feed through to actual pricing behavior? Promising recent research has looked at price changes at very disaggregated levels for insight into the pricing decision (Bils and Klenow, 2004; Nakamura and Steinsson, 2007). But this research has not yet linked pricing decisions at the microeconomic level to inflation expectations; undertaking that next step would no doubt be difficult but also very valuable." — Bernanke (2007)

1 Introduction

Many academics and policymakers believe inflation expectations matter for actual inflation dynamics. This belief hinges on the idea that expectations matter for forward-looking pricing decisions. When expectations are anchored, price setters should expect the effects of shocks to inflation to be short-lived. As a result, their forward-looking pricing decisions should be less sensitive to those shocks. In such an environment, actual inflation becomes more stable, and medium- and long-run inflation expectations become somewhat insensitive to short-run inflation developments.[1] Underlying such an environment is the belief the central bank will do its job and prevent persistent deviations of inflation from target.

In this paper, we present evidence that the state of inflation expectations matters for individual pricing decisions and provide the first set of facts about price setting when expectations are unanchored. To that end, we exploit various micro datasets over a 15-year time period during which the degree of anchoring of inflation expectations varied significantly in Brazil. When expectations are unanchored, wholesailers increase passthrough of exchange rate movements into prices. They also make fewer mistakes when trying to anticipate how they will set their own prices in the future. In particular, they underestimate how often they end up increasing their prices.[2] We also present a case study of an episode in which unanchoring was arguably caused by an important monetary policy mistake. Finally, we show our empirical findings are consistent with a simple model in which expectations can become unanchored.

The degree of anchoring of inflation expectations in Brazil has varied significantly over time. This provides an ideal laboratory to study how different states of expectations are associated with price-setting behavior. To that end, we combine several datasets over the period 2008–2020. For individual pricing decisions, we rely on microdata underlying the Producer Price Index published by IBRE-FGV ("PPI-FGV"). We also use microdata from another survey conducted by IBRE-FGV, which contains questions about manufacturing firms' demand, costs, inventories and, importantly, pricing intentions. For a subset of firms, we manage to merge these two datasets, and thus compare firms' intended and actual pricing decisions. Regarding expectations, we use both aggregate and individual data from Banco Central do Brasil's survey of professional forecasters, known as the "Focus Survey." Finally, we use a variety of aggregate and sectoral data as well.

We use expectations data from the Focus Survey to construct both a continuous measure of the degree of unanchoring of inflation expectations, and the dating of anchored and unanchored regimes, based on a threshold for that measure.[3] Essentially, our measure of expectations unanchoring captures deviations of inflation expectations from target three years out. Using the resulting sample split into anchored and unanchored regimes, we present basic price-setting statistics in the spirit of Bils and Klenow (2004) – such as frequency and size of price changes –

[1] Bernanke (2007) defines anchored inflation expectations precisely as being "relatively insensitive to incoming data." Carvalho, Eusepi, Moench, and Preston (2022) formalize this idea in a model of learning in which the degree of anchoring is endogenous and time-varying.

[2] As described in Section 2, periods of unanchored inflation expectations in Brazil are associated with above-average inflation. This may explain the direction of firms' forecasting mistakes. In an environment of low inflation, with expectations unanchored on the downside, it may be the case that firms would err in the other direction.

[3] Our measure of the degree of unanchoring is based on Cecchetti and Krause (2002), and can also be thought of as a measure of imperfect credibility of monetary policy.

for each regime.[4]

We then present one of our main findings – that the passthrough of exchange rate movements into prices is higher when inflation expectations are unanchored. To that end, we run panel regressions along the lines of Gopinath, Itskhoki, and Rigobon (2010) and Gopinath and Itskhoki (2010), exploiting changes in the exchange rate over the life of individual price spells. We control for a variety of aggregate and sectoral variables over the duration of each spell, and saturate our panel model with individual product- and time-fixed effects. We then interact exchange rate changes over each spell with a dummy variable that flags the unanchored regime. Robustly across many different specifications, we find a positive coefficient on that interaction, implying higher exchange rate passthrough when inflation expectations are unanchored. We also run an analogous specification with our continuous measure of expectations unanchoring, and find higher unanchoring implies higher passthrough.

We also exploit available data on individual firms' price expectations. For the subset of firms that are part of both the PPI-FGV survey and IBRE-FGV's survey of manufacturing firms, we construct a measure of "correct" price forecasts. In the manufacturing survey, firms are asked about the direction of their intended price changes (i.e. whether the firm expects to increase, decrease, or leave its price unchanged in subsequent periods). We compare that expectation to what firms actually do ex-post, and construct two types of indicators. One that identifies correct directional forecasts, and another indicator that "signs" firms' forecasting mistakes. We then run two sets of panel regressions of those individual indicators on the dummy that separates anchored from unanchored regimes. We find firms make fewer mistakes when expectations are unanchored. In particular, in that regime they underestimate how often they end up increasing their prices.

Finally, we develop and calibrate a model where expectations can become unanchored, providing structural interpretation for our empirical findings. The model is an extension of the standard new Keynesian model with imported inputs in the production function and different regimes for inflation expectations. Shocks in exchange rate acts as a cost-push shock, creating a channel for exchange rate passthrough. Inflation expectations regimes are either anchored or unanchored. In unanchored regime, agents believe the central bank accomodates shocks by changing inflation target. We calibrate the model to the Brazilian economy, without targeting the effect of unanchoring on passthrough. We then simulate artificial data and run passthrough regressions analogous to empirical specifications. As in the data, the model produces higher exchange rate passthrough when expectations are unanchored, with quantitative results that are similar to the empirical findings.

1.1 Related literature

Following the seminal work of Bils and Klenow (2004), a plethora of studies have provided empirical evidence on pricing decisions using microdata that underlie national consumer and producer price indices.[5] This paper contributes to that literature by providing the first comparison of price-setting statistics across periods of anchored and unanchored inflation expectations.

This paper also contributes to the literature that estimates the passthrough from exchange rates into domestic prices using panel regressions with microdata. For example, Gopinath and Rigobon (2008) use microdata on U.S. import and export prices to estimate the exchange rate passthrough into U.S. import prices.[6] Gopinath, Itskhoki, and Rigobon (2010) study how the estimated passthrough varies across products according to the degree of price stickiness, while Gopinath and Itskhoki (2010) compare the estimated passthrough across different invoice currencies. We build on that literature to provide the first estimates of how exchange rate passthrough varies across

[4] Barros, Bonomo, Carvalho, and Matos (2009) provide descriptive price-setting statistics using price microdata underlying IBRE-FGV's Consumer Price Index. Abib and Matos (2022b) do so for IBRE-FGV's PPI.

[5] See Klenow and Malin (2010) and Nakamura and Steinsson (2013) for surveys of the literature.

[6] See Burstein and Gopinath (2014) for a survey.

periods of anchored and unanchored inflation expectations.

Finally, this paper also contributes to the literature that documents and studies the anchoring and unanchoring of inflation expectations and its macroeconomic implications. Carvalho, Eusepi, Moench, and Preston (2022) develop a model in which the degree of expectations' unanchoring is endogenous and time-varying. Their model accounts for the variation in long-term inflation expectations observed in the data, and identifies episodes of anchoring and unanchoring of expectations. Reis (2021) documents the de-anchoring of inflation expectations in episodes of inflation acceleration in the U.S., Brazil, Turkey, and South Africa. In this paper, we document unanchoring of inflation expectations in Brazil, provide evidence it was caused by a monetary policy mistake, and assess implications of unanchored expectations for individual pricing decisions. We also develop a model that provides a structural interpretation for our main empirical findings.

2 A brief history of Brazil's inflation targeting regime

The inflation targeting and floating exchange rate regime in Brazil was established in March 1999, triggered by a currency crisis in the beginning of that year. The target for a consumer price index (IPCA) and a tolerance interval (or "band") around it are defined by the National Monetary Council (NMC), which consists of three members – two from the executive branch and the governor of Banco Central do Brasil (BCB). Until 2017, target and tolerance bands had to be defined until June of each year for the calendar year two years ahead. For example, in June 2016, the National Monetary Council set the inflation target for the calendar year of 2018 to be 4.5% with a 3–6% tolerance interval. Historically, however, targets were revised a few times in the first few years of the regime. The goal was to adjust the path of the target – which started at a high level of 10% for the 1999 calendar year and embedded reductions towards a lower level after a few years – in response to sizable shocks that made the original targets no longer credible. The procedure changed in 2017, with a new presidential decree that instructed the NMC to set the target for 2019 and 2020, and established that from then onward the target had to be defined by June of each year for the calendar year three years ahead.

If 12-month inflation at the end of the calendar year is outside the tolerance interval, the governor of BCB must write an open letter to the Minister of Finance explaining the reasons for missing the target, the measures taken to assure that inflation will converge to the tolerance interval, and the horizon for convergence.

Figure 1 shows the evolution of target and tolerance bands since the begining of the inflation targeting regime.[7] It is apparent that, after an initial transition period, the target was stable at 4.5% between 2005 and 2018, when it started to decrease gradually. The initial tolerance band was set at 2% for deviations in each direction, and remained unaltered for most of this stability period. In June 2015, however, the NMC decided to narrow the tolerance interval to 1.5% from 2017 onward. The next important change happened in 2017, when the NMC decided to set a lower target for both 2019 and 2020 (lower by 25 bps each year). Since then, the NMC has set lower targets for every year until 2024, for which it defined a 3% target.[8] Figure 1 also shows the evolution of 12-month inflation.

In the last 20 years, Brazil suffered through two periods where inflation expectations got unanchored and later reanchored. These episodes are illustrated in Figure 2, which shows expected 12-month inflation three years out and associated target and tolerance bands. The shaded areas show periods in which inflation expectations were unanchored according to our methodology (see Section 3.5 for details on our measure of inflation expectations three years out, the associated target and tolerance bands, and on our measure of expectation unanchoring). In 2002, inflation increased sharply for a few months, and expectations got unanchored for a while. This period was

[7] We convert calendar year targets and tolerance bands into monthly values by simple interpolation.
[8] The target for 2025 has also been set to 3%.

