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# The Causal Effects of Expected Depreciations*


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**Abstract**

We estimate the causal effects of a shift in the expected future exchange rate of a local currency against the US dollar on a representative sample of firms in an open economy. We survey a nationally representative sample of firms and provide the one-year-ahead nominal exchange rate forecast published by the local central bank to a random sub-sample of firm managers. The treatment is effective in shifting exchange rate and inflation expectations and perceptions. These effects are persistent and larger for non-exporting firms. Linking survey responses with administrative census data, we find that the treatment affects the dynamics of export and import quantities and prices at the firm level, with differential effects for exports to destination countries that use the US dollar as their currency. We instrument exchange rate expectations with the variation induced by the treatment and estimate a positive elasticity of a future expected depreciation in import expenditures.



**JEL classifications:** E31, E71, F31, G41

**Keywords:** Expectations, exchange rate, firms



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# 1 Introduction

Few prices are more crucial to an open economy than the nominal exchange rate of its local currency against the United States dollar (USD). Shifts in this price have direct effects on revenues and input costs (Gopinath, Itskhoki, and Rigobon, 2010; Auer, Burstein, and Lein, 2021), and indirect effects via general equilibrium effects and the condict of economic policy (Gali and Monacelli, 2005). Future expected exchange rates are an essential determinant of price-setting, production, and input demand for forward-looking firms.

Despite a rich qualitative understanding of the mechanisms at play that determine the reaction of firms to changes in expected future exchange rates, where concepts such as expenditure switching, nominal rigidities, and currency of invoicing play an important role, it is challenging to gauge the empirical causal effects of expected future depreciations on firm outcomes. The reasons behind this challenge are unsurprising. The path of expected future exchange rates and current firm-level decisions are determined jointly in equilibrium as a function of a combination of potentially unobserved shocks that affect firms and the economy in general. Moreover, measurement is imperfect: measures of exchange rate expectations of firm decision-makers are scarce, substantially more so than for other key macroeconomic aggregates, such as expected inflation, where the profession has made significant improvements in measurement (Candia, Coibion, and Gorodnichenko, 2021).

In this paper, we make progress on both of these issues. We start this paper by presenting a measurement of one-year-ahead exchange rate forecasts and nowcasts for a nationally representative monthly panel survey of firm managers in Colombia, a country that almost exclusively relies on dollar invoicing of exports and imports (Gopinath et al., 2020); that is, where the dollar is king in international trade.[1] Better data do not solve the identification challenge on its own. We introduce an information treatment to a subsample of firms that induces exogenous variation in future expected depreciations across firms, solving the main identification challenge. Two ex-ante identical firms will have different expectations of the future exchange rate due to the information treatment. We use these exogenous shifters of exchange rate expectations to estimate the causal effects of an expected depreciation on various firm-level outcomes. Our identification approach uses variation in future expected depreciations induced by an RCT across firms in the same country, as opposed to using variation in exchange rate regimes across countries (Fukui, Nakamura, and Steinsson, 2023; Bouscasse, 2022; Candia and Pedemonte, 2021) or large unexpected devaluations

[1] We refer to nowcasts and perceptions interchangeably. In particular, the exchange rate nowcast is the exchange rate of the local currency against the US dollar at which firms perceive they could transact.

(Burstein, Eichenbaum, and Rebelo, 2005), as in the existing literature.

Our first finding is descriptive and does not rely on the randomized intervention. Firms are substantially more aware of the current exchange rate level than the current inflation rate for the Colombian economy. There is substantial disagreement on the future level of the exchange rate, but this disagreement is smaller than the one prevailing about the future level of the inflation rate. These findings are consistent with the view that firms operate under imperfect information but are more attentive to the exchange rate than to other macroeconomic outcomes, such as the inflation rate, that are less payoff-relevant and less volatile.

The main contribution of this paper is to estimate the elasticity of firm-level outcomes to an expected future depreciation. These elasticities are useful to discipline the strength of different mechanisms present in models of international economics (Egorov and Mukhin, 2023). These firm-level effects will be estimated using variation in exchange rate expectations generated through an informational randomized controlled trial (RCT), which complements existing estimates of the elasticities of aggregate outcomes using cross-country data. We provide the average one-year-ahead exchange rate forecast published by the central bank to a random subset of firms –the treatment group. This one-year-ahead forecast is the average of the forecast produced by financial institutions and think tanks selected by the central bank. The remaining firms –the control firms– do not receive any additional information compared to the treated ones.

The first set of findings is akin to a first stage, in which we measure the effects of the treatment on expectation formation. For firms in the control group, managers who perceive a high current value of the exchange rate also expect a high future value. The slope between perceptions and forecasts for the exchange rate is indistinguishable from 1 for firms in the control group. Our treatment, which uses readily available public information about exchange rate forecasts, substantially weakens the relationship between perceptions and expectations of the exchange rate. The slope between perceptions and expectations for firms in the treatment group is between 30 percent to 40 percent of the slope for firms in the control group, depending on the specification.[2] The treatment also successfully weakens the relationship between perceptions and expectations for the inflation rate. The slope between inflation perceptions and inflation expectations is between 50 percent to 66 percent as large as that for firms in the treatment group compared with firms in the control group. While informed, firms still learn from public information and adjust their forecast,

[2]We estimate this treatment effect via OLS or Huber robust regression, which controls for outliers and influential observations.

suggesting uncertainty or inattention about macroeconomic variables (Weber et al., 2023).

These patterns not only hold at the time of the treatment but are persistent for several months. The difference in the weight of pre-treatment perceptions on future expectations lasts 2 to 4 months after treatment. The effects of inflation are less persistent, in line with previous work by Coibion, Gorodnichenko, and Ropele (2020). Not only do we document persistent effects in forecast formation, but persistent effects in future nowcast formation. That is, future perceptions of firms in the control group correlate significantly more with the pre-treatment perception than do those of firms in the treatment group.

We estimate the effect of the treatment on economic decisions at the firm level, akin to a reduced form where we estimate the effect of the treatment on outcomes of interest. We link the survey data with granular administrative records on the export and import decisions of the firms, along with information on the country of origin or destination, the value of the transaction in US dollars and pesos, and detailed information on product categories.

We estimate significant effects of the exchange rate forecasts on exporting and importing behavior. The treatment decouples firm-level exports and imports in a post-treatment year (12 months starting when the intervention started) from their pre-treatment levels (previous 12 months). We find that firms reset their unit prices, particularly so for exports to destinations using a currency different from the USD, consistent with Boz et al. (2022). Under the dominant currency pricing, expenditure switching is stronger for destinations that do not use the USD, increasing the incentives to reset prices to those destinations.

Finally, we put together our reduced-form and first-stage results and estimate the elasticity of firm-level outcomes to an expected depreciation using the treatment intensity as an instrument. This strategy is similar in spirit to Coibion et al. (2023). We estimate an elasticity of imports to a future expected depreciation of 8, which means that a 1 percent future expected depreciation increases realized imports by 8 percent. We interpret this finding as consistent with an anticipatory movement of firms in expanding input demand. We estimate insignificant effects on exports, although the confidence intervals are large. This result is consistent with the finding that the treatment is ineffective in shifting exporters' exchange rate expectations.

Throughout the paper, we reject the economic null hypothesis that firm managers incorporate all public information to form their expectations, perceptions, and actions. Documenting information frictions for the exchange rate is particularly informative, since we introduce an information treatment about a payoff-relevant and volatile economic variable, two ingredients that predict

high attention by price setters. We also show relevant margins of heterogeneity to the same piece of information, further confirming the role of information frictions. The treatment is more effective in shifting the expectations of firms that do not export, which aligns with the intuition that exporting firms are more sophisticated and interact more often with international markets.

**Related Literature:**

This work is related to studies on the role of firms' expectations in their decisions. Coibion, Gorodnichenko, and Kumar (2018) document that even in a country with low and stable inflation, firms have dispersed inflation expectations, a behavior more similar to that of consumer expectations than that of professional forecasters. This fact also holds for developed economies such as the US (Candia, Coibion, and Gorodnichenko, 2021; Garciga et al., 2023), and Germany (Link et al., 2023), and developing economies such as Uruguay (Frache, Lluberas, and Turen, 2024). We find a similar pattern in Colombia and document the dispersion of expectations for the nominal exchange rate against the US dollar.

While there is a large literature documenting the expectation formation process of firms, there is little evidence of the effect of those expectations on actual decisions. The relatively small literature documenting the effects of expectation formation on decisions arises from the difficulty of linking survey and administrative data. There are notable exceptions. Coibion, Gorodnichenko, and Kumar (2018) and Coibion, Gorodnichenko, and Ropele (2020) estimate that changes in firms' inflation expectations, driven by an information treatment, affect firms' pricing and employment decisions. Other notable examples are Savignac et al. (2021), Abberger et al. (2023), and Buchheim, Link, and Mohrle (2023).

Most of the evidence in the literature comes from developed economies, but there is some evidence from developing countries. Frache et al. (2023) show that firms in Uruguay form inflation expectations, paying particular attention to the price of the USD, and that international shocks affect their inflation expectations and decisions. D'Acunto and Weber (2022) show that consumers across countries use specific salient prices to form expectations. In this paper, we show how exchange rate expectations and inflation expectations interact. In addition, we show that exchange rate expectations are relevant information for firms' trade decisions. Candia, Coibion, and Gorodnichenko (2023) review the available evidence and make clear that there are very few surveys of firms' exchange rate expectations.

In open economies, exchange rate behavior is relevant for firm decisions fluctuations in the exchange rate influence input and output prices, especially for exporting firms. The magnitude

of the effect of exchange rate fluctuations on local prices and quantities depends on the extent of nominal rigidities and the currency in which firms price their goods (Gali and Monacelli, 2005; Burstein and Gopinath, 2014; Amiti, Itskhoki, and Konings, 2022). Recent literature has provided evidence of firms choosing a dominant currency, notably the United States dollar, to invoice their transactions, a phenomenon called dominant currency pricing. Using Colombian data from the same source we exploit in this paper, Gopinath et al. (2020) find that trade in Colombia is almost exclusively invoiced in dollars. Egorov and Mukhin (2023) study the implications of pricing in the dominant currency for monetary policy. Devereux and Engel (2007) highlight the importance of intermediate inputs pricing to understanding the aggregate effects of exchange rate policy. In this paper, we show that firms react strongly to changes in the expected exchange rate via changes in imports, likely intermediate goods, suggesting that pricing is in the exporter's currency or the dominant currency.

# 2 Survey

## 2.1 Questionnaire and Time Frame

Since 1979, the Managerial Expectations Survey, known as the EOE for its name in Spanish (*Encuesta de Opinión Empresarial*), has been conducted monthly by surveying managers from a nationally representative sample of firms in the manufacturing and retail sector. The Colombian think tank *Fedesarrollo* and the Central Bank of Colombia conduct the survey. The sampling universe of firms comes from the universe of all companies reporting to the National Manufacturing Survey,[3] to the Foreign Exchange Risk survey conducted by the Central Bank of Colombia, and to the Financial Superintendency of Colombia. The survey includes 500 firms per month, roughly 200 in the retail sector and 300 in the manufacturing sector. General managers and firm administrators (CEOs), financial department directors, and chief accountants (CFOs) respond on behalf of their firms.

The survey includes a wide range of questions on firm sentiments and the qualitative assessment of the business environment. The aggregate results from the EOE survey are an input to public policy discussions in Colombia, and due to the survey's track record, the completion rate by firm managers is high.

We modified existing questions and added new questions, and an information treatment to this survey. Starting in January 2019, when we designed this project, we suggested a modifica-

[3]Collected by DANE, the national administrative department of statistics (Departamento Administrativo Nacional de Estadística in Spanish)

tion of a qualitative question that captured whether firms expected the inflation rate to increase, decrease, or stay the same into a question that measures a numerical expectation for the inflation rate one year in the future.

Starting in July 2021, after the emergencies associated with the COVID-19 pandemic eased, we introduced two questions to record the perceptions and the one-year-ahead expectations about the exchange rate and an additional question measuring the firms' one-year-ahead expected inflation. The purpose of asking questions related to the inflation rate along with questions about the exchange rate is to provide a benchmark with which to compare the results from this survey with those of the extensive literature that measures firms' inflation expectations (Candia, Coibion, and Gorodnichenko, 2021).

