The Causal Effects of Expected Depreciations*

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Abstract

We estimate the causal effects of shifts in future exchange rates on the import demand for Colombian firms. We create a novel measure of one-year-ahead exchange rate forecasts and nowcasts for non-financial firms. A randomly assigned group received a publicly available exchange rate forecast. This information persistently shifted expectations and perceptions, with stronger effects for non-exporting firms. Linking survey responses with the universe of import transactions, we estimate a positive intertemporal elasticity of import demand to future expected input costs. Our findings highlight the role of intertemporal substitution after anticipated changes in trade costs.

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1 Introduction

The nominal exchange rate of a local currency vis-à-vis the US dollar (USD) is a crucial price for open economies, as shifts in this price directly affect firms' revenues and input costs (Gopinath, Itskhoki, and Rigobon, 2010; Auer, Burstein, and Lein, 2021) and indirectly affect economic policy implementation and the determination of prices in general equilibrium (GE) (Gali and Monacelli, 2005). Future expected exchange rates are an essential determinant of current price-setting, production, and import demand for forward-looking firms.

Despite a rich qualitative understanding of the mechanisms that determine firms' reactions to changes in current and expected future exchange rates—where concepts such as expenditure switching, nominal rigidities, inventory holding costs, and currency of invoicing play an important role—assessing the empirical causal effects of anticipated future currency depreciations on firm outcomes poses a significant empirical challenge. 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. Using a nationally representative monthly panel survey of firm managers in Colombia, we collect one-year-ahead exchange rate forecasts and nowcasts.[1] Notably, Colombia heavily relies on dollar invoicing for both exports and imports, indicating the dollar's

[1] "Nowcasts" and "perceptions" are used interchangeably throughout the paper. They denote the perceived exchange rate at which firms anticipate conducting transactions using the local currency relative to the USD in the current week.

dominant role in the country's international trade (Gopinath et al., 2020). To solve the identification challenge, we introduce an information treatment to a random sub-sample of firms that induces exogenous variation in future expected depreciations across firms. As a result, 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 a randomized control trial (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 current devaluations (Burstein, Eichenbaum, and Rebelo, 2005), as in the existing literature.

We link the survey responses with administrative records measure the extent to which they changed their behavior due to the experiment. The dynamic aspect of the variation induced by our RCT allows us to measure an *intertemporal elasticity of import demand*. Importer firms learn in the present that the local-currency denominated price of their imports will change at a future date. Some firms will receive news of a future expected increase in input prices, while others will receive news of a future expected decrease. The heterogeneity induced by a common information shock is a function of the pre-existing dispersion in beliefs about the future exchange rate. Therefore, economically, the elasticities we measure in the data not only include the widely studied effect of changes in foreign input prices on firm scale in the long run, or the substitution across inputs sourced from different origins, but, crucially, they also include an intertemporal elasticity of foreign input demand.

Firms that receive an expected depreciation shock will anticipate their expenditures, while those that receive an expected appreciation shock will postpone their import expenditures compared to similar firms in the control group. This intertem-

poral elasticity of foreign inputs demand is conceptually different to the trade elasticity that measures the reaction of trade flows after a change in trade costs in the cross-section of import origins. The reason is that the universe of import transactions in Colombia are denominated in dollars, and as a consequence, a change in the COP-USD exchange rate will change import costs from the universe of origins.

Although less studied in the international trade literature, the intertemporal elasticity of import demand is conceptually related to the intertemporal elasticity of demand in the investment and durable consumption literature (House and Shapiro, 2008; McKay and Wieland, 2021). Our design offers the added benefit of having very clean identifying assumptions and serves as a crucial input to models of durable import behavior, as discussed in Alessandria, Kaboski, and Midrigan (2010). While other works have attempted to estimate this intertemporal elasticity (Khan and Khederlarian, 2021), we are the first to measure firm-level expectations and actions after a clean intervention, and more generally, this paper belongs to the very small subset of papers that have linked survey expectations with measured actions outside the survey (Coibion et al., 2020).