Figure 1: **Inflation, targets and tolerance bands**

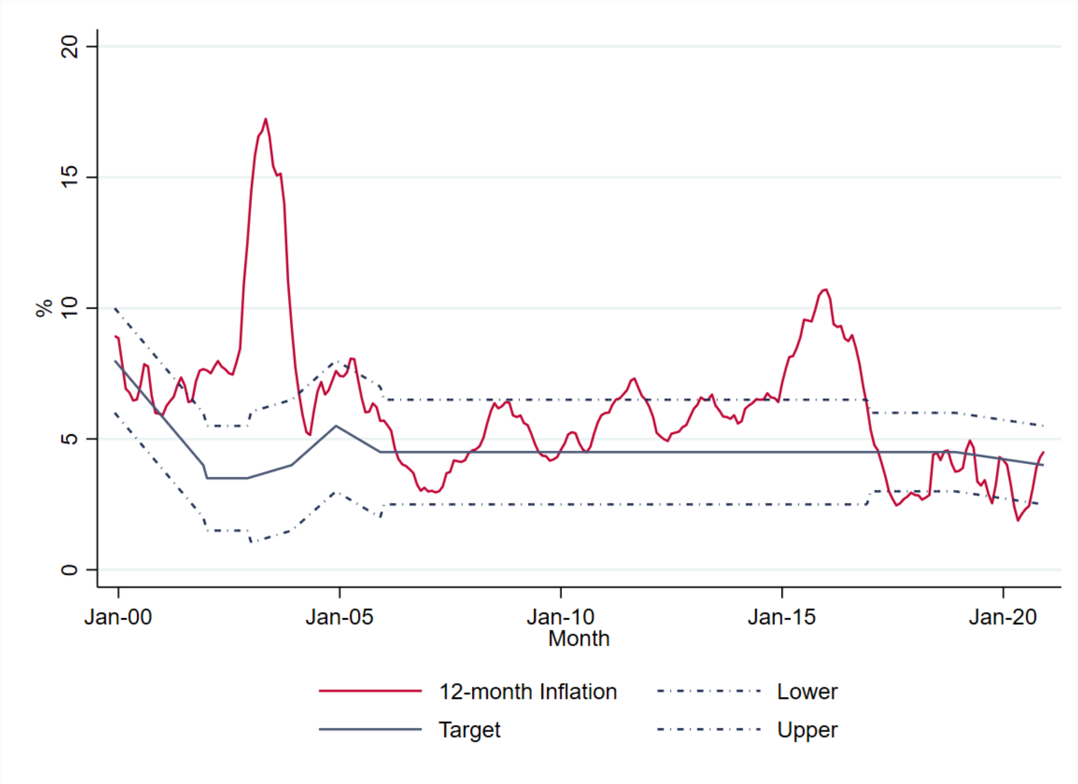
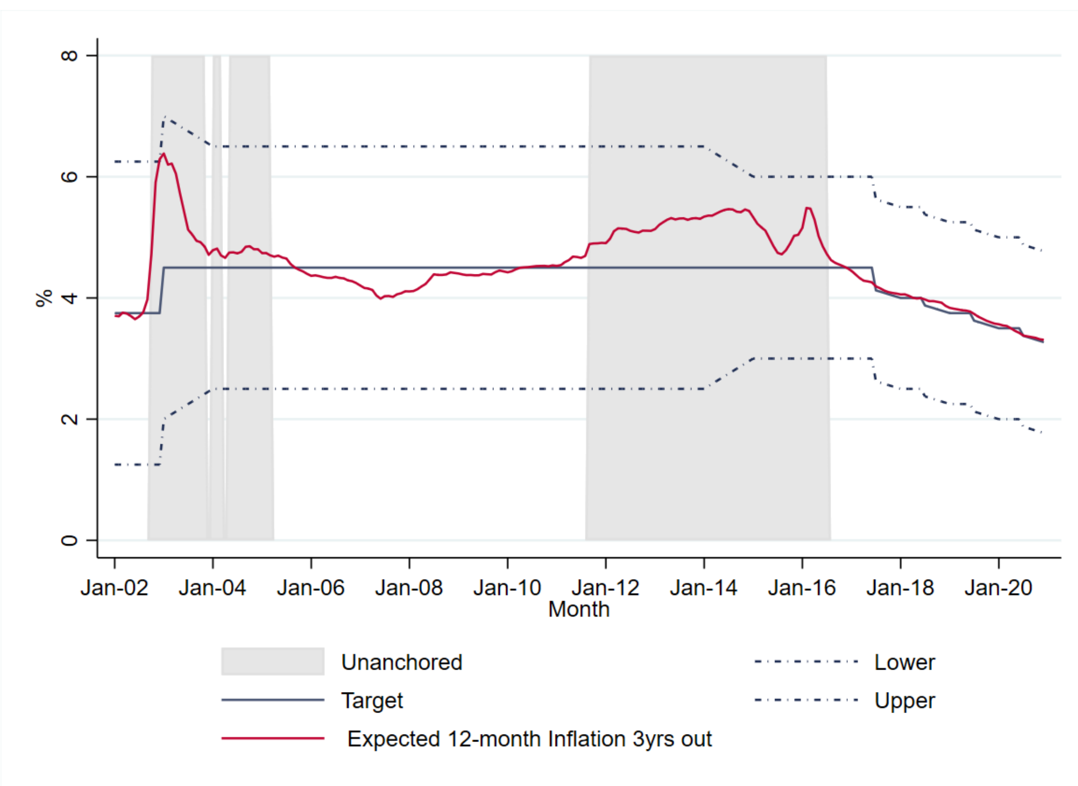


Figure 2: **Expected 12-month inflation 3yrs out, target and tolerance bands**



followed by a fast disinflation during 2003. Between 2005 and early 2010, inflation fluctuated around target, and expectations were anchored.[9] From then on, inflation drifted toward the upper part of the band until 2015, when it surpassed by far the top of the tolerance band. Inflation expectations became unmoored in the second half of 2011, after an important monetary policy mistake, and remained so essentially until mid 2016. After that, expectations were reanchored and a fast disinflation ensued.

Those two unanchoring and reanchoring episodes were very different in nature. The first one was provoked by fear of a debt default, which was backed by the 2002 program of the leading presidential candidate, "Lula." As elections approached, Brazil witnessed strong capital outflows that caused a sharp exchange rate depreciation, with important inflationary consequences. As the new government assured the market debt contracts would be fulfilled, exchange rate and inflation reversed course. The second unanchoring episode was caused by a sharp and unexpected reversal in monetary policy, which immediately impacted inflation expectations.

Reanchoring happened after President Dilma Roussef was impeached and a new economic team and a renovated BCB board were appointed in mid 2016. There was a sharp turn in the direction of economic policies, with announcement of an ambitious reform agenda. Through tight monetary policy, the new monetary policy committee successfully signaled their commitment to bring inflation down to target. Altogether, annual inflation fell from more than 10% in 2015 to around 6.3% in 2016, and to slightly below the band floor of 3% in 2017.[10]

3 Empirical strategy and data

3.1 Empirical strategy

Before detailing the various sources of data we use in our analysis, we present our empirical strategy. Our baseline results exploit exchange rate passthrough over the life of individual price spells, as in previous work by Gopinath, Itskhoki, and Rigobon (2010) and Gopinath and Itskhoki (2010). We exploit time variation in the degree of anchoring of inflation expectations in Brazil, to assess how passthrough varies across anchored and unanchored regimes.

More specifically, using their notation, our baseline panel regression is (all variables in logs):

$$\Delta_{\tau_i} p_{it} \equiv p_{it} - p_{it-\tau_{it}} = \alpha_i + \gamma_t + \beta_1 \Delta_{\tau_i} e_t + \beta_2 \Delta_{\tau_i} e_t \times \mathbb{1}_t{}^{Unanch} + \lambda_x x_{it} + \lambda_\tau x_{\tau_i t} + \epsilon_{it}, \tag{1}$$

where $\Delta_{\tau_i} p_{it} \equiv p_{it} - p_{it-\tau_{it}}$ is the price change over the spell of item i – of length τ_{it} – that ends in period t, α_i and γ_t are item- and time-fixed effects, respectively, e_t is the nominal exchange rate, $\Delta_{\tau_i} e_t \equiv e_t - e_{t-\tau_{it}}$ is the change in the exchange rate over the life of that price spell, $\mathbb{1}_t{}^{Unanch}$ is a dummy variable that indicates the unanchored inflation expectations regime, x_{it} and $x_{\tau_i t}$ are control variables,[11] and ϵ_{it} is an error term.

Inspired by Gopinath, Itskhoki, and Rigobon (2010) and Gopinath and Itskhoki (2010), we run an alternative specification that includes the change in the exchange rate in the previous price spell and its interaction with the unanchoring dummy:

$$\Delta_{\tau_i} p_{it} = \alpha_i + \gamma_t + \beta_1 \Delta_{\tau_i} e_t + \beta_2 \Delta_{\tau_i} e_{t-\tau_{it}} + (\beta_3 \Delta_{\tau_i} e_t + \beta_4 \Delta_{\tau_i} e_{t-\tau_{it}}) \times \mathbb{1}_t{}^{Unanch} + \lambda_x x_{it} + \lambda_\tau x_{\tau_i t} + \epsilon_{it}, \tag{2}$$

[9] Our methodology produces two months of anchored expectations around the end of 2003 and beginning of 2004. That period witnessed a sharp disinflation, followed by a temporary increase in inflation. As a result, inflation expectations three years out also fluctuated temporarily, before resuming their movement back towards target. In terms of the history of unanchoring and reanchoring of inflation expectations in Brazil, those two months can be seen as a nuisance.

[10] That outcome was influenced by extremely favorable crop conditions, which lead the IPCA "Food at home" component to fall by 5% in 2017.

[11] Since we include time-fixed effects, control variables do not comprise aggregate data in the time series dimension. We include both sectoral data, and variables that involve either aggregate or sectoral data over the duration of individual price spells – e.g. change over each price spell in a comprehensive measure of sectoral costs or aggregate unit labor costs.

where $\Delta_{\tau_i} e_{t-\tau_{it}} \equiv e_{t-\tau_{it}} - e_{t-\tau_{it}-\tau_{it-\tau_{it}}}$ denotes the change in the exchange rate over the life of item i's previous price spell. Including lagged exchange rate variation can account for slow passthrough due to real rigidities in the sense of Ball and Romer (1990).

Finally, we estimate specifications analogous to (1) and (2) replacing the binary regime indicator with a continuous measure of the degree of expectations unanchoring, defined in Section 3.5.

3.1.1 Firms' forecasting accuracy

We also investigate whether environments with unanchored inflation expectations affect firms' ability to anticipate their own future pricing decisions. To that end, we exploit microdata from a survey that inquires firms about their pricing intentions. For a subset of firms in that survey, we can identify their prices in the PPI microdata. We use these combined data to construct measures of firms' accuracy when anticipating their own future price changes, and study whether accuracy varies with the state of inflation expectations.

To explain how we analyze this question, we introduce some notation. Let $Forecast^i_{t,t+1}$ denote the answer given in period t by the firm that produces item i to the question of whether it expects to increase, decrease or keep its prices constant in period $t+1$:

$$Forecast^i_{t,t+1} = \begin{cases} 1 & if \;\; E^i_t[p_{it+1}] > p_{it}; \\ 0 & if \;\; E^i_t[p_{it+1}] = p_{it}; \\ -1 & if \;\; E^i_t[p_{it+1}] < p_{it}, \end{cases} \tag{3}$$

where $E^i_t[p_{it+1}]$ stands for the firms' expectation of its price next period. We define also an outcome variable that indicates the direction of realized price changes:

$$Outcome^i_{t+1} = \begin{cases} 1 & if \;\; p_{it+1} > p_{it}; \\ 0 & if \;\; p_{it+1} = p_{it}; \\ -1 & if \;\; p_{it+1} < p_{it}. \end{cases} \tag{4}$$

We then look at whether firms' expectations match outcomes. To that end, we define the following variable:

$$Mistake^i_{t+1} = \begin{cases} 1 & if \; Outcome^i_{t+1} \neq Forecast^i_{t,t+1}; \\ 0 & otherwise, \end{cases} \tag{5}$$

and estimate the following panel logit regression:

$$Mistake^i_t = F(\alpha_i + \gamma_t + \beta_1 \mathbb{1}_t{}^{Unanch} + \beta_2 \tau_{it} + \beta_3 x_{it}) + u_{it}, \tag{6}$$

where $F(\cdot)$ is the logistic function, α_i and γ_t are firm- and time-fixed effects, respectively, τ_{it} is the duration of the price spell ending in period t, x_{it} are control variables, and u_{it} is an error term.