The first two new questions measure managers' perceptions (or nowcasts) about the current inflation rate and exchange rate against the US dollar. We pin down these perceptions by asking participants about the price they would pay if they purchased dollars in the financial market in the current week. Similarly, we ask them about the 12-month CPI inflation rate at the end of the current month.

We ask their one-year-ahead expectations for the inflation and US dollar exchange rates. We ask for the price they expect to pay for one US dollar if they purchase dollars one year from now in the financial market. Similarly, we measure their 12-month-ahead annual inflation expectations. The four key questions in the survey are as follows: [4]

1. If you were to buy dollars this week in the financial sector, what is the exchange rate at which you could purchase them? (Value in pesos; do not use commas or points)

2. At the end of the current month, by what percentage do you think the CPI will have changed in the last 12 months? (Percentage value; in case of a decrease, use a negative number)

3. What exchange rate would you expect if you were to purchase dollars in the financial sector in 12 months? (Value in pesos; do not use commas or points)

4. How much do you anticipate the prices of Colombia's economy, as measured by the con-

[4] In Spanish: 1. Si fuera a comprar esta semana dólares en el sector financiero, a qué tasa de cambio cree que los podrá conseguir? (Valor en pesos, no utilice comas ni puntos como separador de miles) 2. Al final del mes en curso en que porcentaje cree usted que habrá cambiado el IPC en los últimos 12 meses? (Valor porcentual; en caso de disminución utilice un número negativo). 3. Si dentro de doce meses fuera a comprar dólares en el sector financiero A qué tasa de cambio cree que los podrá conseguir? (Valor en pesos, no utilice comas ni puntos como separador de miles). 4. En qué porcentaje cree usted que los precios de la economía, medidos mediante el índice de precios al consumidor (IPC), aumentarán o disminuirán en Colombia en los próximos 12 meses? (Valor porcentual; en caso de disminución utilice un número negativo).

sumer price index (CPI), to increase or decrease in the next 12 months? (Percentage value; in case of a decrease, use a negative number)

From August 2021 to November 2021, we provided firms with an information treatment that contained the one-year-ahead forecast of the exchange rate between the US dollar and the Colombian peso obtained from a monthly and publicly available professional forecasters survey of the Central Bank of Colombia.[5] We assigned 50 percent of the whole universe of potential survey participants to a treatment group and the remaining 50 percent of firms to a control group. We implemented the treatment after eliciting nowcasts and before eliciting forecasts, that is, between questions 2 and 3 in the list of questions above. Table 8 shows that for the firms surveyed in the baseline period (July 2021), the prior and posterior of the exchange rate and inflation are well balanced; so there is no statistically significant differences between the treatment and the control group.

Survey conductors attempt to contact firms, prioritizing obtaining answers from a subset of firms that the central bank has judged to be of particular interest. If contacting a given firm is not possible, survey conductors contact other firms up to the point at which they gather 500 responses. As a result of this sampling procedure, our data are an unbalanced panel. To avoid selection into treatment, we randomized the universe of firms in the sampling set into a treatment or control group. We stratified the randomization by the firms' self-reported assessment of whether they were exporters in the pre-period and the central bank's assessment of whether individual firms were of particular interest.

We treat firms in the treatment group only once: the first month they were surveyed, starting in August 2021. We avoided creating additional treatment arms with differential treatment intensity to avoid self-selection on unobservables into higher treatment intensities by firms with a higher likelihood of responding to the survey. Because firms may receive the treatment in potentially different months, we include time fixed effects to absorb any variation induced by any aggregate shock.

The treatment consists of information delivered to firms after they answer the second question and before they answer the third question listed above. The treatment information reads as follows, translated from the original text in Spanish:

*According to the latest Survey of Analyst Expectations conducted by the central bank, the*

[5]Encuesta mensual de expectativas de analistas económicos (EME), available at: https://www.banrep.gov.co/es/estadisticas-economicas/encuesta-mensual-expectativas-analistas-economicos .

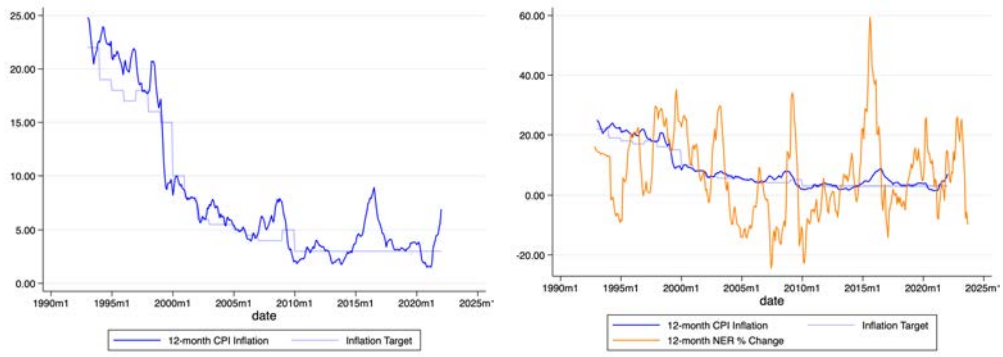


Figure 1: 12-month CPI inflation rate, the inflation target, and 12-month COP-USD nominal exchange rate.

*exchange rate in July 2022 is expected to be 3,650 pesos per dollar.*[6]

Firms in the control group did not receive any information between the second and third questions listed before.

## 2.2 Colombian Economy

Colombia is a small open economy with a floating exchange rate and an independent central bank using an inflation targeting framework to keep inflation within 2 to 4 percent, with 3 percent as the target value. According to the classification of Ilzetzki, Reinhart, and Rogoff (2019), Colombia has a *managed floating exchange rate regime*.

Figure 1 shows the 12-month inflation rate of Colombia since 1991, the year in which the current constitution was passed, along with the midpoint of the inflation target.[7] After a steady disinflation that lasted for a decade, Colombia kept the inflation rate within single digits up to the recent inflationary episode after the pandemic. As in many parts of the world, inflation fell during the early stages of the COVID crisis. It troughed in November 2020 and started thereafter to increase. July 2022, the last month of our survey, was the first time in more than two decades that inflation was above 10 percent. Our survey period started with inflation at 4.4 percent in August 2021 and ended with inflation at 10.2 percent in July 2022.

For comparison, the left panel of Figure 1 reports the same series as in the right panel of Figure 1 along with the 12-month percent change in the exchange rate between the Colombian peso and

[6]We updated the month and the exchange rate forecast for firms treated in later months.

[7]The constitution of 1991 increased the central bank's independence. Price stability became its primary goal. The board of directors of the central bank is composed of seven members: one director, five co-directors, and the Minister of Finance. The Colombian President nominates two members in the middle of his or her mandate, which lasts for four years. Therefore, a president will have appointed three out of seven members.

the US dollar. The nominal exchange rate variation overshadows the variation in consumer prices, a common feature in emerging market economies.

# 3 Facts on Perceptions and Expectations of the Exchange Rate and the Inflation Rate

This section documents the cross-sectional average and the cross-sectional dispersion of the perception and one-year-ahead forecast of the exchange rate between the Colombian peso and the United States dollar, and the inflation rate. While the implications of inattention in the international economy context have been studied theoretically (Crucini, Shintani, and Tsuruga, 2010, 2020), there is little evidence on how inattentive firms are to exchange rates. This sections aims to provide information about the level of firms' inattention to aggregate national and international variables.

We document three novel features of the data. First, the cross-sectional distribution of perceptions and expectations of the exchange rate is substantially more compressed than the analogous objects for the inflation rate. This fact confirms the intuition that the nominal exchange rate of the local currency against the US dollar is a nominal variable that receives substantial attention by firms in developing and emerging market economies (see also Frache et al. (2023)). Second, there is substantially more disagreement about the expected future level of the exchange rate compared to the current level of the exchange rate. Third, the average perception and the average forecast of the exchange rate strongly co-move with respect to the realized level of the exchange rate, even more so than the co-movement between perceptions and expectations of the inflation rate.

Surveys usually contain outliers and non-responses. We trim observations, for nowcast and forecasts, that are below the 1st or above the 99th percentile of the distribution (for the inflation rate, this corresponded, in August 2021 to observations below -2 percent and above 30 percent). Table 7 in Appendix A.1 summarizes the mean, median, standard deviation, minimum and maximum of each variable in July 2021, the baseline of our survey before treatment assignment.

Figure 2 illustrates our first finding. The top panel shows the realization as well as different moments of the cross-sectional distribution of nowcasts and forecasts of the exchange rate of the Colombian peso against the USD (COP/USD). In particular we will discuss the average as well as the range between the 10th and the 90th percentile for nowcasts and forecasts.

First, firms correctly perceive, on average, the current level of the exchange rate, as the solid red line tracks the solid black line. Second, the average forecast (solid blue line) closely tracks

the average perception (solid red). Third, there is substantially more cross-sectional dispersion of the exchange rate forecasts compared to the exchange rate perceptions (the blue shaded areas are wider than the red shaded areas).

To provide a benchmark for the variation in perceptions and forecasts, the lower panel of Figure 2 shows the same statistics for the inflation rate. There is considerable disagreement on the inflation rate across firm managers. The average interquartile range of perceptions was 3 percentage points, 65 percent as large as the average inflation rate at the beginning of the sample. Although on average firms have perceptions of the inflation rate in the ballpark of official numbers, the finding that the average perception does not match the official rate and that there is considerable cross-sectional dispersion in the perception of the inflation rate confirms previous findings first documented in Jonung (1981) and in models of costly information acquisition of current states of the economy (Maćkowiak and Wiederholt, 2009). At the beginning of the period for which we have data, inflation expectations were higher than current inflation, and although the average forecast increased at the end of the sample, it did so more slowly than realized inflation. This feature, higher inflation expectations than actual inflation pre-2021 and lower inflation expectations after inflation picked up, is consistent with data on US firms (Candia, Coibion, and Gorodnichenko, 2021; Garciga et al., 2023).

The cross-sectional dispersion of the exchange rate is significantly smaller than that for inflation as we show in Table 1.[8] While we cannot disentangle the reason for the lower dispersion, the exchange rate against the dollar is typically reported in the economic section of every daily TV news show and every major newspaper. It is usual to see the nominal exchange rate against the US dollar posted at the entrance to currency exchange retailers (*casas de cambio* in Spanish), similar to gas prices in gas stations.

To provide an additional benchmark of the forecasts provided by firm managers, in Table 1 we compare their nowcasts and forecasts to those of professional forecasters to document that although in general firms have more dispersed beliefs and expectations, their behavior is closer to that of professional forecasters for the exchange rate than for the inflation rate.[9] Firms' exchange rate nowcasts and forecasts are 3 to 4 times more dispersed than those of professional forecasters. This dispersion gap between firms and profesionnal forecsters is almost half the dispersion gap for inflation. The dispersion gap for inflation in Colombia is similar to the one in other countries

[8]Table 9 in Appendix A.1 shows the same statistics, separating treatment and control groups.

[9]The survey of professional forecasters from the survey "Encuesta Mensual de Expectativas de Analistas Economicos," ran by the central bank of Colombia and that surveys financial and research institutions.