One of the main advantages of our approach is that it isolates the direct effects of changes in exchange rates from indirect GE effects and policy reactions that current exchange rate movements induce. For example, following an exchange rate depreciation, monetary policy rates could adjust in response to the GE pass-through of the exchange rate to local inflation. Additionally, the local central bank's response to inflation shifts will influence the form and magnitude of this adjustment. Therefore, the estimated effects of an exchange rate movement in the time series will be a combination of the direct, indirect (GE), and policy reaction effects. Our approach effectively shuts down the reaction of aggregate quantities and prices in the present, preserving the expected direct and indirect effects of exchange rate shocks.[2] Our estimates are natural well-identified moments (Naka-

[2]Andre et al. (2022) shows that economic agents can interpret the same macro information differently as a function of the mental model they use. We do not restrict the set of admissible

mura and Steinsson, 2018) to target in dynamic models of international finance and trade with forward-looking firms(Alessandria, Arkolakis, and Ruhl, 2021; Egorov and Mukhin, 2023; Alessandria, Khan, and Khederlarian, 2024; Chen et al., 2024; Boehm et al., 2024).

We first survey firm managers in the baseline period and find that they demonstrate significantly greater awareness of the current exchange rate level than the current inflation rate. Although there is considerable disagreement on the exchange rate's future level, it is less pronounced than the disagreement concerning the future level of the inflation rate.

We next measure the treatment's effects on expectation formation. For firms in the control group, we find that the slope between exchange rate perceptions and forecasts is indistinguishable from 1, meaning that managers who perceive a high current value of the exchange rate also expect high future values. Our treatment significantly weakens this relation: for firms in the treatment group, the slope between perceptions and expectations is 30–40 percent of the control group's slope, depending on the specification.[3] The treatment also weakens the relationship between perceptions and expectations for the inflation rate, as the correlation between inflation perceptions and inflation expectations is 50–66 percent smaller for treated firms. Thus, while informed, firms still learn from public information and adjust their forecast, suggesting uncertainty or inattention about macroeconomic variables (Weber et al., 2023).

These patterns not only hold at the time of the treatment but also persist for several months afterward. Specifically, the difference in the weight of pre-treatment perceptions on future expectations lasts two to four months after treatment. We document this persistence not only for forecast formation but also for future nowcast formation, where future perceptions of control firms exhibit a notably stronger

mental models of decision makers. We discuss these issues thoroughly in Section 7.

[3]We estimate this treatment effect using ordinary least squares (OLS) or Huber robust regressions, which control for outliers and influential observations.

correlation with pre-treatment perceptions compared to treated firms.

We link survey responses with administrative firm-level data to estimate treatment effects on firm-level economic decisions. Specifically, we link the survey data with the universe of transaction-level administrative records on firms' exports and imports before and after the intervention took place. Statistically significant treatment effects on data gathered outside the survey is the cleanest test of the relevance of the information we provide since it is clean of survey demand effects.

With these data, we estimate the intertemporal elasticity of firm-level outcomes to an expected depreciation, using the treatment intensity as an instrument, a strategy similar in spirit to Coibion et al. (2023). We estimate that a 1 percent future expected depreciation (appreciation) increases (decreases) realized imports by 6 percent in the year following the intervention. The elasticity we measure reflects changes in the intensive and extensive margin across origins and products. We conduct a series of tests to validate the exclusion restriction of our research design. We find that changes in expected inflation do not explain our results, highlighting the mechanism through changes in expected depreciation. Our estimates imply large back-of-the-envelope relevance of the information. We estimate that a 10 percent correctly anticipated depreciation decreases import costs by 2.9 percent.