3.2 PPI microdata

The PPI-FGV dataset contains detailed price information from the survey used to construct IBRE-FGV's Producer Price Index. Individual prices are collected through monthly telephone surveys, which target formal firms in the manufacturing sectors that have at least thirty employees.[12] Firms are asked to report the prices of individual

[12] Number of employees is based on the Annual Survey of Industry from the Brazilian Institute of Geography and Statistics (PIA-IBGE).

goods sold to other firms, alongside a description of the physical characteristics of the goods and information about the transactions.

We refer to the most disaggregated level of our data as an item. An item is associated with a set of characteristics, including the company name, location, product classification, model, size, brand, and packaging. Items are classified into one of 343 products specified in the National Classification of Economic Activities (CNAE).[13] Weights are given at the product level to compute the aggregate producer price index.[14] A few examples of items and products are provided in Table 1.

Table 1: **Examples of items and products in the PPI-FGV dataset**

Item	Printed tricoline fabric (1.5 M)
Producer	NOVA AMÉRICA S.A.
Id. code	175068
CNAE (Product)	202213201
Group Name	Textiles Products
Group Code	2022130
Item	GALVANIZED WIRE BWG 18 (T)
Producer	GPM-GERDAU PRODUTOS METALURGICOS
Id. code	319247
CNAE (Product)	202224301
Group Name	Manufacture of fabricated metal products.
Group Code	2022240
Item	AIR CHAMBER FOR TIRE 13C360 PIRELLI (UNIT)
Producer	Pirelli Pneus Ltda.
Id. code	842344
CNAE (Product)	202222104
Group Name	Manufacture of rubber and plastics products.
Group Code	2022220
Item	UREA FOR FERTILIZER NPK-45.00.00(T)
Producer	Yara Brasil Fertilizantes S.A.
Id. code	694203
CNAE (Product)	202220108
Group Name	Manufacture of chemicals and chemical products.
Group Code	2022200

Our sample covers the period from January 2008 to December 2020. It results from the merging of the (active) dataset currently used to calculate the PPI-FGV with an inactive dataset. The latter comprises those items discontinued from the current dataset, which belonged to the PPI-FGV at some point since January 2008. An item may be deemed inactive if its price has been missing for a long period. A particular feature of this data set is that there is never a substitution of an item by another similar one belonging to the same product category. If a price is not reported in a round of the survey, the quote line will feature a missing value.

3.2.1 Data treatment

We work at the monthly frequency. Hence, for items that are surveyed more than once per month, we choose to keep the last price quote of the items in each month. We assign missing values to outliers. We define as outliers all prices that are higher than 10 times or lower than 0.1 times the preceding price in the item's quote line. This aims at eliminating common typing errors. We further refine our sample by eliminating items with too many or too many consecutive missing prices. We drop items with more than 30% of missing prices,

[13]The list of products is chosen by FGV based on their relevance in the Annual Survey of Industry (PIA-IBGE).
[14]Weights are also based on PIA-IBGE.

as well as items with more than 12 consecutive missing observations. Moreover, for each item and in each month, we assign missing values to price quotes that are above the 99.5^{th} and below the 0.5^{th} percentiles. The final sample has 14.164 items and 883.782 price quotes.

3.3 Survey of Industrial Conditions

We use a set of sectoral data that capture relevant information for firms' pricing decisions. Data are from the "Survey of Industrial Conditions," published by IBRE-FGV, to which we have access at a monthly frequency. The survey allows a clear mapping between (a subset of) the products in our PPI price data set and a set of sectoral data. The Survey questionnaire includes questions regarding the main product lines of the firm, which provide information about domestic and external demand, inventory, the business situation, and production.

We also use unpublished data from the Manufacturing Industry Survey provided by IBRE-FGV grouped in 63 sectors, instead of the 19 sectors in the published survey. From this survey, we use indices related to "Total Demand" and "Inventory Level."[15] The "Total Demand" index provides information about sectoral demand that should be relevant for firms' desired prices. Sectoral inventories can also impact firms' pricing decisions.

On a quarterly basis, the survey features additional questions, such as those related to factors limiting the expansion of production, assessments of the supply of raw-materials, and prices in domestic and external markets. In addition, there is one question about the "Tendency of sales prices in the following three months." For all these questions, answers are categorical variables with 3 distinct values, which indicate a positive, neutral or negative outcome.

For a subset of firms, IBRE-FGV provided us with the microdata related to the question about such pricing intentions. The possible answers indicate whether the firm's price is expected to increase, remain constant or decrease. In order to compare the firm's expected price change with actual behavior, we merge this survey with the PPI microdata.

3.4 Additional aggregate and sectoral data

We also include variables to control for other determinants of firms' pricing decisions. We consider cost components common to all firms as well as a sectoral cost measure. Labor and energy costs should affect all firms. For the cost of labor, we use the measure of unit labor costs (ULC) published by the BCB. It is the ratio between industrial wages (deflated by the real exchange rate) and labor productivity.

For energy costs, we use annual average of the industrial electricity tariffs, provided by Ilumina.[16] They updated the methodology of The Brazilian Electricity Regulatory Agency (ANEEL), after ANEEL stopped releasing this information. In order to be able to use monthly data, we interpolate the annual average using monthly energy inflation from IPCA.

To control for sectoral costs, we include in our regressions a variable called "sectoral costs," produced by IBRE-FGV. Following a methodology employed by Banco Central do Brasil, IBRE-FGV constructed proxies for input costs of 30 sectors.[17] The 2015 Industrial Input-Output Matrix allows identification of 127 inputs for each sector. Then, for each input, IBRE-FGV matched the most related price index. They used disaggregated inflation series from Producer Price Index and IPCA, in the case of services inputs. To construct a final monthly cost measure for each sector, they applied constant weights from the 2015 Industrial Input-Output Matrix. For each sector, the

[15] In order to construct the inventory index, we consider a "net index": "excessive level" minus "insufficient level".
[16] http://www.ilumina.org.br/a-tarifa-brasileira-em-dados-historicos/.
[17] Sectors' codes and descriptions are given in Appendix Table 11.

weight corresponds to the share of a specific item in the sector's total intermediate consumption.[18] For instance, for sector 1091 (Slaughter and meat products), the share of organic and chemical fertilizers is 26% in the total intermediate consumption. Moreover, the price index that was used for this input is the PPI product: 202220109 - Organic and chemical fertilizers.[19]

3.5 Expectations data – Focus Survey

Expectations data are from the survey of professional forecasters conducted by the BCB, the *Focus Survey*. It contains forecasts of the main inflation indices, GDP growth, the exchange rate, the policy rate (Selic), as well as fiscal indicators and external sector variables. Forecasts are provided by about 140 institutions, comprising mostly banks and asset managers.[20] To participate in the survey, all candidate institutions must have a research-dedicated unit and a chief economist whose profile must be approved by BCB.

Accredited institutions can update their forecasts at any time through the *Market Expectation System*, and the central bank compiles them every working day. Forecast updates are not mandatory, but BCB devised incentives for participating institutions to update their forecasts frequently. First, it sets a contest date every month, in which forecasts of the specific economic variable are collected and compared to the actual data upon its release. It then publishes a ranking with the names of the five most accurate forecasters (institutions) according to the absolute forecast error.[21] Second, every Monday BCB publishes the *Focus Market Readout* containing a summary of the forecasts, restricting the sample to those forecasts that were updated within the last thirty days. Finally, an institution that does not update its forecasts within six months is excluded from the survey and needs to file a formal renewal request to resume its participation.

We focus on forecasts of IPCA inflation and the Selic policy rate. For the IPCA, participants can report monthly inflation forecasts for each of the next 24 months[22] and annual inflation rates for the current and each of the following 4 years. These annual inflation rates correspond to the calendar years, so we resort to linear interpolation to calculate a time series of inflation forecasts for horizons longer than the monthly forecasting horizon. For the Selic rate, participants report their forecasts of the policy rate that will be decided in each of the following pre-scheduled monetary policy meetings (COPOM) in the next 24 months, as well as the end-of-period and annual average policy rate for the current and each of the following 4 years.

3.5.1 Measuring the degree of unanchoring

We construct a measure of the degree of unanchoring, inspired by Cecchetti and Krause's (2002) measure of credibility for an inflation targeting central bank:

$$Unanch_t = \begin{cases} 1 & if\ \mathbb{E}_t\left[\pi_{t+s}\right] > \pi_{t+s}^{max}; \\ \frac{\mathbb{E}_t\left[\pi_{t+s}\right]-\pi_{t+s}^{T}}{\pi_{t+s}^{max}-\pi_{t+s}^{T}} & if\ \pi_{t+s}^{T} \leq \mathbb{E}_t\left[\pi_{t+s}\right] \leq \pi_{t+s}^{max}; \\ 0 & if\ \mathbb{E}_t\left[\pi_{t+s}\right] < \pi_{t+s}^{T}, \end{cases} \tag{7}$$

where $\mathbb{E}_t\left[\pi_{t+s}\right]$ is the inflation expectation at time t for horizon s, π_{t+s}^{T} is the inflation target for period $t+s$, and π_{t+s}^{max} is an arbitrary limit associated with complete unanchoring. For Brazil, we define π_{t+s}^{max} to be the top of the

[18] See BCB's March 2021 Quarterly Inflation Report and https://blogdoibre.fgv.br/posts/elevacao-do-custo-dos-insumos-dos-bens-industriais.
[19] A full list of the codes used for matching is provided in Appendix Table 13.
[20] The group of forecasters also includes other institutions such as nonfinancial companies, brokers, and consulting firms.
[21] This contest is highly valuable, as top-five institutions often advertise their accomplishments. See Gaglianone et al. (2020) for a detailed description of the contest.
[22] Initially, the forecasting horizon for monthly inflation was up to 12 months. It was later extended to 18 months, and to 24 months more recently.

inflation target's tolerance band. In our baseline results, we use average inflation forecasts. In the Appendix, we present results with median forecasts.

To make our unanchoring measure operational we need to define an appropriate horizon s. Expectations for short horizons can reflect temporary supply shocks to which the monetary authority may be unwilling to respond, without compromising convergence to the target at a longer horizon. Expectations for horizons that are too long may end up being excessively inertial. We thus construct a measure of "forward expectations" for the horizon between 24 and 36 months out. Given transmission lags are usually thought of as being shorter than two years,[23] this forward window should be far enough into the future for the effects of ongoing shocks to have faded – if the central bank so whishes.