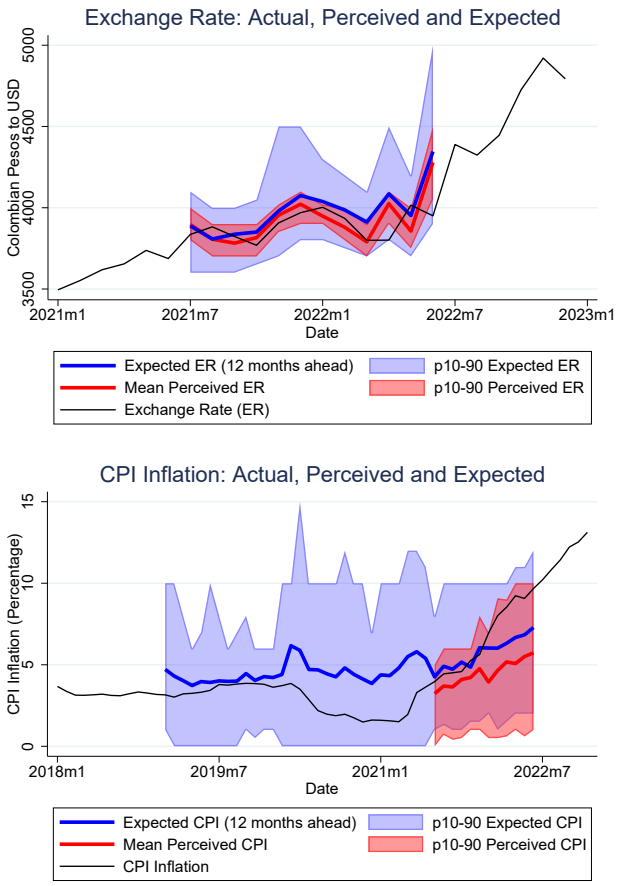


Figure 2: Perceptions and expectations of the inflation rate and the nominal exchange rate in Colombia.

*Note*: This figure shows the behavior of the nominal exchange rate between the Colombian peso and the United States dollar in the top panel and CPI inflation in Colombia in the lower panel. The solid black lines shows the realization of each variable. The solid blue lines shows the one-year-ahead expectation for each variable. The associated blue shaded areas show the 90th and 10th percentiles of the cross-section of forecasts. The solid red line depicts the average nowcast of each variable. The associated shaded red areas depict the 90th and 10th percentiles of the cross-sectional distribution of nowcasts. See the main text for a description of our trimming procedure on the raw data.

such as New Zealand (Coibion, Gorodnichenko, and Kumar, 2018) or Germany (Link et al., 2023).

# 4 Treatment Effects on the Formation of Expectations

The results of this section measure the effects of the treatment on the formation of expectations. We invite the reader to interpret this section as documenting a first-stage regression.

We estimate the causal effects of the information treatment on the formation of firm-level expectations and perceptions following the approach outlined by Coibion, Gorodnichenko, and Weber (2022), Armantier et al. (2016), Cavallo, Cruces, and Perez-Truglia (2017) and Coibion, Gorod-

| | Average | Standard Deviation | For Error |
|---|---|---|---|
| Nowcast Exchange Rate | | | |
| Professional Forecasters | \$3874 | \$55.89 | \$105.9 |
| Firms | \$3921 | \$204.9 | \$45.43 |
| Forecast Exchange Rate | | | |
| Professional Forecasters | \$3734 | \$133.2 | \$854.4 |
| Firms | \$3980 | \$329.4 | \$634.4 |
| Nowcast Inflation | | | |
| Professional Forecasters | 6.65% | 0.14% | 0.01% |
| Firms | 4.48% | 4.23% | 2.18% |
| Forecast Inflation | | | |
| Professional Forecasters | 4.10% | 0.55% | 8.19% |
| Firms | 5.76% | 4.60% | 6.54% |
| Professional Forecasters (from 2019m1) | 3.40% | 0.37% | 3.92% |
| Firms (from 2019m1) | 4.87% | 4.76% | 3.31% |

Table 1: Descriptive Statistics for Firms and Professional Forecasters

*Note*: This table summarizes the average nowcast and forecast for the nominal exchange rate between the Colombian peso and the US dollar and headline CPI inflation in Colombia for a sample of professional forecasters surveyed by the Colombian central bank, firm managers in our sample, and the same managers in the treatment and control groups. The third column titled *For Error* shows the difference between the forecast of a given variable and its realization. We use data from July 2021 to June 2022. For inflation forecasts we have data from January 2021 to June 2022. We use trimming procedures as explained in the text.

nichenko, and Kumar (2018), the gold standard in this literature. We measure the differential effect of a prior belief of a given economic variable on the formation of expectations of the same variable between treatment and control groups. Since treatment assignment is random and therefore exogenous to the firm, the differential effect of the prior on the forecasts captures the weight that managers in the control group place on the signal contained in the treatment.

Formally for a Kalman gain of $G$ associated with a signal, the formation of a posterior belief follows

$$posterior_i = G \times signal_i + (1 - G) \times prior_i.$$

Ideally, a researcher would have access to a prior and posterior belief of the same variable. In this case this would amount to a pre-treatment and post-treatment measure of exchange rate forecasts at the firm level. However, there are practical concerns associated with asking the same question twice to a given respondent in a survey. The literature has approached this issue by either asking for a probability distribution first and then asking for an expected value, or by asking for a variable that correlates at the firm level with the forecast. We follow the latter approach and use the

nowcast measure as a proxy for the prior in the equation above. It is not obvious ex-ante that nowcasts and forecasts are strongly correlated at the firm level. We will document a strong correlation between nowcasts and forecasts at the individual level for firms in the control group, validating our use of the nowcast as a proxy for the prior belief about future exchange rate forecasts.

We operationalize the estimation of $G$ by estimating specifications of the following form

$$X^e_{i,t+h,t+h+\tau} = \beta_t + \beta_1 T_{i,t} + \beta_2 X^e_{i,t,t} + \beta_3 T_{i,t} \times X^e_{i,t,t} + \epsilon_{i,t}, \tag{1}$$

where t represents the time of the treatment, and $X^e_{i,t+h,t+h+\tau}$ represents firm $i$'s expectation formed $h$ periods after treatment about the realization of variable $X$ in $h+\tau$ periods after treatment. For example $S^e_{i,t,t+12}$ denotes the expectation of firm $i$ about the level of the nominal exchange rate one year from the treatment assignment, and $S^e_{i,t+1,t+1}$ represents the nowcast of firm $i$ formed in the month after treatment. $T_{i,t}$ is a dummy variable equal to 1 for treated firms.

A key regressor in specification 1 is $X^e_{i,t,t}$, the nowcast of variable $X$ by firm $i$ in period $t$. As shown in Weber et al. (2023), the sum of coefficients $\beta_2 + \beta_3$ captures the weight assigned to the prior by firms in the treatment group, and $\beta_2$ captures the weight assigned to the prior by firms in the control group. Therefore, $\beta_3$ captures the differential weight on the prior due to the effect of the signal contained in the treatment. If firms learn from the treatment, we would expect $\beta_3 < 0$. A negative $\beta_3$ implies that the treatment contains a more valuable signal for the average firm in the treatment group and would put less weight on their prior. Under the reasonable assumption that firms do not receive differential information about the economy as a function of their treatment status in the time elapsed between when the nowcasts and the forecasts are elicited (a matter of a couple of minutes), we can assign the extent of learning to our treatment.

### 4.1 On-Impact Causal Effects

We start this section by documenting the on-impact causal effects of the treatment on the formation of expectations, meaning for the answering in the same wave of the survey. We will later exploit the panel dimension, estimating the effect in subsequent surveys for continuous firms. We estimate regressions of the form 1 where $X$ will either be equal to $S$ the nominal exchange rate between the Colombian peso and the US dollar, or $\pi$, the rate of CPI inflation for the Colombian economy. We compute one-year-ahead expectations, so $\tau = 12$ and $h = 0$ in equation 1. We use the expectations formed in the month in which firms receive the treatment.

We show the results of the estimation of equation 1 using ordinary least squares (OLS) using Huber (1964) robust regressions as in Coibion, Gorodnichenko, and Ropele (2020) to deal with outliers and influential observations. We will report standard errors clustered at the time the firms were treated and include time fixed effects in order to absorb variation driven by aggregate shocks that may be correlated with the temporal pattern in which firms participate in the survey. Since we are measuring the causal effects of the treatment on impact, we will only use one observation per firm, and our benchmark sample consists of 681 firms.

| | Exchange Rate | | Inflation | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Prior | 0.978*** | 0.958*** | 0.771*** | 0.893*** |
| | (0.152) | (0.082) | (0.064) | (0.043) |
| Prior x Treatment | -0.601** | -0.672*** | -0.263** | -0.444*** |
| | (0.163) | (0.089) | (0.071) | (0.038) |
| Treatment | 2,208*** | 2,496*** | 1.062** | 1.338*** |
| | (604.1) | (334.1) | (0.274) | (0.098) |
| Constant | 143.2 | 196.1 | 1.932*** | 0.956*** |
| | (569.6) | (309.0) | (0.217) | (0.062) |
| Regression | OLS | Huber | OLS | Huber |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 681 | 659 | 681 | 648 |

Table 2: Treatment Effect on Exchange Rate and Inflation Inflation Expectations

*Note*: This table summarizes our estimation of equation 1, for two variables $X$. One is the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and another is the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and we use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

Columns (1) and (2) of Table 2 estimate regression 1 for the exchange rate using information from 681 firms for OLS and 659 using Huber robust regressions. The first row shows our estimates of $\hat{\beta}_2$, the weight on the nowcast for firms in the control group. This coefficient is interpreted as a slope coefficient. Firms in the control group that perceive an exchange rate 1 Colombian peso higher, also forecast an exchange rate 1 Colombian peso higher one year from now. We cannot reject the null hypothesis that this coefficient is equal to one. That firms in the control group show a strong correlation between nowcasts and forecasts validates our choice of asking for perception variables as a proxy for the prior belief of firms about future exchange rates.

Our coefficient of interest is the one in the the second row: the coefficient associated with the interaction of the nowcast with treatment assignment, $\hat{\beta}_3$. The negative coefficient means that

firms assign weight to the signal in order to form their exchange rate expectations. This coefficient is statistically significant when using OLS and Huber robust regressions, meaning that we reject the null hypothesis that firms do not use the signal contained in the treatment to form their own expectations about the exchange rate. That the coefficient is economically large equal to -0.6 in OLS and -0.67 using robust regression implies that firms assign a large weight to the signal when forming their exchange rate expectations. In particular, firms in the treatment group assign a weight of 0.377 = 0.978 - 0.601 to their prior under OLS, and a weight of 0.286 = 0.958 - 0.672 when using Huber regressions.

Figure 3 offers a graphical representation of the results in Column (1) of Table 2. The figure is a binned scatterplot of the nowcast of the exchange rate after controlling for time fixed effects on the x-axis, and the one-year-ahead exchange rate forecasts after controlling for time fixed effects. The control group, here plotted in blue squares and a dashed blue line, is best represented by a 45-degree line linking variation in the nowcast and the forecast of the exchange rate. We do not take a stance on the drivers of dispersion in nowcasts across firms. The relationship between nowcasts and forecasts for firms in the treatment group is depicted with the orange line and orange diamonds. The relation between nowcasts and forecasts for the treatment group is weaker than for firms in the control group, and this effect is a causal effect of the treatment. Firms in the treatment group have exchange rate expectations that are less tightly linked to exchange rate perceptions. Table 2 shows that the difference in this pattern is statistically significant.