Throughout the paper, we reject the economic null hypothesis that firm managers incorporate all public information into their expectations, perceptions, and actions. Our documentation of information frictions concerning the exchange rate is particularly informative, as we introduce an information treatment about a payoff-relevant and volatile economic variable, two factors that predict high attention from 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 contributes 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 professional forecasters. This finding holds for developed economies, such as the United States (Candia, Coibion, and Gorodnichenko, 2021; Garciga et al., 2023) and Germany (Link et al., 2023), and also in 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 a large literature documents the expectation formation process of firms, there is little evidence of the effect of those expectations on actual decisions due to the difficulty in linking survey and administrative data. Two exceptions are Coibion, Gorodnichenko, and Ropele (2020) and Akarsu, Aktug, and Torun (2024), who estimate that changes in firms' inflation expectations, driven by an information treatment, affect firms' outcomes in Italy and Turkey, respectively. We focus on shifts to exchange rates and measure inflation expectations as well to disentangle the economic mechanisms behind the causal effects. Other works that study firms' expectations and decisions are relevant for firm-decision-making Coibion, Gorodnichenko, and Kumar (2018), Savignac et al. (2021), Abberger et al. (2023), and Buchheim, Link, and Mohrle (2023), but they use information within the survey.

While most of the evidence in the literature on expectation formation comes from developed economies, 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 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. We show how exchange rate expectations and inflation expectations interact, and that ex-

change 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 decision fluctuations in the exchange rate's influence on 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 USD, to invoice their transactions, a phenomenon called DCP. Using Colombian data from the same source that 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, while Devereux and Engel (2007) highlight the importance of intermediate inputs pricing to understanding the aggregate effects of exchange rate policy. We show that firms strongly react 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.

Alessandria, Kaboski, and Midrigan (2010) highlight the role of inventory management problems for importers. The authors document that imports are lumpy and importer firms have higher inventory ratios than firms that do not import. Modeling this feature of imports, they find that the frictions associated with inventory management are equivalent to a 20 percent tariff. They also highlight the importance of the inventory problem for import dynamics. Our findings at the firm level confirm that these considerations are relevant for explaining firms' behavior when facing uncertainty about the future price of the exchange rate.

2 The Survey: Questionnaire and Time Frame

We rely on the Managerial Expectations Survey, known as the EOE for its name in Spanish (Encuesta de Opinión Empresarial), to collect data on firms' inflation and exchange rate expectations. The EOE is a monthly survey conducted since 1979 by Colombian think tank Fedesarrollo and the Central Bank of Colombia, targeting managers from a nationally representative sample of firms in the manufacturing and retail sectors. The sampling universe of firms consists of all companies reporting to the National Manufacturing Survey,[4] the central bank's Foreign Exchange Risk survey, and the Financial Superintendency of Colombia. The survey follows 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 EOE, which includes a wide range of questions on firm sentiments and a qualitative assessment of the business environment, also contributes to public policy discussions in Colombia. Due to the survey's proven track record, it maintains a high completion rate among firm managers. Online Appendix C presents details on the survey's history, sampling universe, and questions.

We modified existing questions and added new ones, including an information treatment, to this survey starting in January 2019. Specifically, we suggested modifying 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. In July 2021, after COVID-19 restrictions eased, we introduced two additional questions regarding perceptions and one-year-ahead expectations about the exchange rate and an additional question about firms' one-year-ahead annual expected inflation. These inflation questions were designed to provide a benchmark for comparing the results of this

[4]Collected by DANE, the National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística in Spanish).

survey with those of the extensive literature that measures firms' inflation expectations (Candia, Coibion, and Gorodnichenko, 2021).

Two of the new questions measure managers' perceptions (or nowcasts) about the current inflation rate and exchange rate against the US dollar. Specifically, we ask 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 consumer price index (CPI) inflation rate at the end of the current month. The other two questions record their one-year-ahead expectations for the annual inflation and USD exchange rates. In particular, we ask what price they would expect to pay for $1 USD if they were to purchase dollars one year from now in the financial market. Likewise, we measure their 12-month-ahead annual inflation expectations. The four key questions in the survey are as follows:[5]

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

[5]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).

by the consumer 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 USD/COP exchange rate obtained from a monthly and publicly available professional forecasters survey of the Central Bank of Colombia.[6] 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. The treatment was implemented after eliciting nowcasts and before eliciting forecasts, that is, between questions 2 and 3 in the list of questions above. Table 6 in Online Appendix A shows that for firms surveyed in the baseline period (July 2021), the prior and posterior of the exchange rate and inflation are well balanced, meaning there is no statistically significant differences between the treatment and the control group.