Since for longer horizons the Focus Survey only has data for calendar years, we combine inflation expectations data for two adjacent years into an appropriate weighted average. As the year progress, the weight in the year further away increases. More specifically, for each month m of year y, we construct our forward inflation measure between months 24 and 36 according to:

$$\mathbb{E}_{y,m}\pi^{24,36} = \frac{12-(m-1)}{12}\mathbb{E}_{y,m}\pi^{y+2} + \frac{m-1}{12}\mathbb{E}_{y,m}\pi^{y+3}, \tag{8}$$

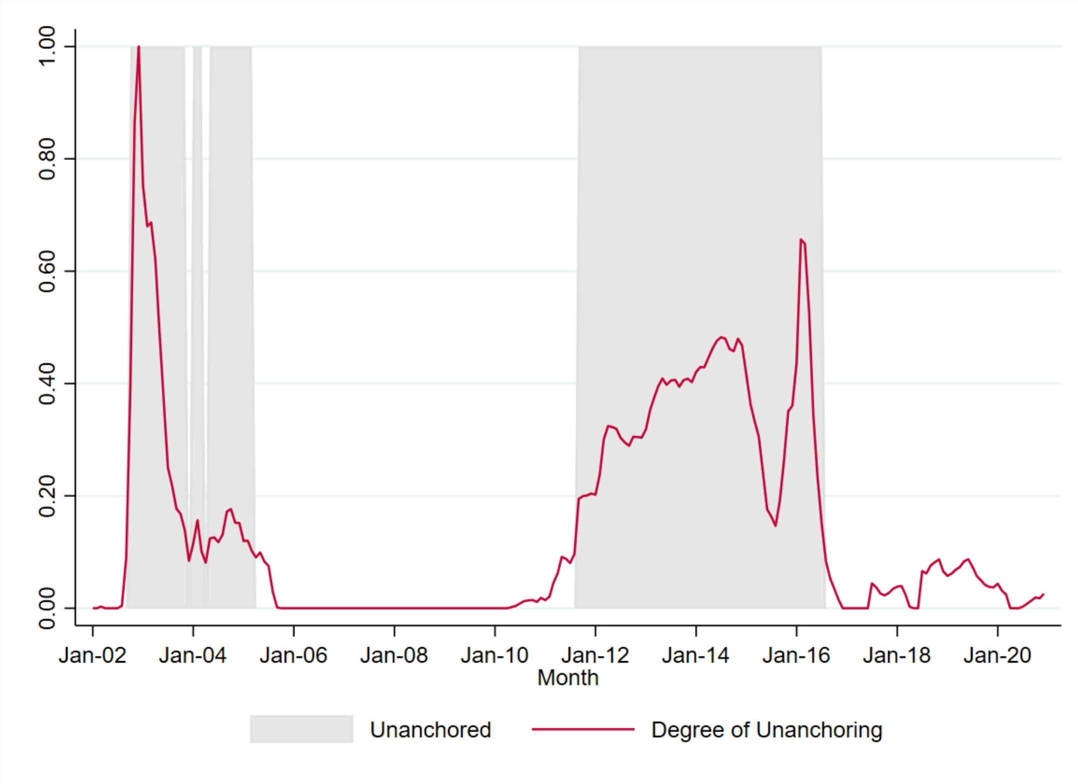
where $\mathbb{E}_{y,m}\pi^{y+2}$ and $\mathbb{E}_{y,m}\pi^{y+3}$ are inflation expectations for the calendar years two years and three years ahead, respectively. We construct a corresponding forward measure for the inflation target using an analogous formula.

Finally, we define anchored and unanchored regimes based on (7). Expectations are assumed to be anchored if $Unanch_t < 0.1$. The threshold value was selected to accommodate small fluctuations is the measure of unanchoring that arise due to announcements of lower inflation targets towards the end of the sample period.

Figure 2 in Section 2 shows results for $\mathbb{E}_t\pi_t^{24-36}$, the associated inflation target and bands, and anchored and unanchored periods. The underlying continuous measure of the degree of unanchoring together with the resulting regimes are shown in Figure 3 for the subsample for which the PPI microdata are available (2008-2020). In the Appendix we present results when the measure of unanchoring and associated regimes are based on median inflation forecasts.

[23] Currently, BCB formally conducts monetary policy focusing on 12-month inflation ending eighteen months ahead – i.e. cumulative inflation between months 6 and 18.

Figure 3: **Degree of unanchoring and anchored/unanchored regimes**



4 Empirical results

4.1 Descriptive price-setting statistics

Price-setting statistics in the spirit of Bils and Klenow (2004), Klenow and Kryvtsov (2008), and Nakamura and Steinsson (2008), for anchored and unanchored regimes. There are no meaningful differences across regimes. The model we develop in Section 5 to provide a structural interpretation to our findings assumes Calvo pricing and is consistent with these results.

	Whole Sample		**Anchored**		**Unanchored**	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**
Freq. of price changes	0.395	0.317	0.400	0.320	0.384	0.312
Size of price changes	0.057	0.041	0.059	0.043	0.050	0.038

4.2 Passtrough regressions

In this section we provide results for our baseline passthrough regressions and a few variants. All regressions are unweighted. Additional specifications and robustness analysis are reported in the Appendix, but results are essentially unchanged.

Table 2 report our baseline passthrough regression. In the first column, we report that when we do not allow for different passthrough results, a 10% exchange rate devaluation in the last price spell is associated with a 0.4% additional increase in the product price at the firm's adjustment date. When we allow for unanchored and anchored regimes, the passthrough coefficient is estimated to be 0.0225, increasing almost threefold - to 0.0685 - in the unanchored regime. The third column adds several controls to this estimation, resulting in an proportionally higher increase in passthrough coefficient in the unanchored regime - from less than 0.01 to 0.0524.

Table 3 report results of analogous regressions to those of Table 2, using our continuous degree of unanchoring variable instead of a regime dummy. Results are qualitatively unaltered. Estimation results indicate that the passthrough coefficient increase from 0.0179 to 0.1589 when you go from an entirely anchored regime (degree of unanchoring 0) to a fully unanchored regime (degree of uanchoring 1) . Results are not much affected by the addition of control variables. The estimation results using the degree of unanchoring continuous variable draw attention to the large quantitative impact of the monetary authority credibility on the exchange passthrough.

Table 2: **Baseline passthrough regressions with unanchoring dummy**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0225***	0.00956*
	(0.00393)	(0.00545)	(0.00567)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0460***	0.0428***
		(0.00805)	(0.00897)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.122***
			(0.00521)
τ_{it}			0.000421***
			(0.0000976)
$\Delta_{\tau_i} ULC_t$			0.0263***
			(0.00613)
$\Delta_{\tau_i} energy_t$			-0.0254***
			(0.00644)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0369***
			(0.0104)
$Sectoral\ inventory_t$			-0.000177***
			(0.0000184)
$Sectoral\ demand_t$			0.000324***
			(0.0000287)
$constant$	0.0435***	0.0428***	0.00208
	(0.00245)	(0.00245)	(0.00380)
N	192502	192502	178442
$adj.R^2$	0.0500	0.0502	0.0655
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 3: **Passthrough regressions with degree of unanchoring**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0179***	0.00747
	(0.00393)	(0.00529)	(0.00551)
$\Delta_{\tau_i} e_t \times Unanch_t$		0.151***	0.124***
		(0.0210)	(0.0227)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.122***
			(0.00521)
τ_{it}			0.000415***
			(0.0000978)
$\Delta_{\tau_i} ULC_t$			0.0273***
			(0.00613)
$\Delta_{\tau_i} energy_t$			-0.0239***
			(0.00620)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0351***
			(0.0103)
$Sectoral\ inventory_t$			-0.000177***
			(0.0000183)
$Sectoral\ demand_t$			0.000324***
			(0.0000287)
$constant$	0.0435***	0.0426***	0.00201
	(0.00245)	(0.00245)	(0.00380)
N	192502	192502	178442
$adj.R^2$	0.0500	0.0504	0.0655
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

4.2.1 Specification with exchange rate change over previous price spell

Inspired by Gopinath, Itskhoki, and Rigobon (2010) and Gopinath and Itskhoki (2010), we run an alternative specification that includes the change in the exchange rate in the previous price spell and its interaction with the unanchoring dummy. Including the change in the exchange rate during the previous price spell can account for incomplete passthrough due to real rigidities in the sense of Ball and Romer (1990).

Column 1 of Table 4 reports the results of passthrough estimation in the last and in the previous spell, indicating that the passthrough in the last spell is more than four times larger than the one in previous spell (0.0416 vs 0.00989). When we allow for different regimes, the passthrough of the previous spells become pratically null for the anchored regime, increasing to about 2.8% in the anchored regime. As for the passthrough of the last spell, the passthrough increases from approximately 2% to 5%.

Results using the continuous degree of unanchoring variable are reported in Table 5, but are qualitatively similar to those of Table 4.

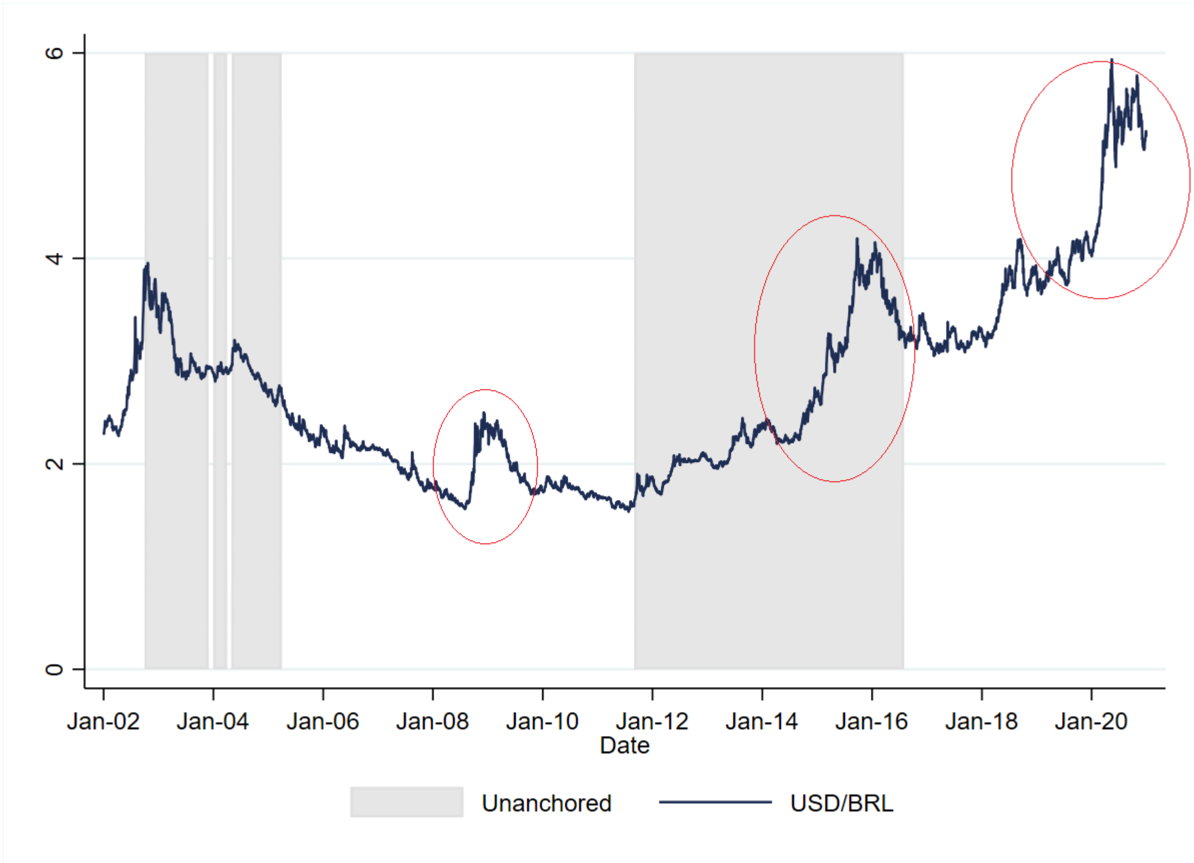
Table 4: **Passthrough regression with exchange rate change over previous price spell – unanchoring dummy**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0416***	0.0197***	0.0128**
	(0.00425)	(0.00594)	(0.00627)
$\Delta_{\tau_i} e_{t-\tau_{it}}$	0.00989**	-0.000976	0.00490
	(0.00335)	(0.00435)	(0.00440)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0505***	0.0486***
		(0.00854)	(0.00926)
$\Delta_{\tau_i} e_{t-\tau_{it}} \times \mathbb{1}_t^{Unanch}$		0.0277***	0.0324***
		(0.00648)	(0.00648)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.123***
			(0.00522)
τ_{it}			0.000460***
			(0.0000981)
$\Delta_{\tau_i} ULC_t$			0.0250***
			(0.00615)
$\Delta_{\tau_i} energy_t$			-0.0278***
			(0.00643)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0334**
			(0.0104)
$Sectoral\ inventory_t$			-0.000177***
			(0.0000184)
$Sectoral\ demand_t$			0.000327***
			(0.0000288)
$constant$	0.0384***	0.0381***	0.00189
	(0.00246)	(0.00245)	(0.00381)
N	178442	178442	178442
$adj.R^2$	0.0473	0.0477	0.0658
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 5: **Passthrough regression with exchange rate change over previous price spell – degree of unanchoring**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0416***	0.0165**	0.0105*
	(0.00425)	(0.00573)	(0.00606)
$\Delta_{\tau_i} e_{t-\tau_{it}}$	0.00989**	-0.00748	-0.00135
	(0.00335)	(0.00433)	(0.00438)
$\Delta_{\tau_i} e_t \times Unanch_t$		0.142***	0.126***
		(0.0219)	(0.0229)
$\Delta_{\tau_i} e_{t-\tau_{it}} \times Unanch_t$		0.115***	0.125***
		(0.0164)	(0.0164)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.123***
			(0.00521)
τ_{it}			0.000487***
			(0.0000984)
$\Delta_{\tau_i} ULC_t$			0.0242***
			(0.00615)
$\Delta_{\tau_i} energy_t$			-0.0240***
			(0.00619)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0304**
			(0.0104)
$Sectoral\ inventory_t$			-0.000179***
			(0.0000184)
$Sectoral\ demand_t$			0.000326***
			(0.0000288)
$constant$	0.0384***	0.0383***	0.00222
	(0.00246)	(0.00245)	(0.00382)
N	178442	178442	178442
$adj.R^2$	0.0473	0.0480	0.0661
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Figure 4: **USDBRL and anchored/unanchored regimes**