Columns (3) and (4) of Table 2 are analogous to Columns (1) and (2) but using information on inflation nowcasts and forecasts instead. Notice that the treatment contained information about the expected future value of the exchange rate, and no information directly linked with the expected future value of the inflation rate. Therefore, the effects on the formation of inflation expectations must happen because of the way in which firm managers process information about the exchange rate to update their outlook on the economic environment that is relevant for the formation of inflation expectations. We cannot tease out the different mechanisms by which this update occurs, we can only test whether it happens. The first row shows a coefficient of 0.771 between nowcasts and forecasts for OLS and 0.893 for the Huber robust regressions. Firms that perceive inflation to be higher by 1 percentage point in a given month expect inflation to be higher a year from now by 0.771 percentage points. The estimates for OLS and robust regressions are statistically different from 1, different than in the case of the exchange rate. The point estimate of the interaction of the treatment status and the inflation rate nowcast is negative and economically

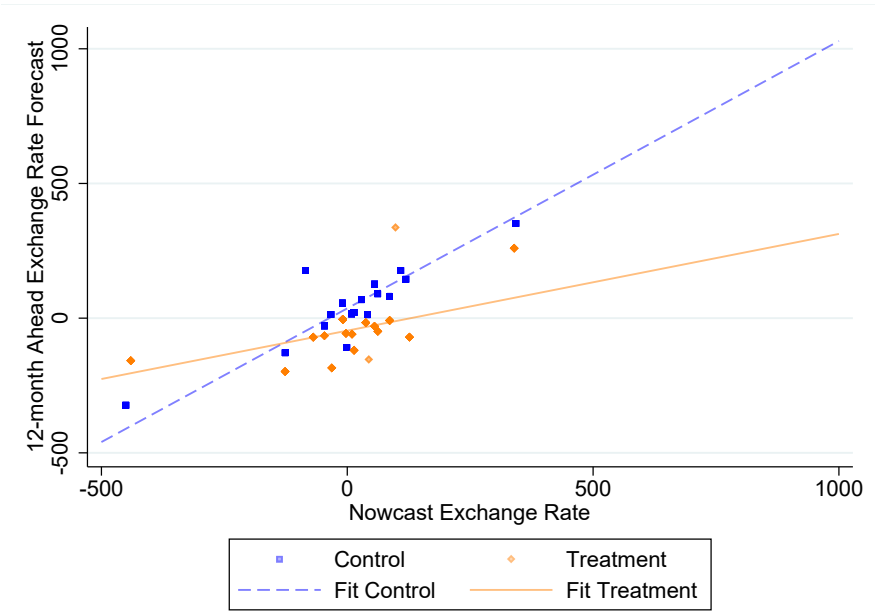


Figure 3: Relationship of Perceptions and Forecasts for Treated and Control Groups: Nominal Exchange Rate

*Note*: This figure shows the cross-sectional relationship between inflation perceptions on the x-axis and 12-months-ahead inflation forecasts on the y-axis using a binned scatterplot. The blue squares depict this relationship for the control group and the dashed blue line provides a linear fit. The orange diamonds depict the same relationship for firms in the control group, and the solid orange line shows the best linear fit. The x-axis and y-axis are expressed in percentage points relative to the monthly average.

large. The significance of that coefficient depends on the treatment of outliers and influential observations. In Column (3) which shows our OLS estimates, the effects are statistically significant at the 5 percent level. When using a Huber regression, the results are statistically significant, and the weight on the prior for the treatment group is roughly half as large as that for the control group. These results mean that the treatment is also successful in decoupling the formation of inflation expectations from current beliefs about the inflation rate even though the treatment was not directly related to the inflation rate.

In the same spirit as Figure 3, Figure 4 offers a graphical representation of the results in Column (3). The x-axis shows the nowcast of inflation in percentage points after controlling for time fixed effects. The y-axis depicts the one-year-ahead inflation rate forecast in percentage points after controlling for time fixed effects. The blue squares and the blue dashed line depict the relationship between nowcasts and forecasts of the inflation rate for firms in the treatment group. The statistical significance behind this relationship is shown in Table 2. The orange diamonds and the solid orange line show the relationship between nowcasts and forecasts of the inflation rate for firms in the treatment group. As was the case for the nominal exchange rate, the treatment

is successful in weakening the relation between nowcasts and forecasts. The extent to which the orange and blue lines have a different slope statistically is shown in the second row of Columns (3) and (4) of Table 2.

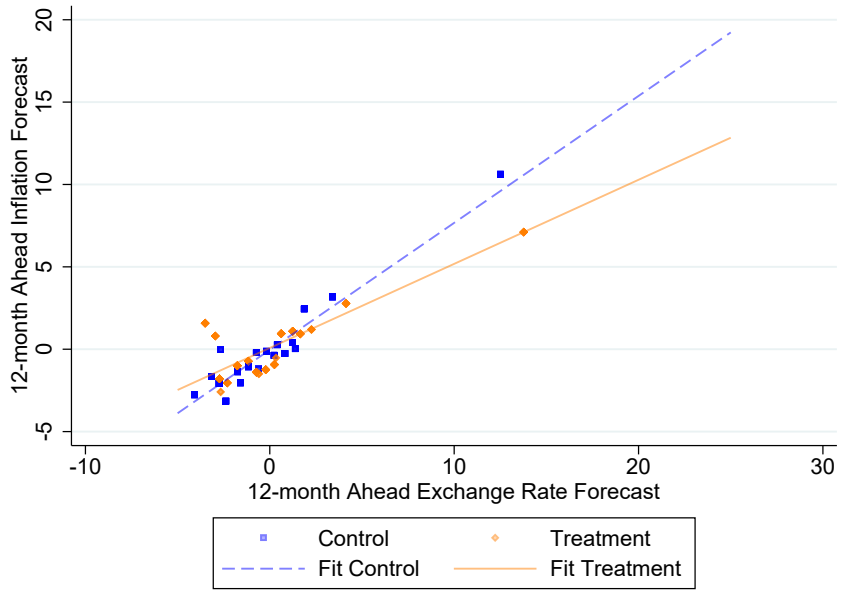


Figure 4: Relation of Perceptions and Forecasts for Treated and Control Groups: Inflation

*Note*: This Figure shows the cross-sectional relation between inflation perceptions in the x-axis and 12-month-ahead inflation forecasts in the y-axis using a binned scatterplot.The blue squares depict this relationship for the control group and the dashed blue line provides a linear fit. The orange diamonds depict the same relation for firms in the control group, and the solid orange line shows the best linear fit. The x-axis and y-axis are expressed in percentage points relative to the monthly average.

Table 2 documents the effects of the treatment on expectation formation for the average firm. Economic theory suggests that in principle there could be substantial heterogeneity in the importance of the signal contained in the treatment across firms. For example, under heterogeneity in the frequency with which firms update their information set in sticky information models (Mankiw and Reis, 2002), heterogeneity in the precision of private signals across firms in noisy information models (Angeletos and La'o, 2013), or heterogeneity in the cost of acquiring information in rational inattention models (Afrouzi, 2023; Sims, 2003), the informational content of a public signal will be heterogeneous. Moreover, not only may awareness about the state of the economy be heterogeneous across firms, but the marginal value of information may also be heterogeneous across firms.

We repeat our estimations after splitting the firms into the sample in two dimensions to inquire about the quantitative relevance of heterogeneous effects. The two sample splits are a broad sectoral definition and the exporting status of the firm. The status of these two variables was

self-reported by the firms before treatment. We stratified the randomization behind the treatment in these two dimensions to ensure that treatment assignment is balanced in these dimensions. We split the sample into firms in the industrial sector and firms in the retail sector. Firms in the industrial sector may self-report themselves to be exporters.

Figure 5 plots the results of the main regression, and details are in Appendix A.1. For brevity we discuss only the estimations using robust regressions in the main text, but Appendix Tables 10 and 11 in Appendix A.1 also include estimations using OLS. Qualitatively, the effects are similar, although the extent of decoupling of expectations from perceptions is stronger for firms in the industrial sector than for firms in the retail sector. For inflation, we estimate a coefficient $\hat{\beta}_3 = -0.33$ for firms in the retail sector, and $\hat{\beta}_3 = -0.5$ for firms in the industrial sector. For the exchange rate we estimate a coefficient $\hat{\beta}_3 = -0.54$ for firms in the Retail sector and $-0.82$ for firms in the industrial sector.

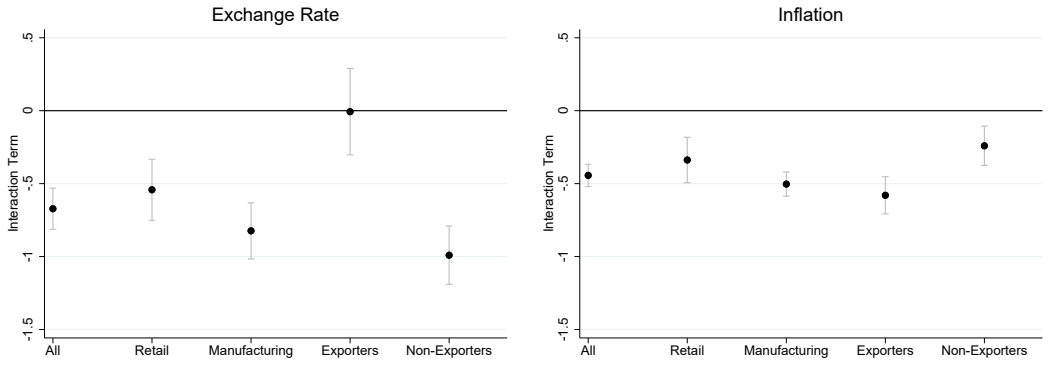


Figure 5: Treatment Effect by Type of Firm

*Note*: The figures show the treatment effect in the prior $\hat{\beta}_3$ for different all firms, retail firms, manufacturing firms, manufacturing exporters, and manufacturing non-exporters. The treatment is randomized at each of these group levels. The left panel shows results for exchange rate expectations and the right panel for inflation expectations The black dots plot the point estimate and the grey lines show 95 percent confidence intervals. Each regression uses Huber weights, includes time fixed effects, and use robust standard errors.

Figure 5 also repeats the analysis splitting firms in the industrial sector between exporters and non-exporters. Details of the regressions are in Appendix Tables 12 and 13 in Appendix A.1. Intuitively, a sanity check is that the effect of the treatment for highly informed firms about the exchange rate should be smaller, and exporters should be such firms. In fact, Table 12 documents that the treatment produces statistically insignificant effects on the formation of exchange rate forecasts for exporters, although it changes the formation of inflation expectations for this subgroup. The extent of decoupling from priors and forecasts of the exchange rate for non-exporter

firms is complete as we estimate a coefficient $\hat{\beta}_3 = -0.991$. The treatment also decouples inflation forecasts from inflation expectations for non-exporting firms, although the effects are weaker.

Finally, Figure 5 also shows the results of our estimations for exporters and non-exporters. Tables 12 and 13 in Appendix A.1 show more details. One caveat is that the sample size is smaller. In general we find similar results for retailers and firms in the industry sector, although the results for inflation expectations are statistically significant when we use OLS for retailers. Within the industry sector, we find that the treatment effect is more relevant for the non-exporter group and small and insignificant for the exporter group. These effects are expected. Firms that export are more exposed to information about the exchange rate, so the treatment information is less effective for them.

### 4.2 Dynamic Causal Effects

One of the main advantages of the panel structure of our research design is that we can estimate equation 1 for $h > 0$, tracing the impulse response functions of the expectations $X^e_{t+h,t+h+\tau}$. Moreover, we can trace the impulse response functions of future nowcasts $X^e_{t+h,t+h}$. In principle, firms may receive substantial information after the period-t survey but before the period-t+1 survey, making the period-t information treatment obsolete. We can test for this possibility by estimating a series of regressions where future forecasts and future perceptions are the dependent variable. For brevity, we report the results of the impulse response estimation using a set of figures.

Figure 6 shows the dynamic causal effects on exchange rate forecasts and nowcasts. The top panel presents the impulse response of the weight allocated to the $h = 0$ before treatment prior on the forecast in period $h$ after treatment. The results for horizon $h = 0$ are the same as those reported in Table 2. The red line shows the point estimate and associated confidence intervals for the control group. The weight that firms assign to the pre-treatment prior decays slowly as time progresses. In particular, the forecasts of exchange rates formed 2 months after the treatment are positively associated with the prior belief in the initial period. For firms in the treatment group not only is the importance of the prior at period 0 lower, as documented before, but starting 1 period after the treatment, there is no association between the pre-treatment prior and the formation of exchange rate expectations. Formation of inflation expectations for both treatment and control groups differs for 2 months after the treatment.