Firms were only treated once, in 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 have received the treatment in potentially different months, we include time fixed effects to absorb any variation induced by aggregate shocks.

The treatment consists of information delivered to firms after they answer the second question and before they answer the third question listed above. Firms in the control group did not receive any information between receiving the second and third questions. The treatment information read as follows, translated from the original text in Spanish: "According to the latest Survey of Analyst Expectations conducted by the central bank, the exchange rate in July 2022 is expected to

[6]Encuesta Mensual de Expectativas de Analistas Económicos (EME), available at https://www.banrep.gov.co/es/estadisticas-economicas/encuesta-mensual-expectativas-analistas-economicos. See Online Appendix E for details on the time-series properties of the COP/USD nominal exchange rate, as well as the time-series properties of the average forecast from the survey.

be 3,650 pesos per dollar."[7]

Survey conductors attempted to contact firms and prioritize obtaining answers from a subset of firms that the central bank had judged to be of particular interest. If contacting a given firm was not possible, the conductors contacted other firms up to the point at which they gathered 500 responses. As a result of this sampling procedure, our data are an unbalanced panel. To avoid selection into treatment, we randomize the universe of firms in the sampling set into a treatment or control group, stratifying 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.

3 Colombian Economy

Colombia is a small open economy with a floating exchange rate and an independent central bank using an inflation targeting framework that aims to keep inflation within 2–4 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 country's 12-month inflation rate since 1991, the year in which the current constitution was passed, along with the midpoint of the inflation target.[8] 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, troughed in November 2020, and began to increase thereafter. July 2022, the last month of our survey, was the first time in more than two decades

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

[8] When the 1991 Constitution of Colombia increased the central bank's independence, price stability became its primary goal. The bank's board of directors is composed of seven members: one director, five independent deputy directors, and the Minister of Finance. The Colombian president nominates two independent deputy directors in the middle of his or her mandate, which lasts for four years.

that inflation was above 10 percent. Our survey period started with inflation at 4.4 percent in August 2021 and ended at 10.2 percent in July 2022.

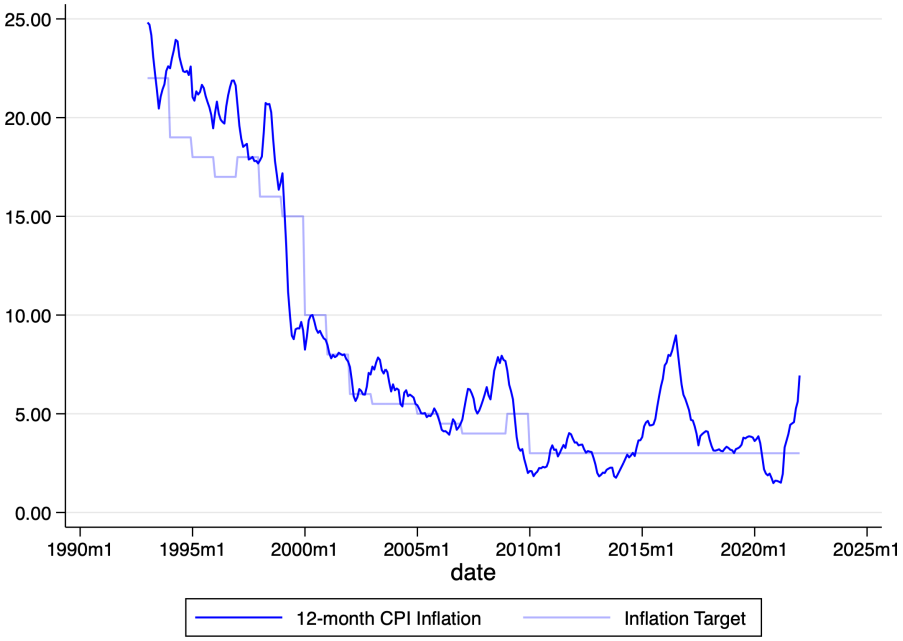
Panel (a) of Figure 1 reports the same series as in panel (b) but adds the 12-month percent change in the COP/USD exchange rate. The nominal exchange rate variation overshadows the variation in consumer prices, a common feature in emerging market economies.