4.2.2 Unanchoring or non-linearity in passthrough?

It is possible that higher passthrough when expectations are unanchored only reflects larger exchange rate movements during those periods, coupled with a non-linearity in passthrough. Fortunately, Brazil has experienced sizable exchange rate depreciations both in anchored (e.g. in 2008) and unanchored (e.g. in 2015) regimes – see Figure 4. So we can try to tell these two possibilities apart. Results show our findings reflect the state of expectations rather than non-linearity in passthrough.

Table 6: **Passthrough regressions with nonlinearity**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0225***	0.0315***	0.0193***	0.00937*
	(0.00393)	(0.00545)	(0.00495)	(0.00582)	(0.00603)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0460***		0.0425***	0.0427***
		(0.00805)		(0.00834)	(0.00900)
$(\Delta_{\tau_i} e_t)^2$			0.0455***	0.0220	0.00161
			(0.0163)	(0.0170)	(0.0192)
$\Delta_{\tau_i} p_{it-\tau_{it}}$					-0.122***
					(0.00521)
τ_{it}					0.000417***
					(0.000106)
$\Delta_{\tau_i} ULC_t$					0.0263***
					(0.00613)
$\Delta_{\tau_i} energy_t$					-0.0255***
					(0.00650)
$\Delta_{\tau_i} Sectoral\ cost_t$					0.0370***
					(0.0104)
$Sectoral\ \ inventory_t$					-0.000177***
					(0.0000183)
$Sectoral\ \ demand_t$					0.000324***
					(0.0000287)
$constant$	0.0435***	0.0428***	0.0431***	0.0426***	0.00207
	(0.00245)	(0.00245)	(0.00246)	(0.00246)	(0.00380)
N	192502	192502	192502	192502	178442
$adj.R^2$	0.0500	0.0502	0.0501	0.0502	0.0655
$Individual\ Fixed\ Effects$	Yes	Yes	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes	Yes	Yes

Table 7: **Passthrough regressions with nonlinearity – continuous unanchoring measure**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0179***	0.0315***	0.0152**	0.00752
	(0.00393)	(0.00529)	(0.00495)	(0.00575)	(0.00592)
$\Delta_{\tau_i} e_t \times Unanchor_t$		0.151***		0.145***	0.124***
		(0.0210)		(0.0216)	(0.0227)
$(\Delta_{\tau_i} e_t)^2$			0.0455***	0.0174	-0.000477
			(0.0163)	(0.0169)	(0.0192)
$\Delta_{\tau_i} p_{it-\tau_{it}}$					-0.122***
					(0.00521)
τ_{it}					0.000416***
					(0.000106)
$\Delta_{\tau_i} ULC_t$					0.0273***
					(0.00613)
$\Delta_{\tau_i} energy_t$					-0.0239***
					(0.00628)
$\Delta_{\tau_i} Sectoral\ cost_t$					0.0350***
					(0.0104)
$Sectoral\ \ inventory_t$					-0.000177***
					(0.0000183)
$Sectoral\ \ demand_t$					0.000324***
					(0.0000287)
$constant$	0.0435***	0.0426***	0.0431***	0.0425***	0.00201
	(0.00245)	(0.00245)	(0.00246)	(0.00246)	(0.00380)
N	192502	192502	192502	192502	178442
$adj.R^2$	0.0500	0.0504	0.0501	0.0504	0.0655
$Individual\ Fixed\ Effects$	Yes	Yes	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes	Yes	Yes

4.3 Accuracy of firms' own price forecasts

Regressions using the measures of firms' forecasting accuracy presented in Section 3.1.1. Evidence indicates firms make fewer mistakes when expectations are unanchored (Table 8, top panel). In particular, the higher the degree of unanchoring, the more they tend to underestimate how often they end up increasing their prices (Table 8, bottom panel).

Table 8: **Accuracy regressions**

Dependent Variable: $Match_t^i$	**(1)**	**(2)**
$\mathbb{1}_t^{Unanch}$	-0.741*	
	(-1.77)	
$Unanch_t$		-5.180
		(-1.03)
τ_{it}	0.0451***	0.0451***
	(6.12)	(6.12)
$Size.Med$	-14.50	-14.50
	(-0.02)	(-0.02)
$Size.Small$	-28.47	-28.47
	(-0.02)	(-0.02)
N	2961	2961
$pseudo.R^2$	0.03034	0.03034
$Individual\ Fixed\ Effects$	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes

Dependent Variable: $Surprise_t^i$	**(1)**	**(2)**
$\mathbb{1}_t^{Unanch}$	0.162	
	(1.01)	
$Unanch_t$		4.396**
		(2.27)
τ_{it}	-0.0045*	-0.0045*
	(-1.91)	(-1.91)
$Size.Med$	0.327	0.327
	(0.83)	(0.83)
$Size.Small$	0.295	0.295
	(0.41)	(0.41)
$constant$	-0.236	-0.236
	(-1.56)	(-1.56)
N	2976	2976
$adj.R^2$	0.0374	0.0374
$Individual\ Fixed\ Effects$	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes

5 The model

We study the price setting implications of unanchored inflation expectations in a simple New Keynesian model, building on Woodford (2003). Households derive utility from a composite consumption good, and incur disutility from supplying labor to firms. Firms produce and sell differentiated goods in a monopolistically competitive environment, subject to Calvo (1983)-type nominal rigidities. The central bank sets the short-term interest rate in response to inflation and output in deviation from their targets. We depart from most common assumptions in two ways. First, following Bonomo et al. (2016), firms use both labor and a foreign intermediate good as inputs. The real exchange rate acts as a cost-push shock in the model, creating a channel for exchange rate passthrough. Second, we model different regimes of inflation expectations that depend on the credibility of the central bank. Households and firms have imperfect information about the central bank's monetary policy rule and, in particular, its inflation target. A regime of "unanchored" expectations corresponds to a loss of central bank credibility, resulting in medium-term expectations that are inconsistent with the inflation target. Below we discuss the main equations of the model, with emphasis on the anchoring of inflation expectations. Standard equations are presented already in log-linear form. The full model is described in the Appendix.

5.1 Production function

Firm i's output, denoted by $Y_{i,t}$, is produced according to the Cobb-Douglas production function

$$Y_{it} \quad = \quad A_{it} A_t L_{it}^{\alpha} M_{it}^{(1-\alpha)},$$

with labor, L_{it}, and a foreign input, M_{it}, used in the production process. The parameter $0 < \alpha < 1$ defines the elasticity of the production function of each of these production inputs. The production function is affected by exogenous firm-specific ($A_{i,t}$) and aggregate (A_t) productivity processes.

Firm cost minimization leads to the real marginal cost

$$mc_{it} \quad \propto \quad A_t^{-1} A_{it}^{-1} w_t^{\alpha} q_t^{1-\alpha},$$

where w_t is the economy-wide real wage and q_t is the real exchange rate. These, together with fluctuations in productivity, are the "fundamental" drivers of inflation in the model. As discussed below, fluctuations in the real exchange rate act as "cost-push" shocks affecting firms price decisions.

5.2 Private sector

The model is log-linearized around its non-stochastic steady state. The economy's demand for aggregate output $\hat{y}_t$ is described by the familiar forward-looking IS equation

$$\hat{y}_t \quad = \quad \mathbb{E}_t \hat{y}_{t+1} - (R_t - \mathbb{E}_t \pi_{t+1}),$$

where R_t is the short-term interest rate, π_t is the domestic inflation rate, and $\mathbb{E}_t$ denotes the expectations operator, discussed below.

Firms reset prices at random intervals with probability $1-\theta$. When resetting its price, firm i's optimal decision is given by

$$\tilde{p}_{it}^{opt} = \mathbb{E}_t \sum_{T=t}^{\infty} (\theta\beta)^{T-t} \left[(1-\theta\beta)\hat{mc}_T^i + \theta\beta\pi_{T+1} \right],$$

where $\tilde{p}_{i,t}^{opt}$ denotes the optimal price relative to the economy-wide price level and where β is the household discount rate. Firm i's real marginal cost is

$$\hat{mc}_{it} = \alpha\hat{w}_t + (1-\alpha)\hat{q}_t - (\hat{a}_t + \hat{a}_{i,t})$$

Marginal cost is impacted by exogenous shifts in aggregate ($\hat{a}_t$) and firm-specific ($\hat{a}_{i,t}$) productivity – both modeled as AR(1) processes. The real exchange rate is defined by

$$\hat{q}_t = \hat{E}_t + \hat{P}_t^f - \hat{P}_t,$$

where $\hat{E}_t$ denotes the nominal exchange rate, $\hat{P}_t$ is the domestic price level and $\hat{P}_t^f$ is the foreign price level. We take a partial equilibrium approach and assume the nominal exchange rate and the foreign price level evolve exogenously.[24] Given our focus on movements in the nominal exchange rate, we keep the foreign price level constant – $\tilde{P}_t = 0$. $\hat{E}_t$ evolves according to a persistent AR(1) process.

Aggregating across firms, the equilibrium evolution of domestic inflation is determined according to the forward-looking Phillips curve

$$\pi_t = \beta\mathbb{E}_t\pi_{t+1} + \kappa\alpha\left(\hat{y}_t - \alpha^{-1}\hat{a}_t\right) + \kappa(1-\alpha)\hat{q}_t,$$

where $\kappa \equiv \frac{(1-\theta)(1-\theta\beta)}{\theta}\zeta$ denotes its slope, which is decreasing in the degree of nominal rigidities θ, and ζ measures real rigidities in the sense of Ball and Romer (1990). Fluctuations in the real exchange rate act as cost-push shocks in the model, while productivity determines the evolution of the natural level of output (the equilibrium output in absence of nominal rigidities or changes in the real exchange rate). The relative importance of the two components is shaped by the share of foreign inputs in the production function and by their volatilities.