One mechanism to understand the dynamic effects of expectation formation is the persistent effect of the treatment on the formation of current and future beliefs about the economic environ-

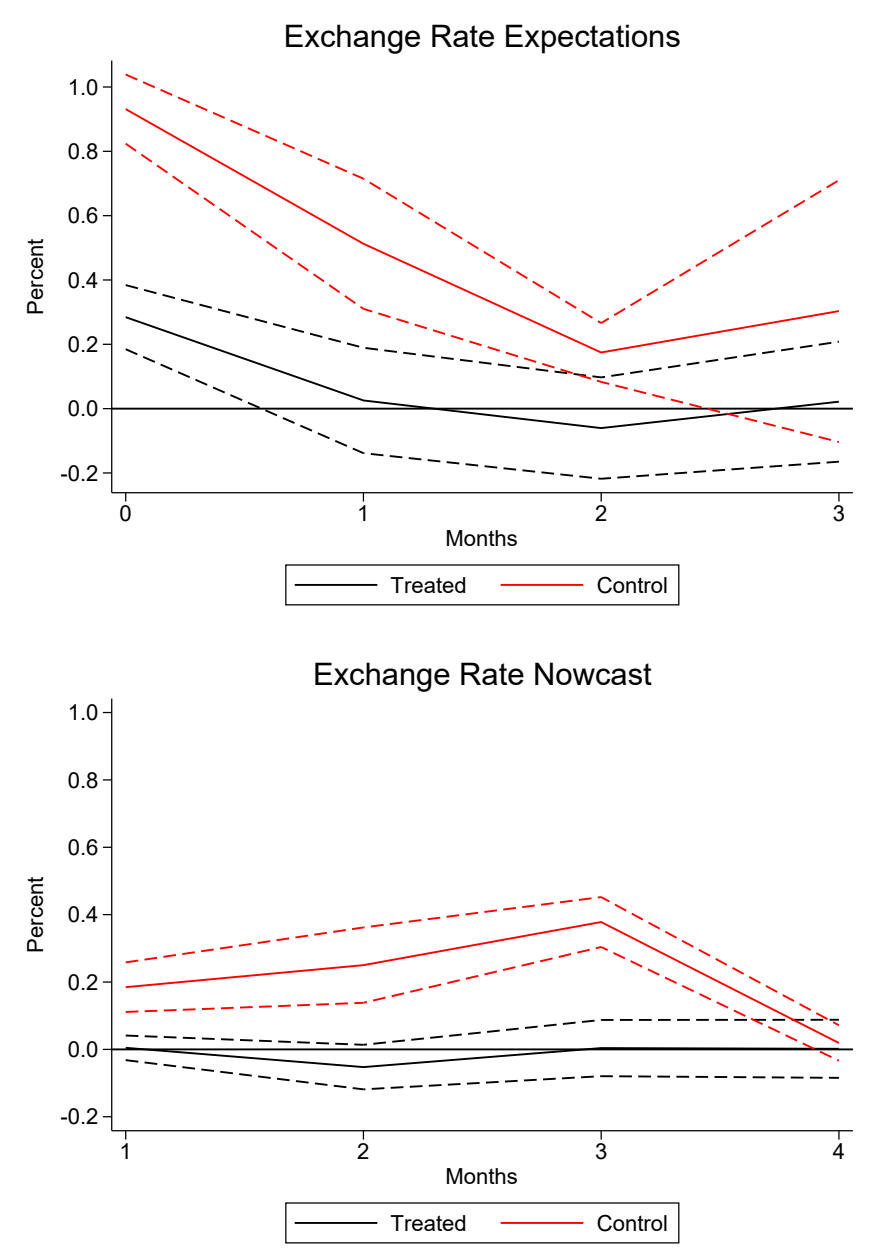


Figure 6: Persistence of Treatment Effects - Nominal Exchange Rates

*Note*: The top panel of this figure shows our estimation of equation 1 for $h \in [0, 3]$ for $S = X$, that is, the one-year-ahead exchange rate forecast formed in $h$ periods after treatment. The solid red line shows the point estimate $\hat{\beta}_2^h$ and its associated 95% confidence bands in dashed lines. The solid black lines represent the estimates for $\hat{\beta}_2^h + \hat{\beta}_3^h$ and the associated confidence intervals in dashed red lines. The bottom panel presents analogous results for the estimation of equation (1), that is, the impulse response functions of priors formed in $\tau$ periods after treatment. We include time fixed effects in every regression and use robust standard errors.

ment. The bottom panel of Figure 6 shows that the treatment not only changes the way firms form their expectations in the future, but it changes the way in which firms form their beliefs about the current state. In particular, firms in the control group have inertial nowcasts, with weights of the

pre-treatment nowcast of roughly 0.2 on future nowcasts. There is no such inertia for firms in the treatment group. We interpret these results as providing support for the finding that the treatment allows firms to update their understanding of the economic environment in which they operate, and these are useful moments for calibrating models of information frictions and endogenous information acquisition at the firm level.

Figure 7 conducts a similar exercise but using information on nowcasts and expectations of the inflation rate. There are some interesting patterns at play. First, the upper panel shows that the importance of current beliefs about inflation do not seem to disappear even three months after treatment, contrary to the behavior of exchange rate forecasts. We hypothesize that this difference has to do with the relative informativeness of signals about exchange rates and inflation rates that firm managers observe in their daily activities, whether they are associated with the firm (exports, imports, debt management), or came from outside the firm (exposure to news about the exchange rate). Unfortunately, we have no way to test this hypothesis. Second, the difference in the weight of the prior between treatment and control groups disappears faster for the inflation rate than for the exchange rate.

The bottom panel of Figure 7 shows that the treatment is less effective in shifting the weight of pre-treatment priors on future prior beliefs. There are statistical differences in period two, but the pattern is less clear compared to the formation of exchange rate nowcasts. Similar to the upper panel, the persistence of pre-treatment priors in future priors is statistically significant even 4 months after treatment.

One of the main contributions of this manuscript is to compute the causal effects of an exchange rate depreciation on expected inflation. There is a large literature estimating the causal effects of shifts in expected inflation both empirically (for a review of articles see Candia, Coibion, and Gorodnichenko, 2023) and theoretically Werning (2022). We estimate an expectational pass-through of an exchange rate depreciation to inflation expectations by estimating the following regression

$$\pi^{e}_{i,t,t+12} = \alpha_t + \alpha_1 \hat{d}^{e}_{i,t,t+12} + \epsilon_i \tag{2}$$

We estimate this specification using an instrumental variable regression in which we instrument an expected depreciation at the firm level with treatment assignment, as in Coibion, Gorod-

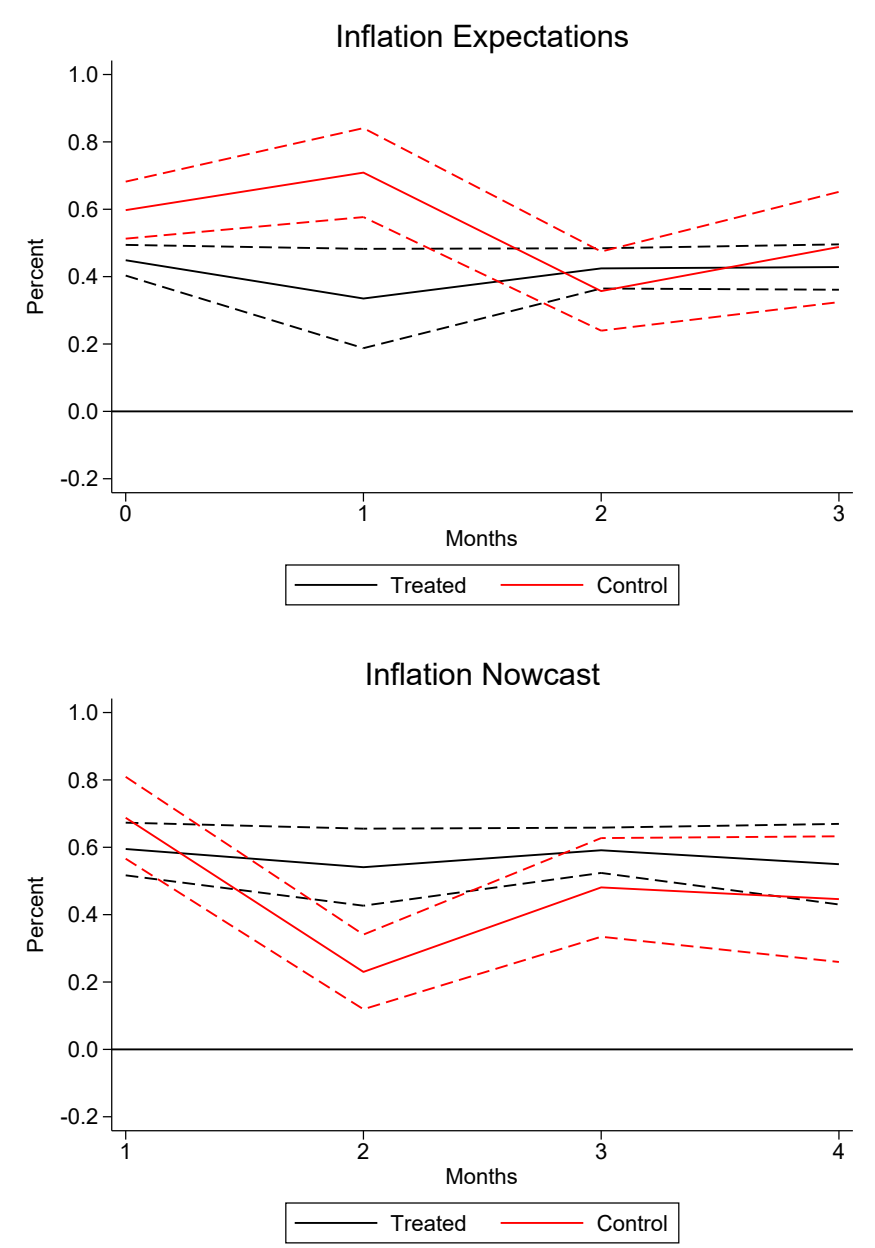


Figure 7: Persistence of Treatment Effect - Inflation Rates

*Note*: The top panel of this figure shows our estimation of equation 1 for $h \in [0,3]$ for $S = \pi$, that is the one-year-ahead inflation rate forecast formed in $h$ periods after treatment. The solid red line shows the point estimate $\hat{\beta}_2^h$ and its associated 95 percent confidence bands in dashed lines. The solid black lines represent the estimates for $\hat{\beta}_2^h + \hat{\beta}_3^h$ and the associated confidence intervals in dashed red lines. The bottom panel presents analogous results for the estimation of equation (1), that is, the impulse response functions of priors formed $\tau$ periods after treatment. We include time fixed effects in every regression and use robust standard errors.

nichenko, and Weber (2022). The exclusion restriction in this specification entails assuming that the treatment about the forecast of exchange rates printed in the monetary policy report affect firm-level inflation expectations through its effect on the formation of exchange rate expectations

at the firm level.

Table 3 presents the results. Columns (1) and (2) present the first-stage results, a regression of expected depreciations at the firm level on treatment assignment. Column (1) does not include a time fixed effect, while Column (2) does. Both columns show a statistically significant effect of treatment assignment on the formation of exchange rate depreciation expectations. Column (3) estimates a simple OLS regression of expected inflation on expected exchange rate depreciations. Column (5) repeats this exercise including time fixed effects. Both columns show null results. They are not statistically significant and economically small. The marginal effect of a 1 percent expected depreciation is associated in these regressions with an increase of 0.01 percent in inflation rate expectations. Columns (4) and (6) estimate an instrumental variable regression, whereas columns (1) and (2) correspond to the first stage. The difference between Columns (4) and (6) is the inclusion of time fixed effects in Column (6). The results are statistically insignificant, although the point estimate is negative and large.

The results from Table 2 suggest that although firms use the information provided in the treatment to form expectations of future expected nominal exchange rates, and although the treatment affects the process by which firms form their inflation expectations (see Columns (3) and (4) of Table 2), those two processes are not systematically related. The positive relationship between exchange rate depreciation and expected inflation in the raw data does not arise from firms expecting that a higher depreciation will cause an increase in inflation.

Table 3: Exchange Rate Pass-through Using Exogenous Variation

| | Expected Depreciation | | Expected Inflation | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | -2.217*** | -2.092*** | | | | |
| | (0.564) | (0.542) | | | | |
| Exp Depreciation | | | 0.015 | -0.120 | 0.015 | -0.128 |
| | | | (0.016) | (0.159) | (0.016) | (0.171) |
| Constant | 1.636*** | | 4.721*** | 4.810*** | | |
| | (0.416) | | (0.171) | (0.205) | | |
| Regression | OLS | OLS | OLS | IV | OLS | IV |
| F Test | | | | 15.465 | | 14.897 |
| Time FE | No | Yes | No | No | Yes | Yes |
| Observations | 681 | 681 | 681 | 681 | 681 | 681 |

*Note*: This table summarizes our estimation of regression 2. The first two columns show the first stage, a regression of expected depreciation at the firm level on treatment status, and they differ in the inclusion of time fixed effects. Columns (3) and (5) show an OLS regression of inflation expectations and expected depreciations. Columns (4) and (6) estimate an IV regression, where an expected depreciation at the firm level is instrumented with the treatment status.