4 Perceptions and Expectations of the Exchange Rate and the Inflation Rate

This section presents the cross-sectional average and dispersion of perceptions and one-year-ahead forecasts about the COP/USD exchange rate and the inflation rate. While the implications of inattention in the international economy context have been studied theoretically (Crucini, Shintani, and Tsuruga, 2010, 2020), little evidence exists on the inattentiveness of firms to exchange rates. We provide information on 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 significantly 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 USD receives substantial attention from firms in developing and emerging market economies (see also Frache et al. (2023)). Second, there is considerably more disagreement regarding the expected future level of the exchange rate compared to the current level. Third, the average perception and the average forecast of the exchange rate strongly co-move with the realized level of the exchange rate, even more so than the co-movement between perceptions and expectations of the inflation rate.

Because surveys usually contain outliers and non-response, we trim observa-



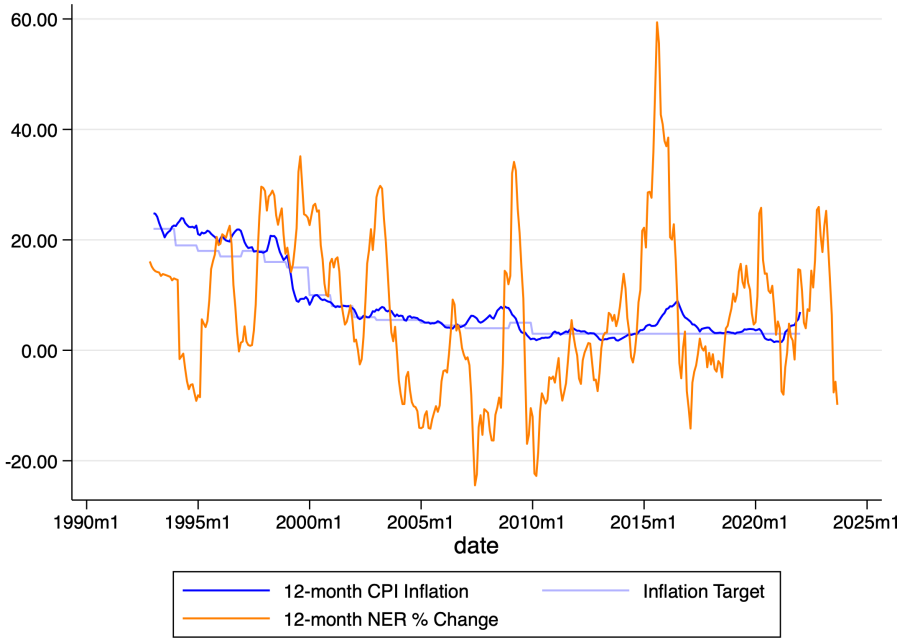


Figure 1: The 12-Month CPI Inflation Rate, Inflation Target, and 12-Month COP/USD Change in the Nominal Exchange Rate

Note: The top panel plots the official 12-month CPI inflation rate for Colombia, along with the center point of the inflation target. The bottom panel plots the same two series but adds, in orange, the 12-month percentage change of the nominal COP/USD exchange rate. All the data series come from the Central Bank of Colombia.

tions, 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 5 in Online Appendix A reports several summary statistics of each variable in July 2021, the baseline period before treatment assignment.