5.3 Central Bank and expectations' anchoring

The central bank sets the short-term nominal rate according to a conventional Taylor rule

$$R_t = \rho R_{t-1} + \phi_\pi(\pi_t - \pi_t^*) + \phi_y\hat{y}_t + \varepsilon_t^R,$$

where $0 \le \rho \le 1$ measures the degree of interest rate smoothing, and ϕ_π, ϕ_y denote the responses to inflation and output, respectively. In addition, the interest rate is driven by two exogenous processes. The first, ε_t^R, is an i.i.d. monetary policy shock. The second corresponds to the central bank time-varying inflation target π_t^*, evolving as

$$\pi_t^* = \rho_{\pi_*}\pi_{t-1}^* + c_e\hat{e}_{t-1} + \varepsilon_t^*.$$

The inflation target changes in response to exogenous idiosyncratic shifts in policymakers' preferences, ε_t^*, and in response to movements in the real exchange rate. The magnitude of this response, captured by the coefficient c_q, measures the 'weakness' of central bank in responding to cost-push shocks. A real exchange rate depreciation (a

[24]The implicit assumption is that the foreign price level does not respond to movement in the nominal exchange rate.

positive cost-push shock) leads to an increase in inflation and a decline in output.

Now consider the response of the economy to a real exchange depreciation under a "weak" and a "strong" central banker, respectively. A weak central bank ($c_e > 0$) would partially accommodate the shock by increasing the inflation target with the goal of muting its negative effects on economic activity. In response to such policy, medium-term inflation expectations would increase and firms would increase their prices, boosting inflation. Conversely, a strong central bank would keep the inflation target unchanged in response to the cost-push shock, with stabilizing effects on inflation expectations. In such policy regime, price-setting firms would respond less to the same cost-push shock.

In this simple model, central bank credibility is tied to market participants' *beliefs* about the type of central bank they face. While agents form expectations rationally about every other aspect of the economy, they have incomplete information about the central bank's inflation target. First, agents cannot directly infer the inflation target from the policy rule. In fact, they cannot observe separately monetary policy (ε_t^R) and inflation target (π_t^*) shocks. Second, agents expectations can become unanchored when their beliefs about the central bank 'type' – as measured by c_q – are not consistent with actual policy. The degree of unanchoring is measured by the parameter $\hat{c}_q$: agents' own beliefs about the degree of weakness of the central bank.

To fix ideas, in our baseline case we assume a strong central banker with $c_e = 0$. We then evaluate an anchored regime, where beliefs are consistent with actual policy ($\hat{c}_e = 0$), and an unanchored regime where $\hat{c}_e > 0$. In the unanchored regime, the *perceived* inflation target will respond to cost-push shocks, affecting firms' price decisions.

Agents use the Kalman filter to revise their estimate of the inflation target:

$$\pi^*_{t+1|t} \quad = \quad \rho_{\pi_*}\pi^*_{t|t-1} + \hat{c}_e\hat{e}_t + \bar{g}\left(\tilde{\pi}_t - \pi^*_{t|t-1}\right),$$

where

$$\tilde{\pi}_t \quad = \quad \pi_t^* + \phi_\pi^{-1}\varepsilon_{R,t},$$

and where $\bar{g} > 0$ denotes the Kalman gain. As shown in the Appendix, the gain depends both on the relative volatility of the two exogenous processes and the persistence of the inflation target. Changes is the estimated inflation target are driven by temporary monetary policy shocks, by exogenous shifts in the inflation target and, when expectations are unanchored, by shifts in the real exchange rate. All of these changes affect firms' optimal prices, as they are perceived to have persistent effects on inflation.

Does this model provide an accurate description of the behavior of medium-term inflation expectations? Carvalho et al (2022) introduce a model of expectations anchoring based on the idea that firms revise their estimate of the inflation target in response to short-term inflation surprises, driven in large part by cost-push shocks. The model, estimated using US inflation and survey-based *short-term* inflation expectations, predicts very accurately the behavior of *long-run* inflation expectations both for the US economy and other countries spanning the period from the 1970s to 2022. The degree of anchoring is endogenous and depends on the size and persistence of forecast errors. The model detects episodes of unanchoring of expectations in all countries considered.

While the expectations formation mechanism presented here abstracts from some of these features, its main predictions are the same. This gives us confidence that the model introduced here is suitable to evaluating the effects of expectations unanchoring on individual firms' price setting decisions. Below, we detail the sets of experiments that we run and how they are connected to the empirical analysis presented above.

5.4 The experiment

In order to interpret the empirical evidence presented in Section 4.2 through the lens of the model, we perform the same regression analysis on simulated data from our simple economy. We first calibrate the model to selected moments from the Brazilian economy. Crucially, in the simulation we discipline the behavior of inflation expectations in both anchored and unanchored regimes using survey data. In particular, we look at the volatility of relatively long-term inflation expectations from BCB's Focus Survey. We consider 12-month inflation ending three years ahead.

In a little more detail, we consider Brazilian macroeconomic indicators over the period from June 2008 to December 2020. The inflation rate is based on the consumer price index that Brazil uses to implement its inflation target regime, the IPCA, published by the Brazilian Institute of Geography and Statistics (IBGE). The interest rate corresponds to the policy rate set by BCB, the Selic. As measures of real de-trended output and nominal exchange rate, we use the Hodrick-Prescott filtered cyclical component of their monthly series.[25] Real output is obtained from the Central Bank Economic Activity Index (IBC-Br), and the nominal exchange rate is the monthly average BRL/USD foreign exchange rate.

As shown in table 9, which summarizes the calibration exercise, in the unanchored regime medium-term inflation expectations are two and a half times as volatile as in the anchored regime. Despite its extreme simplicity, the model can match reasonably well all of the moments targeted using empirically plausible parameters for the monetary policy rule and the elasticity of the production function to imported inputs.[26]

Table 9: **Model calibration**

Parameters	**Description**		**Parameters**	**Description**	
$1-\alpha$	import elasticity	0.080	σ_{π^*}	vol. π_t^* shock	0.106
β	discount rate	0.995	σ_R	vol. mp shock	0.991
$1-\theta$	freq. Δp^i	0.300	ρ_E	persistence E_t	0.890
ζ	real rigidities	0.400	ρ_z	persistence z_t	0.989
ϕ_π	TR: $\pi_t - \pi_t^*$	2.473	ρ_a	persistence a_{it}	0.700
ϕ_y	TR: y_t	0.240	σ_E	vol. E_t shock	3.475
ρ_i	TR: R_{t-1}	0.982	σ_z	vol. z_t shock	0.293
$\hat{c}_e$	unanchoring	0.013	σ_a	vol. a_{it} shock	7.500

Moments	**Model**	**Data**
$\sigma(\pi_t)$	0.300	0.300
$\sigma(R_t)$	1.109	0.260
$\sigma(E_t)$	7.802	7.800
$\sigma(\hat{y}_t)$	2.434	2.400
$\sigma(\mathbb{E}^{Anc}\pi)$:	0.099	0.100
$\sigma(\mathbb{E}^{Unanc}\pi)$:	0.250	0.250
$\rho(\pi_t, \pi_{t-1})$:	0.768	0.570
$\rho(R_t, R_{t-1})$:	0.884	0.950
$\rho(\hat{y}_t, \hat{y}_{t-1})$:	0.823	0.750
$\rho(E_t, E_{t-1})$:	0.896	0.890
$\mathbb{E}(\lvert\Delta p_t^i\rvert)$:	5.400	6.000

Note: The table shows the calibrated parameters used in our simulation, and the statistical moments for key variables implied by the calibration. The model-implied moments are compared with corresponding moments from the data.

We then simulate the model for 2000 months, switching to the unanchored regime in month 1001.[27] In every

[25] We set the smoothing parameter to 14,400.

[26] With the only exception of the policy rate, which is predicted to be substantially more volatile than in the data.

[27] In future drafts we will perform a Monte Carlo analysis with a large number of artificial datasets with the same time-series dimension as in our sample.

period the artificial economy generates 5800 firm-specific prices, where 30% of (randomly selected) firms update and the remaining fraction leaves prices unchanged, as observed in the data. As shown in Table 9, the parameters of firm-specific productivity shocks are calibrated to deliver mean absolute price changes roughly in line with the micro data.

Table 10 shows the results we obtain when running the analogous regressions we apply to actual data on the artificial data generated from the model. The results are surprisingly close to the empirical exercise.

Table 10: **Regressions with model-generated microdata**

	(1)	(2)
$\Delta_{\tau_i} e_t$	0.0215***	0.0329***
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$	0.0319***	0.0560***
$\Delta_{\tau_i} e_{it-\tau_{it}}$		0.0156***
$\Delta_{\tau_i} e_{t-\tau_{it}} \times \mathbb{1}_t^{Unanch}$		0.0344***
$\Delta_{\tau_i} p_{it-\tau_{it}}$	-0.295***	-0.296***
$Constant$	-1.618***	-1.613***
N	3,475,424	3,475,424
$Num. of\ Items$	5,800	5,800
$adj.R^2$	0.116	0.117
$Individual\ Fixed\ Effects$	No	No
$Time\ Fixed\ Effects$	Yes	Yes

6 Conclusion

We present evidence that the state of inflation expectations matters for individual pricing decisions and provide the first set of facts about price setting when expectations are unanchored. In such circumstances, wholesailers increase passthrough of exchange rate movements into prices.

Combining a data set of wholesalers expectations with the microdata underlying the PPI index, we also provide evidence that wholesalers make fewer mistakes during the unanchoring regime, when trying to anticipate how they will set their own prices in the future.

Finally, in order to provide a structural interpretation for our passthrough results, we develop and calibrate a model in which expectations can become unanchored. As in the data, our model produces higher exchange rate passthrough when expectations are unanchored. Quantitative results similar to empirical findings.

References

Abib, D., and S. Matos (2022a): "Dynamics of the Brazilian PPI and the exchange rate pass-through using highly disaggregated microdata," *Working paper.*

——— (2022b): "Price setting behavior in Brazil: Evidence from PPI microdata," *Working paper.*

Ball, L., and D. Romer (1990): "Real rigidities and the non-neutrality of money," *The Review of Economic Studies*, 57(2), 183–203.

Barros, R., M. Bonomo, C. Carvalho, and S. Matos (2009): "Price setting in a variable macroeconomic environment: Evidence from Brazilian CPI," *unpublished paper, Getulio Vargas Foundation and Federal Reserve Bank of New York.*

Bernanke, B. S. (2007): "Inflation Expectations and Inflation Forecasting," Speech given at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts.

Bils, M., and P. J. Klenow (2004): "Some evidence on the importance of sticky prices," *Journal of political economy*, 112(5), 947–985.

Bonomo, M., C. Carvalho, O. Kryvtsov, S. Ribon, and R. Rigato (2022): "Multiproduct Pricing: Theory and Evidence From Large Retailers," .

Bonomo, M., and B. Martins (2016): "The Impact of Government-Driven Loans in the Monetary Transmission Mechanism: what can we learn from firm-level data," *Banco Central do Brasil, Texto para discussão nº*, 419.