# 5 Causal Treatment Effects on Firm-level Decisions

In this section, we estimate the extent to which the exogenous provision of information about exchange rate forecasts affect firm-level decisions. We link the firms we surveyed with detailed administrative records on the universe of import and export transactions of Colombian firms recorded by the Tax and Customs Office. We start by documenting how treatment assignment affects the dynamics of export and import decisions. These regressions should be interpreted as a reduced form (in the IV language). They capture how an instrument affects some outcomes of interest. Finally, we estimate the elasticity of firm decisions to a 1 percent expected depreciation using an IV approach, where the instrument is the treatment intensity induced by the RCT. This IV regression takes as inputs the reduced-form regressions estimated in this section and the first-stage results estimated in the previous section. Computing the sensitivity of firm-level outcomes to the provision of public information and computing the elasticity of firm outcomes to expected depreciations are the main contributions of this manuscript.

We use administrative data that cover the universe of importing and exporting transactions by Colombian firms. These data are generated by the Tax and Customs National Direction (DIAN in Spanish), and made public by the National Statistical Agency (DANE). The data are made available by firm, month, origin or destination of the transaction, and 8-digit product category. The identity of the firms is made public by stating the tax payment identification number of the firm (NIT in Spanish). The data set contains information on the value of the shipment (free on board), and the gross and net weight of the shipment, which allows us to compute measures of unit prices. For our analysis, we will compute several aggregations of the data, either exploiting time-series variation at the firm level or unpacking this variation between destinations and origins. In particular, we will aggregate origins and destinations in two categories, countries that use the United States dollar as their currency versus other currencies. Notice that these aggregations do not correspond to the currency of invoicing of the transactions –for Colombia, virtually all of transactions are invoiced in dollars (Boz et al., 2022)– but the currency used as legal tender of the origin and destination.

When analyzing the effect of the treatment on exports and imports we will time-aggregate the monthly data to an annual frequency, adding the value of the transaction for a pre-period of 12 months before treatment and a post-period treatment of 12 months after treatment. The reason for time aggregation is that firm exports and imports are notoriously lumpy, with periods of inaction

followed by large spikes. We will estimate results for both the intensive and extensive margin. Among the 680 firms in our sample, 285 of them (42 percent) have exported at some point during the historical data to which we have access (2012-2022). Among the same 680 firms, 480 (71 percent) of them have imported during the same period. Firms vary in the intensity and frequency with which they export and import.

The Colombian case is particularly interesting. Colombia is a country heavily exposed to origins and destinations that use and do not use the United States dollar as their currency. On top of the obvious case of the United States, important origins and destinations for Colombia include Ecuador, Panama, El Salvador, and Puerto Rico, which use the USD as their legal tender. Many important trade partners of Colombia, notably most countries in Latin America, do not use the dollar as their currency. Whenever local firms use the USD as their currency of invoicing, as in the case of Colombia, a depreciation of the USD creates a differential expenditure switching motive for customers located in countries that do not use the USD as their currency. This is a key prediction of the dominant currency pricing (DCP) as argued by Gopinath et al. (2020). Notably Gopinath et al. (2020) use the same underlying micro data we use.

As an additional piece of evidence on the randomization of the treatment assignment, we perform balance tests between treatment and control groups on exporting behavior before treatment assignment. Table 14 shows that there are no discernible statistical differences in the level of overall exports, the level of exports to destinations that use the US dollar, the level of exports to destinations that do not use the US dollar, and the level of overall imports. Table 14 also provides information about the average importing and exporting behavior of firms in our sample. On average, firms run a negative trade balance, importing almost twice as much compared to their exports. They export roughly 22 percent of their exports to destinations that use the US dollar. This result combines the differences in the extensive and intensive margins of exports and imports. In particular, more firms are active importers than active exporters, which is partially explained by the presence of retail firms in our sample.

How does information about expected future exchange rates affect the dynamics of firm-level trade flows? Our first specification is analogous to our estimation of the treatment effects for the formation of expectations. We will test for differential autocorrelation of exports and imports for firms in the treatment versus control groups. Formally, we estimate the following specification

$$Y_{i,22m6,21m7} = \alpha + \beta Y_{i,21m6,20m7} + \theta Y_{i,21m6,20m7} \times T_i + \gamma T_i + \varepsilon_i, \tag{3}$$

where $Y_{i,t_1,t_0}$ is the sum of the realization for an outcome variable $Y$ for firm $i$ between period $t_0$ and $t_1$. We average the monthly realization of variable $Y$ between $t_0$ and $t_1$ for ease of interpretation of our estimated coefficients. For example, $\text{Exports}_{i,22m6,21m7}$ denotes the average level of exports for firm $i$ starting at the treatment period. $T_i$ is a variable that takes a value of 1 if firm $i$ was treated in 2021. Equation 3 estimates the differential autocorrelation between pre-treatment and post-treatment caused by the treatment assignment.

Table 4 shows the results of our estimation. We present results estimated via OLS, and we include time fixed effects to soak any variation driven by the time period in which firms were treated. The results of the estimation when we use Huber robust regressions instead of OLS are similar.

| | All Exports | Exports (USD) | Exports (Others) | All Imports |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $Y_{i,-1,0}$ | 0.924*** | 0.788*** | 0.923*** | 1.182*** |
| | (0.011) | (0.002) | (0.018) | (0.041) |
| $Y_{i,-1,0}$ x $T_i$ | -0.218*** | -0.340** | -0.166*** | -0.193* |
| | (0.014) | (0.081) | (0.018) | (0.068) |
| $T_i$ | 33,186*** | 15,302** | 12,231*** | 49,839*** |
| | (9,322) | (4,491) | (6,029) | (12,485) |
| Constant | -10,441** | 5,125 | -6,039 | -3,386 |
| | (3,442) | (3,818) | (2,309) | (18,510) |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 680 | 680 | 680 | 680 |

Table 4: Treatment Effect on Trade

*Note*: This table shows results of regression (3). Column (1) shows results for all exports in USD. Column (2) shows results for all exports to countries that use the USD. Column (3) shows results for exports to countries that use a local currency different from the USD as their local currency, and column (4) shows results for total imports. The dependant variables are the monthly average of each of these variables for the period from July 2021 to June 2022. The independent variable $Y_{i,-1,0}$ is the monthly average of those variables for the period July 2020 to June 2021. $T_i$ is an indicator that takes a value of one if the firm $i$ received a treatment at any point between August 2021 and November 2022. We include time fixed effects for the date when the firm was first surveyed. Standard errors are clustered at the date of the first survey.

Column (1) of Table 4 presents the estimation of equation 3 when using the overall firm level of exports as outcome variable $Y$. The first row shows the autocorrelation of firm-level exports between pre-treatment and post-treatment periods for firms in the control group. We estimate a statistically significant coefficient of 0.924 which should be interpreted as a strong firm-level inertial component of exports. The coefficient is statistically indistinguishable from 1. In the cross-section of firms in the control group, firms that also exported more pre-treatment, exported more post-treatment.

Our coefficient of interest appears in the second row of Table 4. Firms in the treatment group have a lower autocorrelation of overall exports compared to firms in the control group. The size of the coefficient is economically significant. The inertia of exports is 24% lower for firms in the treatment group than for firms in the control group. Note that our estimate of $\theta$ does not imply that firms in the treatment group are exporting more than firms in the control group; it suggests that the inertial component of exports is lower for firms in the treatment group. In fact, a negative estimate for $\theta$ and a positive estimate for $\gamma$ imply that firms in the treatment group with a lower level of pre-existing exports increased their level of exports, and firms in the treatment group with high export intensities in the pre-period decreased their level of exports compared to firms in the control group with comparable pre-existing exports. For firms with low pre-existing exports, $\gamma$ will be higher than $\theta$ $times Y_{i,21m6,20m7}$, so the marginal effect is positive. The opposite occurs for firms with high $Y_{i,21m6,20m7}$.

Columns (2) and (3) of Table 4 repeat this exercise but using as the variable $Y$, the value of exports as a function of the destination of the exports. We split destinations into two groups: those that use the US dollar as their domestic currency, and those that do not. Note that our data split is not necessarily a function of the currency of invoicing. The vast majority of exports from Colombian firms are denominated in dollars regardless of the currency of the destination country. Column (2) presents the results for destination countries where the US dollar is the legal tender. In addition to the United States, the main destinations that use the US dollar from the perspective of Colombian exporters are Ecuador, Panama, Puerto Rico, and El Salvador. Column (3) presents the results for the rest of the countries.

Splitting exports by the currency of the destination country is informative due to evidence that exports are invoiced in dollars, and the importance of dominant currency pricing for the transmission of national and foreign shocks across economies (see Gopinath et al., 2020). Expenditure switching should be stronger in countries with currencies different than the US dollar when the pricing is in US dollars. Consumers in destinations that use the US dollar do not perceive a change in the dollar price of Colombian exports. We find a stronger effect on exports to destination that price in US dollars.

Column (4) of Table 4 analyzes the behavior of imports. The point estimate of the differential response across treatment arms is similar in magnitude for both imports and for exports (-0.193 vs. -0.218); the results are also statistically significant.

The results of Table 4 should be interpreted as the causal effects of the treatment on the dynam-

ics of exports and imports. This regression is not informative on whether the treatment increased or decreased the patterns of trade of treated versus non-treated firms. We will estimate the causal effects of expected depreciations on the level, not the dynamics, of exports later on this section.

In order to unpack the effects of treatment assignment on exports, we present estimations of specification (3) when we use $Y$ as the the average unit price of exports at the firm level. This regression does not use variation in the size of physical shipments of goods, focusing on the value of the shipment per net kilogram. The estimation of the treatment effects on the unit prices only uses data for firms that exported positive quantities in both the pre-period and the post-period.

Table 5 shows the results. A key prediction of the dominant currency pricing literature is the differential incentives for expenditure switching of customers in non-USD destinations of local (in this case Colombian) exports after an appreciation of the United States dollar. These differential demand effects imply that Colombian exporters have higher incentives to reset their prices to non-USD destinations compared to USD destinations. This is consistent with the estimated effects in Table 5. Firms reset prices to non-USD destinations, with effects an order of magnitude larger than for USD destinations.

| | All Exports | Exports (USD) | Exports (Others) |
|---|---|---|---|
| | (1) | (3) | (2) |
| $P_{i,-1,0}$ | 0.840*** | 0.219 | 0.631*** |
| | (0.129) | (0.234) | (0.175) |
| $P_{i,-1,0}$ x $T_i$ | -0.551*** | 0.353 | -0.510*** |
| | (0.130) | (0.408) | (0.183) |
| $T_i$ | -15.211 | -231.281 | -15.130 |
| | (161.698) | (191.301) | (121.089) |
| Time FE | Yes | Yes | Yes |
| Observations | 225 | 192 | 179 |

Table 5: Treatment Effect on Unit Prices

*Note*: This table shows results of regression (3), but using unit prices instead of total exports or imports. Column (1) shows results for unit prices of all exports in USD. Column (2) shows results for unit prices of all exports to countries that use the USD. Column (3) shows results for unit prices of exports to countries that use a local currency different from the USD. The dependent variables are the monthly average of each of these variables for the period July 2021 to June 2022. The independent variable $Y_{i,-1,0}$ is the monthly average of those variables for the period July 2020 to June 2021. $T_i$ is an indicator that takes a value of one if the firm $i$ received a treatment at any point between August 2021 and November 2022. We drop 1 percent of the observations for each pre- and post-treatment variable. We include time fixed effects for the date when the firm was first surveyed and robust standard errors.