Figure 2 illustrates our first finding. In panel (a), we present the realization and different moments of the cross-sectional distribution of nowcasts and forecasts of the COP/USD exchange rate. We specifically analyze the average and the range between the 10th and the 90th percentile for nowcasts and forecasts. The analysis shows that firms correctly perceive, on average, the current level of the exchange rate, as demonstrated by the solid red line that tracks the solid black line. Additionally, the average forecast (solid blue line) closely tracks the average perception (solid red line). Last, there is considerably greater cross-sectional dispersion in exchange rate forecasts compared to exchange rate perceptions, as the blue-shaded areas are wider than the red-shaded areas.

Panel (b) presents the same statistics for the inflation rate, showing considerable disagreement on the inflation rate across firm managers. The average interquartile range of perceptions is 3 percentage points, 65 percent as large as the average inflation rate at the beginning of the sample. Although firms' perceptions of the inflation rate are, on average, close to official numbers, the fact that the average perception does not match the official rate—and that there is considerable cross-sectional dispersion in the perceptions of the inflation rate—confirms previous findings.[9] These were first documented by Jonung (1981) and in models of costly information acquisition regarding current states of the economy (Maćkowiak and Wiederholt, 2009). Interestingly, managers are, on average, slow to realize that inflation is picking up in the second half of the period.

At the beginning of the period for which we have data, inflation expectations

[9]Binetti, Nuzzi, and Stantcheva (2024) show that households' disagreement about inflation can be explained by different understanding of the causes of inflation.

are higher than current inflation, and although the average forecast increases at the end of the sample, it does so more slowly than actual inflation. This finding—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 shown in Table 1.[10] While we cannot disentangle the reason for the lower dispersion, the exchange rate against the dollar is typically reported in the economic section of daily TV news and major newspapers. The nominal exchange rate against the USD is also visibly posted at currency exchange retailers (*casas de cambio* in Spanish), similar to gas prices at gas stations.

	Average	Standard Deviation	For. Error
Nowcast Exchange Rate			
Professional Forecasters	\$3,874	\$55.89	\$105.9
Firms	\$3,921	\$204.9	\$45.43
Forecast Exchange Rate			
Professional Forecasters	\$3,734	\$133.2	\$854.4
Firms	\$3,980	\$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 COP/USD exchange rate and headline CPI inflation in Colombia for a sample of professional forecasters surveyed by the Colombian central bank and firm managers in our sample. Column 3 shows the difference between the forecast of a given variable and its realization. We use data from July 2021 to June 2022 for our analysis, extending back to January 2021 for inflation forecasts. We use trimming procedures as explained in the text.

[10] Table 7 in Online Appendix A shows the same statistics, separating the treatment and control groups.

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.[11] We find that, although firms generally have more dispersed beliefs and expectations, their behavior is closer to that of professional forecasters for the exchange rate than for the inflation rate. Firms' exchange rate nowcasts and forecasts are three to four times more dispersed than those of professional forecasters. The dispersion gap for inflation in Colombia is similar to the one in other countries, such as New Zealand (Coibion, Gorodnichenko, and Kumar, 2018) or Germany (Link et al., 2023), and is much higher than the exchange rate dispersion gap.

5 Treatment Effects on the Formation of Expectations

This section presents the analysis measuring the treatment's effects on the formation of expectations. We invite the reader to view these findings as a "first-stage" result, showing that the intervention is successful in shifting firms' own expectations.

We first 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, Gorodnichenko, and Kumar (2018), the gold standard in this literature. We then measure the differential effect of a prior belief of a given economic variable on the formation of expectations of the same variable between the 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 treatment group place on the signal contained in the RCT.

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

[11] Data for professional forecasters come from the EME survey, which is detailed in Section 2.

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

Ideally, a researcher would have access to both a prior and posterior belief regarding the same variable, which in this case 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 a given respondent the same question twice 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 immediately obvious ex-ante that nowcasts and forecasts are strongly correlated at the firm level. In Section 5.1 we 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 firm i's expectation about the level of the nominal exchange rate one year from the treatment assignment, and $S^e_{i,t+1,t+1}$ represents firm i's nowcast 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 treated firms, and β_2 captures the weight assigned to the prior by control firms. Therefore, β_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 β_3 implies that the treatment contains a valuable signal for the average treated firm 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.