Burstein, A., and G. Gopinath (2014): "Chapter 7 - International Prices and Exchange Rates," in *Handbook of International Economics*, ed. by G. Gopinath, E. Helpman, and K. Rogoff, vol. 4 of *Handbook of International Economics*, pp. 391–451. Elsevier.

Calvo, G. A. (1983): "Staggered prices in a utility-maximizing framework," *Journal of monetary Economics*, 12(3), 383–398.

Carvalho, C., S. Eusepi, E. Moench, and B. Preston (2022): "Anchored inflation expectations," *Forthcoming in the American Economic Journal: Macroeconomics.*

Cecchetti, S. G., and S. Krause (2002): "Central bank structure, policy efficiency, and macroeconomic performance: exploring empirical relationships," *Review-Federal Reserve Bank of Saint Louis*, 84(4), 47–60.

Gaglianone, W. P., R. Giacomini, J. V. Issler, and V. Skreta (2020): "Incentive-driven inattention," *Journal of Econometrics.*

Gopinath, G., and O. Itskhoki (2010): "Frequency of price adjustment and pass-through," *The Quarterly Journal of Economics*, 125(2), 675–727.

Gopinath, G., O. Itskhoki, and R. Rigobon (2010): "Currency choice and exchange rate pass-through," *American Economic Review*, 100(1), 304–36.

Gopinath, G., and R. Rigobon (2008): "Sticky Borders," *The Quarterly Journal of Economics*, 123(2), 531–575.

Hodrick, R. J., and E. C. Prescott (1997): "Postwar US business cycles: an empirical investigation," *Journal of Money, credit, and Banking*, pp. 1–16.

Klenow, P. J., and O. Kryvtsov (2008): "State-dependent or time-dependent pricing: Does it matter for recent US inflation?," *The Quarterly Journal of Economics*, 123(3), 863–904.

Klenow, P. J., and B. A. Malin (2010): "Chapter 6 - Microeconomic Evidence on Price-Setting," vol. 3 of *Handbook of Monetary Economics*, pp. 231–284. Elsevier.

Nakamura, E., and J. Steinsson (2008): "Five facts about prices: A reevaluation of menu cost models," *The Quarterly Journal of Economics*, 123(4), 1415–1464.

Nakamura, E., and J. Steinsson (2013): "Price Rigidity: Microeconomic Evidence and Macroeconomic Implications," *Annual Review of Economics*, 5(1), 133–163.

Reis, R. (2021): "Losing the inflation anchor," CEPR Discussion Papers 16664, C.E.P.R. Discussion Papers.

Woodford, M. (2003): "Interest and prices," .

A Product codes, description and matching codes

Table 11: **Input-Output Matrix: sector codes and description**

Code	Input-Output Matrix Description
1091	Slaughter and meat products, including dairy and fish products
1092	Manufacture and cane sugar refining products
1093	Manufacture of other food products
1100	Manufacture of beverages
1200	Manufacture of tobacco products
1300	Manufacture of textiles products
1400	Manufacture of wearing apparel and accessories
1500	Manufacture of footwear and leather products
1600	Manufacture of wood products
1700	Manufacture of pulp, paper and paper products
1800	Printing and reproduction of recorded media
1991	Manufacture of coke and refined petroleum products
1992	Manufacture of biofuel products
2091	Manufacture of organic and inorganic chemicals, resins and elastomers
2092	Manufacture of Pesticides, Disinfectants, Various Paints and Chemicals
2093	Manufacture of cleaning products, cosmetics/perfumery and personal hygiene
2100	Manufacture of basic pharmaceutical products and pharmaceutical
2200	Manufacture of rubber and plastic products
2300	Manufacture of non-metallic mineral products
2491	Manufacture of pig iron/ferroalloys, steel and seamless steel tubes
2492	Metallurgy of non-ferrous metals and metal smelting
2500	Manufacture of fabricated metal products, except machinery and equipment
2600	Manufacture of computer, electronic and optical products
2700	Manufacture of electrical equipment
2800	Manufacture of machinery and equipment n.e.c.
2991	Manufacture of automobiles, trucks and buses, except their components parts
2992	Manufacture of parts and accessories for motor vehicles
3000	Manufacture of other transport equipment, except motor vehicles
3180	Manufacture of furniture; other manufacturing
3300	Repair and installation of machinery and equipment

Source: Brazilian Institute of Geography and Statistics (IBGE).

Table 12: **Survey of Industry Conditions: sector codes and description**

Code	Survey Description
101	Slaughter and meat products, including dairy and fish products
104	Manufacture of vegetable and animal fats and oils
105	Manufacture of dairy products
106	Milling, manufacture of starchy products and animal feed
107	Manufacture and cane sugar refining products
100A	Manufacture of other food products
111	Manufacture of alcoholic beverages
112	Manufacture of non-alcoholic beverages
12	Manufacture of tobacco products
13	Manufacture of textiles products
14	Manufacture of wearing apparel and accessories
150A	Manufacture of leather
150B	Manufacture of footwear
16	Manufacture of wood products
171	Manufacture of pulp and pulp for papermaking
172	Manufacture of paper and cardboard
173	Manufacture of paper packaging
174	Manufacture of various paper products
18	Printing and reproduction of recorded media
190A	Manufacture of coke and refined petroleum products
190B	Manufacture of biofuel products
201	Manufacture of inorganic chemicals
202	Manufacture of organic chemicals
203	Manufacture of resins and elastomers
205	Manufacture of Pesticides and Disinfectants,
207	Manufacture of paints, varnishes, enamels, lacquers and related products
200A	Other unspecified chemicals
20B	Manufacture of soaps, detergents, cleaning products, cosmetics, perfumery products
21	Manufacture of pharmaceuticals
22A	Manufacture of rubber products
22B	Manufacture of plastic products
231	Manufacture of glass and glass products
232	Manufacture of cement
233	Manufacture of concrete, cement, fiber cement, plaster and similar materials
234	Manufacture of ceramic products
239	Stone rigging and manufacture of other non-metallic mineral products
244	Metallurgy of non-ferrous metals
240A	Steel industry
240B	Other basic metallurgy products
251	Manufacture of metal structures and heavy boiler works
253	Forging, stamping, powder metallurgy and metalworking services
254	Manufacture of Cutlery, Hand Tools and General Hardware
250A	Manufacture of other fabricated metal products
262	Manufacture of computer equipment and peripherals
263	Manufacture of communication equipment
264	Manufacture of audio and video reception, reproduction, recording and amplification apparatus
260A	Others - electronic material, communication, information technology and optical devices and equipment
271	Manufacture of generators, transformers and electric motors
273	Manufacture of equipment for distribution networks and electricity contro
275	Manufacture of home appliance
270A	Manufacture of other electrical equipment and appliances
281	Manufacture of engines, pumps, compressors and transmission equipment
282	Manufacture of machinery and equipment n.e.c.
283	Manufacture of electrical equipment
285	Manufacture of machinery and equipment for use in mineral extraction and construction
280A	Manufactured of other machines and equipment
291	Manufacture of automobiles, vans and utilities
292	Manufacture of trucks and buses
294	Manufacture of parts and accessories for motor vehicles
290A	Manufacture of other motor vehicles
301	Boat Building
304	Aircraft manufacturing
300A	Manufacture of other transport equipment, except motor vehicles
31	Manufacture of Furniture and Related Products
32	Manufacture of other manufacturing products

Source: Survey of Industrial Conditions - IBRE-FGV.

Table 13: **List of codes correspondence: CNAE - PPI; Survey of Industry Conditions (S) and Input-Output Matrix (IOM)**

CNAE	S	IOM	CNAE	S	IOM	CNAE	S	IOM	CNAE	S	IOM
10101	101	1091	15303	150B	1500	21202	21	2100	26204	262	2600
10102	101	1091	15304	150B	1500	22101	22A	2200	26301	263	2600
10103	101	1091	15401	150B	1500	22102	22A	2200	26302	263	2600
10104	101	1091	16101	16	1600	22103	22A	2200	26303	263	2600
10105	101	1091	16201	16	1600	22104	22A	2200	26304	263	2600
10201	101	1091	16202	16	1600	22105	22A	2200	26305	263	2600
10301	100A	1093	16203	16	1600	22106	22A	2200	26401	264	2600
10302	100A	1093	16204	16	1600	22201	22B	2200	26402	264	2600
10303	100A	1093	16205	16	1600	22202	22B	2200	26403	264	2600
10304	100A	1093	16206	16	1600	22203	22B	2200	26501	260A	2600
10305	100A	1093	17101	171	1700	22204	22B	2200	27101	271	2700
10306	100A	1093	17201	172	1800	22205	22B	2200	27102	271	2700
10401	104	1093	17202	172	1700	22206	22B	2200	27103	271	2700
10402	104	1093	17203	172	1700	22207	22B	2200	27104	271	2700
10403	104	1093	17301	173	1700	22208	22B	2200	27201	270A	2700
10404	104	1093	17302	173	1700	22209	22B	2200	27301	273	2700
10405	104	1093	17303	173	1700	22210	22B	2200	27302	273	2700
10406	104	1093	17401	174	1700	22211	22B	2200	27303	273	2700
10501	105	1091	17402	174	1700	22212	22B	2200	27401	270A	2700
10502	105	1091	17403	174	1700	22213	22B	2200	27501	275	2700
10503	105	1091	17404	174	1700	23101	231	2300	27502	275	2700
10504	105	1091	19201	190A	1991	23102	231	2300	27503	275	2700
10505	105	1091	19202	190A	1991	23103	231	2300	27504	275	2700
10506	105	1091	19203	190A	1991	23104	231	2300	27505	275	2700
10507	105	1091	19204	190A	1991	23201	232	2300	27901	270A	2700
10508	105	1091	19205	190A	1991	23301	233	2300	28101	281	2800
10509	105	1091	19206	190A	1991	23302	233	2300	28102	281	2800
10601	106	1093	19207	190A	1991	23303	233	2300	28103	281	2800
10602	106	1093	19208	190A	1991	23304	233	2300	28104	281	2800
10603	106	1093	19301	190B	1992	23401	234	2300	28105	281	2800
10604	106	1093	19302	190B	1992	23402	234	2300	28106	281	2800
10605	106	1093	19303	190B	1992	23403	234	2300	28107	281	2800
10606	106	1093	20101	201	2091	23404	234	2300	28201	282	2800
10701	107	1092	20102	201	2091	23405	234	2300	28202	282	2800
10702	107	1092	20103	201	2091	23901	239	2300	28203	282	2800
10703	107	1092	20104	201	2091	23902	239	2300	28204	282	2800
10801	100A	1093	20105	201	2091	23903	239	2300	28205	282	2800
10802	100A	1093	20106	201	2091	23904	239	2300	28206	282	2800
10901	100A	1093	20107	201	2091	24101	240B	2491	28207	282	2800
10902	100A	1093	20108	201	2091	24102	240B	2491	28301	283	2800
10903	100A	1093	20109	201	2091	24201	240A	2491	28302	283	2800
10904	100A	1093	20110	201	2091	24202	240A	2491	28303	283	2800
10905	100A	1093	20201	202	2091	24203	240A	2491	28304	283	2800
10906	100A	1093	20202	202	2091	24204	240A	2491	28401	280A	2800
10907	100A	1093	20203	202	2091	24205	240A	2491	28501	285	2800
10908	100A	1093	20204	202	2091	24206	240A	2491	28502	285	2800
11101	111	1100	20205	202	2091	24207	240A	2491	28503	285	2800
11102	111	1100	20206	202	2091	24208	240A	2491	28601	280A	2800
11103	111	1100	20207	202	2091	24209	240A	2491	28602	280A	2800
11104	111	1100	20301	203	2091	24210	240A	2491	28603	280A	2800
11201	112	1100	20302	203	2091	24211	240A	2491	29101	291	2991
11202	112	1100	20303	203	2091	24301	240B	2491	29102	291	2991
11203	112	1100	20304	203	2091	24302	240B	2491	29103	291	2991
12101	12	1200	20305	203	2091	24401	244	2492	29201	292	2991
12201	12	1200	20306	203	2091	24402	244	2492	29202	292	2991
13101	13	1300	20307	203	2091	24403	244	2492	29203	292	2991
13102	13	1300	20401	200A	2091	24404	244	2492	29204	292	2991
13201	13	1300	20501	205	2092	24405	244	2492	29301	292	2991
13202	13	1300	20502	205	2092	24406	244	2492	29302	292	2991
13301	13	1300	20503	205	2092	24407	244	2492	29401	294	2992
13501	13	1300	20504	205	2092	24408	244	2492	29402	294	2992
13502	13	1300	20505	205	2092	24501	251	2492	29403	294	2992
13503	13	1300	20601	20B	2093	25101	251	2500	29404	294	2992
13504	13	1300	20602	20B	2093	25102	251	2500	29405	294	2992
14101	14	1400	20603	20B	2093	25201	251	2500	29406	294	2992
14102	14	1400	20604	20B	2093	25301	253	2500	30901	290A	3000
14103	14	1400	20605	20B	2093	25401	254	2500	30902	290A	3000
14104	14	1400	20606	20B	2093	25402	254	2500	30903	290A	3000
14105	14	1400	20701	207	2093	25403	254	2500	31101	31	3180
14106	14	1400	20702	207	2093	25901	250A	2500	31102	31	3180
14107	14	1400	20703	207	2093	25902	250A	2500	31103	31	3180
14108	14	1400	20704	207	2093	25903	250A	2500	31104	31	3180
14201	14	1400	20901	200A	2092	25904	250A	2500	31105	31	3180
15101	150A	1500	20902	200A	2092	25905	250A	2500	31106	31	3180
15102	150A	1500	20903	200A	2092	26101	262	2600	31107	31	3180
15201	150A	1500	20904	200A	2092	26201	262	2600	31108	31	3180
15301	150B	1500	20905	200A	2092	26202	262	2600			
15302	150B	1500	21201	21	2100	26203	262	2600			