We next estimate the elasticity of firm outcomes to a 1 percent depreciation using a two-stage least squares regression. In the first stage, we follow Coibion et al. (2023) and estimate a regression of the log exchange rate forecast on the exchange rate nowcast interacted by the treatment

| | First Stage | | IV Estimates | | | |
|---|---|---|---|---|---|---|
| | $\log \text{Imports}_{0,1}$ | $\log \text{Exports}_{0,1}$ | $\log \text{Imports}_{0,1}$ | $\log \text{Exports}_{0,1}$ | $\log \text{Imports}_{0,1}$ | $\log \text{Imports}_{0,1}$ |
| $T_i$ | -1.976*** | -1.183 | | | | |
| | (0.459) | (0.859) | | | | |
| $\log S^e_{i,0,0} \times T_i$ | 0.237*** | 0.142 | | | | |
| | (0.056) | (0.104) | | | | |
| $\log S^e_{i,0,1}$ | | | 8.300** | 6.585 | 1.501 | 12.301*** |
| | | | (3.346) | (6.465) | (2.323) | (4.629) |
| $\log \text{Imports}_{-1,0}$ | | | 0.998*** | | 1.008*** | 0.946*** |
| | | | (0.025) | (0.034) | (0.031) | (0.034) |
| $\log \text{Exports}_{-1,0}$ | | | | 0.949*** | | |
| N | 451.0 | 230.0 | 451.0 | 230.0 | 230 | 221 |
| Sample | Importers | Exporters | Importers | Exporters | Exporters | Non Exporters |
| F-Test | | | 15.90 | 2.18 | 5.84 | 14.33 |

Table 6: Expected Depreciation Effect on Trade Decisions

*Note*: This table shows the results of regressions for the effect of exchange rate on exports and imports decisions. Column (1) shows first stage of the instrument into the posterior exchange rate, as in Coibion et al. (2023) for the sample of imports. Column (2) shows the first stage for the sample of exporters. Column (3) shows results for the IV for log imports. Column (4) shows results for log exports. Column (5) shows results for imports for the sample of imports that were also exported in the baseline period and Column (6) shows results for the sample of importers that did not export in the baseline period. The independent variable is the log of the expected exchange rate. We include time fixed effects for the date when the firm was first surveyed and the Huber weights obtained in Column (1). We use robust standard errors.

assignment dummy. In the second stage, we estimate a regression of the log level of outcomes in the year after treatment on the log forecast of the exchange rate. In every regression we use the pre-existing level of the outcome as a control. The interpretation of the coefficient of interest is an elasticity of a firm outcome, for example imports, to a 1 percent exogenous expected depreciation.

Table 6 presents the results. The first two columns present the results of the first stage. Consistent with the results of previous sections, the treatment has weak effects on shifting exchange rate expectations, as is clear from the estimates in Column 2, which are not statistically significant. This is not the case for imports. We will discuss our treatment of a weak instrument problem later in this section.

Columns (3) and (4) present our main results. A 1 percent expected future depreciation has a causal effect of an increase of 8.3 percent on firm imports. This effect is statistically significant, and the F stat of the first stage is equal to 15.9. The results for exports are similar in magnitude but not statistically significant, and the F stat is very low, indicative of a weak instrument problem. Columns (5) and (6) unpack the results of Column (3). The elasticity we estimate is explained by a large elasticity of imports to future expected depreciations of importer firms that do not export. The results for importers that export are statistically insignificant and the instrument has a low F stat, consistent with the results in Column 4.

The F stats we presented for imports are above rule-of-thumb values of 10 often used in the lit-

erature. However, due to heteroskedasticity and autocorrelation that invalidate standard metrics, we run weak instrument tests robust to heteroskedasticity and autocorrelation developed by Olea and Pflueger (2013). The effective F statistic for imports is equal to 14.6, larger than the threshold for a worse-case-scenario bias of 10 percent, which is equal to 11.81. We also provide weak instrument robust Anderson-Rubin confidence intervals. We reject elasticities lower than 1.5. We confirm that the instrument is weak for exports, and the AR confidence intervals include the full real line.

The elasticity of imports to expected depreciations that we estimate is a partial equilibrium elasticity that combines many structural parameters. There are at least three forces worth mentioning. First, a future expected depreciation increases future marginal costs and should decrease firm size and the demand for imported inputs. Second, the same force should create substitution away from imported inputs into local inputs. Finally, an expected future depreciation increases incentives to stock up before prices increase, increasing present demand input. We estimate a positive elasticity, implying that the third channel is stronger than the sum of the first two channels.

# 6 Conclusions

In this paper we measure and evaluate the effect of firm expectations on their decisions in an emerging economy. We show that firms in Colombia are relatively informed about the inflation rate, as in developed countries, but they are much more informed and have less disagreement about the exchange rate compared to the inflation rate. We also show that information about the forecast of the exchange rate by professional forecasters influences their expectations about prices and affects firms' economic decisions.

Thanks to the quality of the data, we are able to link our sample to administrative records about the firms. We measure the effect of the information treatment on actual decisions of the firms, which many papers in the literature struggle to do. In this paper, we show that firms' expectations matter for their decisions and that simple information treatments are effective in influencing them.

We also explore the role of limited attention in international economics –most models that look at firms' decisions focus on their pricing decisions– but do not explore how departures from full information rational expectations can affect those findings. In this paper we show that in a country that mostly uses the USD to price its exports, firms still disagree on the value of that price in the next 12 months. Simple information treatment can help to increase firms' agreement and affect their decisions. The findings of this paper show that exploring those deviations from full infor-

mation is important and that central banks, focusing on certain salient prices, might be effective in influencing firms' decisions, even those of managers of relatively large firms.

## References


Abberger, Anne-Kathrin, Klaus amd Funk, Michael Lamla, Sarah Lein, and Stefanie Siegrist. 2023. "Inflation-expectation Pass-Through into Prices and Wages: Evidence from an RCT Survey." Tech. rep., Manuscript.

Afrouzi, Hassan. 2023. "Strategic inattention, inflation dynamics, and the non-neutrality of money." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w31796.

Amiti, Mary, Oleg Itskhoki, and Jozef Konings. 2022. "Dominant currencies: How firms choose currency invoicing and why it matters." *The Quarterly Journal of Economics* 137 (3):1435–1493. https://doi.org/10.1093/qje/qjac004.

Angeletos, George-Marios and Jennifer La'o. 2013. "Sentiments." *Econometrica* 81 (2):739–779. https://doi.org/10.3982/ECTA10008.

Armantier, Olivier, Scott Nelson, Giorgio Topa, Wilbert Van der Klaauw, and Basit Zafar. 2016. "The price is right: Updating inflation expectations in a randomized price information experiment." *Review of Economics and Statistics* 98 (3):503–523. https://doi.org/10.1162/REST_a_00499.

Auer, Raphael, Ariel Burstein, and Sarah M Lein. 2021. "Exchange rates and prices: Evidence from the 2015 Swiss franc appreciation." *American Economic Review* 111 (2):652–686. https://doi.org/10.1257/aer.20181415.

Bouscasse, Paul. 2022. "Canst Thou Beggar Thy Neighbour? Evidence from the 1930s." Tech. rep., Working Paper, Cambridge University.

Boz, Emine, Camila Casas, Georgios Georgiadis, Gita Gopinath, Helena Le Mezo, Arnaud Mehl, and Tra Nguyen. 2022. "Patterns of invoicing currency in global trade: New evidence." *Journal of international economics* 136:103604. https://doi.org/10.1016/j.jinteco.2022.103604.

Buchheim, Lukas, Sebastian Link, and Sascha Mohrle. 2023. "Wage Expectations of Firms and Employees." Tech. rep., Manuscript.

Burstein, Ariel, Martin Eichenbaum, and Sergio Rebelo. 2005. "Large devaluations and the real exchange rate." *Journal of Political Economy* 113 (4):742–784. https://doi.org/10.1086/431254.

Burstein, Ariel and Gita Gopinath. 2014. "International prices and exchange rates." In *Handbook of International Economics*, vol. 4. Elsevier, 391–451. https://doi.org/10.1016/B978-0-444-54314-1.00007-0.

Candia, Bernardo, Olivier Coibion, and Yuriy Gorodnichenko. 2021. "The Inflation Expectations of US Firms: Evidence from a new survey." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w28836.

———. 2023. "The macroeconomic expectations of firms." In *Handbook of Economic Expectations*. Elsevier, 321–353. https://doi.org/10.1016/B978-0-12-822927-9.00018-5.

Candia, Bernardo and Mathieu Pedemonte. 2021. "Export-led decay: The trade channel in the gold standard era." *FRB of Cleveland Working Paper No. 21-11r* https://doi.org/10.26509/frbc-wp-202111.

Cavallo, Alberto, Guillermo Cruces, and Ricardo Perez-Truglia. 2017. "Inflation expectations, learning, and supermarket prices: Evidence from survey experiments." *American Economic*

*Journal: Macroeconomics* 9 (3):1–35. https://doi.org/10.1257/mac.20150147.

Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, and Maarten Van Rooij. 2023. "How does consumption respond to news about inflation? Field evidence from a randomized control trial." *American Economic Journal: Macroeconomics* 15 (3):109–152. https://doi.org/10.1257/mac.20200445.

Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar. 2018. "How do firms form their expectations? New survey evidence." *American Economic Review* 108 (9):2671–2713. https://doi.org/10.1257/aer.20151299.

Coibion, Olivier, Yuriy Gorodnichenko, and Tiziano Ropele. 2020. "Inflation expectations and firm decisions: New causal evidence." *The Quarterly Journal of Economics* 135 (1):165–219. https://doi.org/10.1093/qje/qjz029.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber. 2022. "Monetary Policy Communications and Their Effects on Household Inflation Expectations." *Journal of Political Economy* 130 (6):1537–1584. https://doi.org/10.1086/718982.

Crucini, Mario J, Mototsugu Shintani, and Takayuki Tsuruga. 2010. "Accounting for persistence and volatility of good-level real exchange rates: The role of sticky information." *Journal of International Economics* 81 (1):48–60. https://doi.org/10.1016/j.jinteco.2010.01.003.

———. 2020. "A behavioral explanation for the puzzling persistence of the aggregate real exchange rate." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w27420.

D'Acunto, Francesco and Michael Weber. 2022. "Memory and beliefs: Evidence from the field." *Work. Pap., Univ. Chicago Google Scholar Article Location* .

Devereux, Michael B and Charles Engel. 2007. "Expenditure switching versus real exchange rate stabilization: Competing objectives for exchange rate policy." *Journal of Monetary Economics* 54 (8):2346–2374. https://doi.org/10.1016/j.jmoneco.2006.12.013.

Egorov, Konstantin and Dmitry Mukhin. 2023. "Optimal policy under dollar pricing." *American Economic Review* 113 (7):1783–1824. https://doi.org/10.1257/aer.20200636.

Frache, Serafin, Rodrigo Lluberas, Mathieu Pedemonte, and Javier Turen. 2023. "The Transmission of International Monetary Policy Shocks on Firms' Expectations." *FRB of Cleveland Working Paper* https://doi.org/10.26509/frbc-wp-202301.

Frache, Serafin, Rodrigo Lluberas, and Javier Turen. 2024. "Belief-dependent pricing decisions." *Economic Modelling* 132:106630. https://doi.org/10.1016/j.econmod.2023.106630.

Fukui, Masao, Emi Nakamura, and Jón Steinsson. 2023. "The Macroeconomic Consequences of Exchange Rate Depreciations." https://doi.org/10.3386/w31279.

Gali, Jordi and Tommaso Monacelli. 2005. "Monetary policy and exchange rate volatility in a small open economy." *The Review of Economic Studies* 72 (3):707–734. https://doi.org/10.1111/j.1467-937X.2005.00349.x.

Garciga, Christian, Edward S Knotek II, Mathieu Pedemonte, and Taylor Shiroff. 2023. "The Survey of Firms' Inflation Expectations." *Economic Commentary* (2023-10). https://doi.org/10.26509/frbc-ec-202310.

Gopinath, Gita, Emine Boz, Camila Casas, Federico J Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller. 2020. "Dominant currency paradigm." *American Economic Review* 110 (3):677–719. https://doi.org/10.1257/aer.20171201.

Gopinath, Gita, Oleg Itskhoki, and Roberto Rigobon. 2010. "Currency choice and exchange rate pass-through." *American Economic Review* 100 (1):304–336. https://doi.org/10.1257/aer.100.1.304.