5.1 On-Impact Causal Effects

We start this subsection by documenting the on-impact causal effects of the treatment on the formation of expectations. By on-impact, we mean the effects observed within the same wave of the survey. Later, in Section 5.2, we exploit the panel dimension of our research design. We estimate regressions given by equation 1, where X equals either S or the COP/USD nominal exchange rate. In Online Appendix D, we also consider effects for $X = \pi$, the CPI inflation rate for the Colombian economy. We compute one-year-ahead expectations, and thus $\tau = 12$ and $h = 0$ in equation 1, and use the expectations formed in the month in which firms receive the treatment.

We estimate equation 1 using OLS as our benchmark and include robustness results using Huber (1964) robust regressions, as in Coibion, Gorodnichenko, and Ropele (2020), to address potential concerns driven by outliers and influential observations. We include time-fixed effects representing the date where the firm first participated in the survey, and when they received the treatment in the case of the treated group, to absorb variation driven by aggregate shocks that may correlate

with the temporal pattern in which firms participate in the survey. Since we are measuring the treatment's causal effects on impact, we only use one observation per firm, and our benchmark sample consists of 681 firms.

	Exchange Rate	
	(1)	(2)
Prior	0.978***	0.958***
	(0.152)	(0.082)
Prior x Treatment	-0.601**	-0.672***
	(0.163)	(0.089)
Treatment	2,208***	2,496***
	(604.1)	(334.1)
Constant	143.2	196.1
	(569.6)	(309.0)
Regression	OLS	Huber
Time FE	Yes	Yes
Observations	681	659

Table 2: Treatment Effects on Exchange Rate Expectations

Note: This table summarizes our estimation of equation 1 for the nominal COP/USD exchange rate ($X = S$). The regression is estimated only for the first month of each manager in our panel. Column (1) estimates the regression using OLS. Column (2) estimates 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 equals 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 data from 681 firms with OLS and 659 firms with Huber robust regressions.[12] The first row shows estimates of $\hat{\beta}_2$, the weight on the nowcast for control firms. This coefficient is interpreted as a slope coefficient. We find that control firms that perceive a 1 COP higher exchange rate also forecast a 1 COP higher exchange rate one year from now. We cannot reject the null hypothesis that this coefficient is equal to one. This strong correlation between nowcasts and forecasts for control firms validates our choice of asking for perception variables as a proxy for the prior belief of firms about future exchange rates.

[12]The number of observations changes because the robust regression drops influential observations.

Our coefficient of interest is the one in the second row: the coefficient associated with the interaction of the nowcast with treatment assignment, $\hat{\beta}_3$. A negative coefficient implies that firms assign a positive weight to the signal to form their exchange rate expectations, and consequently assign a lower weight to their prior beliefs. 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 fact that the coefficient is economically large, equal to –0.6 in OLS and –0.67 in robust regression, implies that firms assign a large weight to the signal when forming their exchange rate expectations. In particular, treated firms 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 presents a graphical representation of the results in Column (1) of Table 2. Specifically, it is a binned scatterplot of the nowcast of the exchange rate after controlling for time fixed effects on the x-axis, and one-year-ahead exchange rate forecasts after controlling for time fixed effects on the y-axis. The relationship between perceptions and forecasts for control firms, depicted in blue circles and a blue line, is best represented by a 45-degree line.[13] In contrast, for treated firms, shown in orange, this relationship is weaker, demonstrating a causal effect of the treatment. Treated firms use their perceptions less when forming their exchange rate expectations.

Table 2 documents the treatment's effects 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

[13]We do not need to take a stance on the drivers of dispersion in nowcasts across firms for our research design.

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, both awareness about the state of the economy and the marginal value of information may be heterogeneous across firms.