The PPI code (CNAE) in the survey has 9-digits, but for all products from the Manufacturing Industries the four initial code is the same: 2022. For instance, for the CNAE 10101 the complete code is 202210101. Sources: IBRE-FGV and Brazilian Institute of Geography and Statistics (IBGE).

B Additional results

B.1 Weighted passthrough regressions

Table 14: **Weighted passthrough regressions with PPI weights**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0400***	0.0198***	0.00657
	(0.00377)	(0.00521)	(0.00534)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0479***	0.0455***
		(0.00759)	(0.00846)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.123***
			(0.00552)
τ_{it}			0.000424***
			(0.0000963)
$\Delta_{\tau_i} ULC_t$			0.0241***
			(0.00598)
$\Delta_{\tau_i} energy_t$			-0.0238***
			(0.00632)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0332***
			(0.00964)
$Sectoral\ inventory_t$			-0.000166***
			(0.0000174)
$Sectoral\ demand_t$			0.000298***
			(0.0000274)
constant	0.0430***	0.0422***	0.00441
	(0.00245)	(0.00245)	(0.00374)
N	192502	192502	178442
$adj.R^2$	0.1495	0.1497	0.1658
adj	0.0844	0.0847	0.1006
Individual Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

Table 15: **Equally weighted regressions**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0381***	0.0232**	0.0217***
	(0.00660)	(0.0102)	(0.00919)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0360***	0.0348***
		(0.0131)	(0.0123)
τ_{it}			0.0000299
			(0.000163)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.0731***
			(0.0102)
$\Delta_{\tau_i} ULC_t$			0.0234**
			(0.0100)
$\Delta_{\tau_i} energy_t$			-0.0326***
			(0.00944)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0467***
			(0.0155)
$Sectoral\ inventory_t$			-0.000186***
			(0.0000327)
$Sectoral\ demand_t$			0.000337***
			(0.0000501)
$constant$	0.0410***	0.0405***	-0.00321
	(0.00503)	(0.00503)	(0.00731)
N	192502	192502	178442
$adj.R^2$	0.1112	0.1113	0.1235
adj	0.0432	0.0433	0.0551
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

B.2 Passthrough regressions with no-Covid sample

Passthrough regressions with sample ending in December 2019

Table 16: **Passthrough regressions with unanchoring dummy**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0434***	0.0242***	0.0141**
	(0.00421)	(0.00632)	(0.00661)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0418***	0.0376***
		(0.00882)	(0.0101)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.129***
			(0.00548)
τ_{it}			0.000448***
			(0.000109)
$\Delta_{\tau_i} ULC_t$			0.0246***
			(0.00704)
$\Delta_{\tau_i} energy_t$			-0.0303***
			(0.00664)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0378***
			(0.0113)
$Sectoral\ \ inventory_t$			-0.000188***
			(0.0000200)
$Sectoral\ \ demand_t$			0.000345***
			(0.0000314)
$constant$	0.0438***	0.0430***	0.000353
	(0.00244)	(0.00244)	(0.00400)
N	177620	177620	164549
$adj.R^2$	0.0500	0.0478	0.666
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

B.3 Results using median survey forecasts

Table 17: **Passthrough regressions with unanchoring dummy**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0253***	0.0138**
	(0.00393)	(0.00517)	(0.00539)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t^{Unanch}$		0.0454***	0.0331***
		(0.00811)	(0.00880)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.122***
			(0.00521)
τ_{it}			0.000427***
			(0.0000978)
$\Delta_{\tau_i} ULC_t$			0.0261***
			(0.00612)
$\Delta_{\tau_i} energy_t$			-0.0198**
			(0.00631)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0366***
			(0.0103)
$Sectoral\ inventory_t$			-0.000176***
			(0.0000183)
$Sectoral\ demand_t$			0.000324***
			(0.0000288)
$constant$	0.0435***	0.0429***	0.00222
	(0.00245)	(0.00245)	(0.00380)
N	192502	192502	178442
$adj.R^2$	0.0500	0.0502	0.0654
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 18: **Passthrough regressions with degree of unanchoring**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0410***	0.0201***	0.0106**
	(0.00393)	(0.00505)	(0.00532)
$\Delta_{\tau_i} e_t \times Unanch_t$		0.152***	0.110***
		(0.0202)	(0.0219)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.122***
			(0.00521)
τ_{it}			0.000398***
			(0.0000986)
$\Delta_{\tau_i} ULC_t$			0.0269***
			(0.00613)
$\Delta_{\tau_i} energy_t$			-0.0201**
			(0.00614)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0361***
			(0.0103)
$Sectoral\ inventory_t$			-0.000177***
			(0.0000183)
$Sectoral\ demand_t$			0.000324***
			(0.0000287)
$constant$	0.0435***	0.0427***	0.00219
	(0.00245)	(0.00245)	(0.00380)
N	192502	192502	178442
$adj.R^2$	0.0500	0.0504	0.0655
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 19: **Passthrough regression with exchange rate change over previous price spell – unanchoring dummy**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0416***	0.0222***	0.0165***
	(0.00425)	(0.00567)	(0.00596)
$\Delta_{\tau_i} e_{t-\tau_{it}}$	0.00989**	-0.00386	0.00270
	(0.00335)	(0.00415)	(0.00419)
$\Delta_{\tau_i} e_t \times \mathbb{1}_t{}^{Unanch}$		0.0496***	0.0394***
		(0.00854)	(0.00903)
$\Delta_{\tau_i} e_{t-\tau_{it}} \times \mathbb{1}_t{}^{Unanch}$		0.0434***	0.0464***
		(0.00657)	(0.00653)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.123***
			(0.00522)
τ_{it}			0.000478***
			(0.0000982)
$\Delta_{\tau_i} ULC_t$			0.0237***
			(0.00614)
$\Delta_{\tau_i} energy_t$			-0.0210***
			(0.00630)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0326**
			(0.0104)
$Sectoral\ \ inventory_t$			-0.000177***
			(0.0000183)
$Sectoral\ \ demand_t$			0.000327***
			(0.0000288)
$constant$	0.0384***	0.0383***	0.00226
	(0.00246)	(0.00246)	(0.00382)
N	178442	178442	178442
$adj.R^2$	0.0500	0.0478	0.0659
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 20: **Passthrough regression with exchange rate change over previous price spell – degree of unanchoring**

Dependent variable: $\Delta_{\tau_i} p_{it}$	**(1)**	**(2)**	**(3)**
$\Delta_{\tau_i} e_t$	0.0416***	0.0180**	0.0131**
	(0.00425)	(0.00550)	(0.00586)
$\Delta_{\tau_i} e_{t-\tau_{it}}$	0.00989**	-0.00711	-0.000461
	(0.00335)	(0.00412)	(0.00417)
$\Delta_{\tau_i} e_t \times Unanch_t$		0.150***	0.121***
		(0.0213)	(0.0222)
$\Delta_{\tau_i} e_{t-\tau_{it}} \times Unanch_t$		0.133***	0.140***
		(0.0160)	(0.0159)
$\Delta_{\tau_i} p_{it-\tau_{it}}$			-0.123***
			(0.00521)
τ_{it}			0.000468***
			(0.0000989)
$\Delta_{\tau_i} ULC_t$			0.0231***
			(0.00615)
$\Delta_{\tau_i} energy_t$			-0.0206***
			(0.00613)
$\Delta_{\tau_i} Sectoral\ cost_t$			0.0317**
			(0.0104)
$Sectoral\ inventory_t$			-0.000179***
			(0.0000183)
$Sectoral\ demand_t$			0.000326***
			(0.0000288)
$constant$	0.0384***	0.0384***	0.00241
	(0.00246)	(0.00246)	(0.00382)
N	178442	178442	178442
$adj.R^2$	0.0500	0.0481	0.0661
$Individual\ Fixed\ Effects$	Yes	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes	Yes

Table 21: **Accuracy regressions**

Dependent Variable: $Match_t^i$	**(1)**	**(2)**
$\mathbb{1}_t^{Unanch}$	-0.935**	
	(0.42)	
$Unanch_t$		-4.991
		(-1.03)
τ_{it}	0.0451***	0.0451***
	(0.007)	(0.007)
$Size.Med$	-14.50	-14.50
	(617.62)	(617.62)
$Size.Small$	-28.47	-28.47
	(1218.67)	(1218.67)
N	2961	2961
$pseudo.R^2$	0.03034	0.03034
$Individual\ Fixed\ Effects$	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes

Dependent Variable: $Surprise_t^i$	**(1)**	**(2)**
$\mathbb{1}_t^{Unanch}$	0.0781	
	(0.48)	
$Unanch_t$		4.236**
		(2.27)
τ_{it}	-0.0045**	-0.0045**
	(-1.91)	(-1.91)
$Size.Med$	0.327	0.327
	(0.83)	(0.83)
$Size.Small$	0.295	0.295
	(0.41)	(0.41)
$constant$	-0.236	-0.236
	(-1.56)	(-1.56)
N	2976	2976
$adj.R^2$	0.0374	0.0374
$Individual\ Fixed\ Effects$	Yes	Yes
$Time\ Fixed\ Effects$	Yes	Yes