Huber, Peter J. 1964. "Robust estimation of a location parameter." *Annals of Mathematical Statistics* 35:73–101. https://doi.org/10.1214/aoms/1177703732.

Ilzetzki, Ethan, Carmen M Reinhart, and Kenneth S Rogoff. 2019. "Exchange arrangements entering the twenty-first century: Which anchor will hold?" *The Quarterly Journal of Economics* 134 (2):599–646. https://doi.org/10.1093/qje/qjy033.

Jonung, Lars. 1981. "Perceived and expected rates of inflation in Sweden." *The American Economic Review* 71 (5):961–968. https://www.jstor.org/stable/1803477.

Link, Sebastian, Andreas Peichl, Christopher Roth, and Johannes Wohlfart. 2023. "Information frictions among firms and households." *Journal of Monetary Economics* 135:99–115. https://doi.org/10.1016/j.jmoneco.2023.01.005.

Maćkowiak, Bartosz and Mirko Wiederholt. 2009. "Optimal sticky prices under rational inattention." *American Economic Review* 99 (3):769–803. https://doi.org/10.1257/aer.99.3.769.

Mankiw, N Gregory and Ricardo Reis. 2002. "Sticky information versus sticky prices: A proposal to replace the New Keynesian Phillips curve." *The Quarterly Journal of Economics* 117 (4):1295–1328. https://doi.org/10.1162/003355302320935034.

Olea, José Luis Montiel and Carolin Pflueger. 2013. "A robust test for weak instruments." *Journal of Business & Economic Statistics* 31 (3):358–369. https://doi.org/10.1080/00401706.2013.806694.

Savignac, Frédérique, Erwan Gautier, Yuriy Gorodnichenko, and Olivier Coibion. 2021. "Firms' Inflation Expectations: New Evidence from France." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w29376.

Sims, Christopher A. 2003. "Implications of rational inattention." *Journal of Monetary Economics* 50 (3):665–690. https://doi.org/10.1016/S0304-3932(03)00029-1.

Weber, Michael, Bernardo Candia, Tiziano Ropele, Rodrigo Lluberas, Serafin Frache, Brent H Meyer, Saten Kumar, Yuriy Gorodnichenko, Dimitris Georgarakos, Olivier Coibion, Kenny Geoff, and Jorge Ponce. 2023. "Tell me something I don't already know: Learning in low and high-inflation settings." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w31485.

Werning, Iván. 2022. "Expectations and the Rate of Inflation." Tech. rep., National Bureau of Economic Research. https://doi.org/10.3386/w30260.

# A Appendix

## A.1 Other Tables

| Variable | Obs | Mean | Median | Std. Dev. | p25 | p75 |
|---|---|---|---|---|---|---|
| Perceived Exchange Rate | 383 | 3,896 | 3,900 | 234.0 | 3,850 | 3,960 |
| Perceived Inflation | 383 | 3.231 | 3.000 | 3.490 | 1.000 | 4.000 |
| Expected Exchange Rate | 383 | 3,880 | 3,900 | 258.7 | 3,700 | 4,000 |
| Expected Inflation | 383 | 4.256 | 3.500 | 3.352 | 2.000 | 5.000 |

Table 7: Distribution of Main Variables

*Note*: This table presents summary statistics about the main variable of the survey in July 2021, before any information treatment was included in the sample. We trim answers that have inflation answers below -2% and above 30% (below the 1st percentile and above the 99th percentile of nowcasts in August 2021). We also drop extreme answers about the exchange rate (above 10,000 and below 1,000).

| | Obs | | Average (SD) | | | |
|---|---|---|---|---|---|---|
| Variable | T | C | T | C | Diff | P-Value ($\neq 0$) |
| Perceived ER (2021m7) | 133 | 147 | 3876.6 | 3912.6 | 35.992 | 0.191 |
| | | | (12.485) | (23.572) | | |
| Expected ER (2021m7) | 133 | 147 | 3886.4 | 3899.1 | 12.711 | 0.679 |
| | | | (22.165) | (21.261) | | |
| Perceived Inflation (2021m7) | 133 | 147 | 3.412 | 3.243 | -0.169 | 0.693 |
| | | | (0.310) | (0.296) | | |
| Expected Inflation (2021m7) | 133 | 147 | 4.634 | 3.964 | -0.670 | 0.106 |
| | | | (0.327) | (0.246) | | |

Table 8: Balance between Treatment and Control for Nowcast, forecast and Trade Variables.

*Note*: This table provides a summary of a series of balance tests on the main variables, the perceived and expected exchange rate (ER) and inflation, in the baseline period (July 2021). The first two columns show the number of firms in each group, Treated (T) and Control (C). The third and fourth columns compute the average of each variable and show the standard deviation of each variable in parenthesis. The fifth column shows the difference between the third and fourth columns. The final column shows the p-value associated with the hypothesis that tests for equality of means across treatment and control groups.

| | Average | Standard Deviation | Forecast Error |
|---|---|---|---|
| Nowcast Exchange Rate | | | |
| Professional Forecasters | \$3874 | \$55.89 | \$105.9 |
| Firms | \$3921 | \$204.9 | \$45.43 |
| Firms Treated | \$3917 | \$156.9 | \$41.14 |
| Firms Control | \$3924 | \$222.5 | \$48.93 |
| Forecast Exchange Rate | | | |
| Professional Forecasters | \$3734 | \$133.2 | \$854.4 |
| Firms | \$3980 | \$329.4 | \$634.4 |
| Firms Treated | \$3973 | \$273.4 | \$635.2 |
| Firms Control | \$3985 | \$352.7 | \$632.5 |
| Nowcast Inflation | | | |
| Professional Forecasters | 6.65% | 0.14% | 0.01% |
| Firms | 4.48% | 4.23% | 2.18% |
| Firms Treated | 4.74% | 4.14% | 1.92% |
| Firms Control | 4.34% | 4.25% | 2.31% |
| Forecast Inflation | | | |
| Professional Forecasters | 4.10% | 0.55% | 8.19% |
| Firms | 5.76% | 4.60% | 6.54% |
| Firms Treated | 5.63% | 4.06% | 6.67% |
| Firms Control | 5.84% | 4.87% | 6.43% |
| Professional Forecasters (from 2019m1) | 3.40% | 0.37% | 3.92% |
| Firms (from 2019m1) | 4.87% | 4.76% | 3.31% |

Table 9: Descriptive Statistics for Firms and Professional Forecasters

*Note*: This table summarizes the average nowcast and forecast for the nominal exchange rate between the Colombian peso and the US dollar and headline CPI inflation in Colombia for a sample of professional forecasters surveyed by the Colombian central bank, firm managers in our sample, and the same managers in the treatment and control groups. The third column titled *Forecast Error* shows the difference between the forecast of a given variable and its realization. We use data from July 2021 to June 2022. A firm included in the category "Firms Treated" is a firm that received a treatment at any point between August 2021 and November 2021, and a firm included in the category"Firms Control" is a firm that did not receive a treatment between August 2021 and November 2021.For inflation forecasts, we have data from January 2021 to June 2022. We use trimming procedures as explained in the main text.

| | Exchange Rate | | Inflation | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Prior | 1.014*** | 0.901*** | 0.887*** | 0.807*** |
| | (0.188) | (0.065) | (0.133) | (0.056) |
| Prior x Treatment | -0.557** | -0.542** | -0.444** | -0.338** |
| | (0.247) | (0.103) | (0.137) | (0.061) |
| I.Treatment | 2,012** | 1,997*** | 1.288* | 0.911*** |
| | (905.8) | (380.0) | (0.413) | (0.139) |
| Constant | 38.56 | 418.9 | 1.723** | 1.234*** |
| | (703.0) | (240.7) | (0.391) | (0.117) |
| Sample | Retail | Retail | Retail | Retail |
| Regression | OLS | Huber | OLS | Huber |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 299 | 293 | 299 | 284 |
| R-squared | 0.250 | 0.441 | 0.301 | 0.646 |

Table 10: Treatment Effect for Retail Sector

*Note*: This table summarizes our estimation of equation 1, firms in the retail sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

| | Exchange Rate | | Inflation | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Prior | 0.920*** | 0.994*** | 0.727*** | 0.924*** |
| | (0.129) | (0.075) | (0.043) | (0.039) |
| Prior x Treatment | -0.633* | -0.824*** | -0.170* | -0.503*** |
| | (0.210) | (0.095) | (0.054) | (0.033) |
| I.Treatment | 2,358*** | 3,073*** | 1.041** | 1.628*** |
| | (795.1) | (359.1) | (0.240) | (0.238) |
| Constant | 338.2 | 61.61 | 1.947*** | 0.812*** |
| | (481.2) | (281.6) | (0.161) | (0.054) |
| Sample | Industry | Industry | Industry | Industry |
| Regression | OLS | Huber | OLS | Huber |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 382 | 368 | 382 | 364 |

Table 11: Treatment Effect for Industry Sector

*Note*: This table summarizes our estimation of equation 1, firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

| | Exchange Rate | | Inflation | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Prior | 0.517 | 0.812*** | 0.863*** | 0.963*** |
| | (0.249) | (0.116) | (0.064) | (0.050) |
| Prior x Treatment | -0.186 | -0.007 | -0.321*** | -0.580*** |
| | (0.224) | (0.179) | (0.048) | (0.056) |
| I.Treatment | 664.6 | -43.69 | 1.875** | 1.835*** |
| | (832.5) | (668.1) | (0.448) | (0.267) |
| Constant | 1,860** | 748.2 | 1.342*** | 0.564*** |
| | (948.4) | (433.7) | (0.182) | (0.118) |
| Sample | Exporters | Exporters | Exporters | Exporters |
| Regression | OLS | Huber | OLS | Huber |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 206 | 194 | 206 | 192 |

Table 12: Treatment Effect for Exporters in Industry Sector

*Note*: This table summarizes our estimation of equation 1, for exporting firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

| | Exchange Rate | | Inflation | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Prior | 1.023*** | 1.031*** | 0.664*** | 0.929*** |
| | (0.041) | (0.052) | (0.047) | (0.031) |
| Prior x Treatment | -0.920*** | -0.991*** | -0.086 | -0.241*** |
| | (0.062) | (0.099) | (0.081) | (0.061) |
| I.Treatment | 3,430*** | 3,696*** | 0.294 | 1.001* |
| | (219.5) | (379.5) | (0.465) | (0.386) |
| Constant | -23.70 | -68.81 | 2.421*** | 0.974*** |
| | (162.7) | (197.0) | (0.156) | (0.066) |
| Sample | Non Exporters | Non Exporters | Non Exporters | Non Exporters |
| Regression | OLS | Huber | OLS | Huber |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 168 | 161 | 168 | 162 |

Table 13: Treatment Effect for Non-Exporters in Industry Sector

*Note*: This table summarizes our estimation of equation 1, for non-exporting firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, we use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

| | Observations | | Average (SD) | | | |
|---|---|---|---|---|---|---|
| Variable | Treated | Control | Treated | Control | Diff | P-Value ($\neq 0$) |
| All Exports | 298 | 382 | 206,740 | 276,432 | 69,692 | 0.667 |
| | | | (107,642 ) | (113,339) | (159,710) | |
| Exports to USD | 298 | 382 | 56,239 | 80,971 | 24,731 | 0.534 |
| | | | (17,348) | (32,384) | (39,742) | |
| Exports to Others | 298 | 382 | 150,501 | 195,461 | 44,960 | 0.732 |
| | | | (91,180) | (91,365) | (131,099) | |
| All Imports | 298 | 382 | 526,482 | 406,159 | -120,323 | 0.395 |
| | | | (105,476) | (93,763) | ( 141,239) | |

Table 14: Balance between Treatment and Control for Trade Variables.

*Note*: This table provides a summary of a series of balance tests on the levels of exports, the level of exports to destinations that use the United States dollar as legal tender, exports to destinations that do not use the United States dollar as legal tender, and the level of exports at the firm level for firms in the treatment and control groups. The first two columns show the number of firms in each group. The third and fourth columns compute the average of each variable and show the standard deviation of each variable in parenthesis. The fifth column shows the difference between the third and fourth columns. The final column shows the p-value associated with the hypothesis that tests for equality of means across treatment and control groups.