To examine the quantitative relevance of heterogeneous effects, we repeat our estimations after splitting the firms in the sample into two dimensions: a broad sectoral definition and the firm's exporting status. These two variables were self-reported by the firms before treatment. We then split the sample into firms in the industrial sector and those in the retail sector. Firms in the industrial sector may self-report as exporters. We stratify the randomization behind the treatment in these two dimensions to ensure that treatment assignment is balanced.

Figure 4 plots the regressions' main coefficient of interest, and the regression tables are in Tables 8 and 9 in the Online Appendix A. We find that the extent of decoupling of expectations from perceptions is stronger for firms in the industrial sector than for those 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 those 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 those in the industrial sector.

Figure 4 also repeats the analysis, splitting firms in the industrial sector between exporters and non-exporters, with the caveat that the sample sizes are smaller.[14] Firms that self-report as exporters are presumably more sophisticated and cater to the global market; therefore, they should exhibit smaller treatment effects. Our results confirm this intuition; in fact, we estimate insignificant results and zero point estimates for the treatment's effects on expectation formation for exporters. Mackowiak and Wiederholt (2024) discuss how this behavior can be explained by a model of rational inattention, showing that the cost of incorrect beliefs and the

[14]Details of the regressions are available in Tables 10 and 11 of Online Appendix A.

treatment effect are negatively related. The extent of decoupling from priors and forecasts of the exchange rate for non-exporter firms is complete, as we estimate a coefficient $\hat{\beta}_3 = -0.991$.

5.2 Dynamic Causal Effects

One of the main advantages of our research design's panel structure is the possibility of estimating equation 1 for $h > 0$, allowing us to trace the impulse response functions of 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 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 5 shows the dynamic causal effects on exchange rate forecasts and nowcasts. Panel (a) presents the impulse response of the weight allocated to the pre-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, with the orange line showing the point estimate and its associated confidence intervals for the control group in orange-shaded areas. The weight that firms assign to the pre-treatment prior slowly decays as time progresses. In particular, the forecasts of exchange rates formed two months after the treatment are positively associated with the prior belief in the initial period. For treated firms, not only is the importance of the prior at period 0 lower, as previously documented, but starting at period 1 after the treatment, there is no association between the pre-treatment prior and the formation of exchange rate expectations. Additionally, the formation of exchange rate expectations for both the treatment and control groups differs for two months after the treatment.

An important mechanism to understand the dynamic effects on expectation formation is the treatment's persistent effect on the formation of future beliefs about the economic environment. Panel (b) of Figure 5 shows that the treatment changes not only how firms form their expectations in the future but also how they form their beliefs about the current state. In particular, control firms have inertial nowcasts, with weights of the pre-treatment nowcast of roughly 0.2 on future nowcasts, while there is no such inertia for treated firms. 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 in international economics.

6 Causal Treatment Effects on Firm-Level Decisions

In this section, we estimate the extent to which the exogenous provision of information on exchange rate forecasts affect firm-level decisions. We link the surveyed firms 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 context of instrumental variable (IV) terminology), capturing 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 some of the most important contributions of this manuscript.

We use administrative data that cover the universe of importing and exporting transactions by Colombian firms. These data, obtained from the Tax and Customs National Direction (DIAN in Spanish), and made public by the National Statistical Agency (DANE), are made available by firm, month, origin or destination of the transaction, and eight-digit product category. The identity of the firms is made public by stating the firm's tax payment identification number (NIT in Spanish). The data set contains information on the shipment's value (free on board) and its gross and net weight, allowing us to compute measures of unit prices. For our analysis, we 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 aggregate origins and destinations in two categories: countries that use the USD as their currency versus other currencies. Note that these aggregations do not correspond to the invoicing currency of the transactions—in Colombia, almost all transactions are invoiced in USD (Boz et al., 2022)—but rather to the currency used as legal tender of the origin and destination.

Firms affected by the exchange rate may use financial instruments to hedge. Alfaro, Calani, and Varela (2021), using the universe of transactions for Chile, show that only big firms hedge in that context. In Colombia, the percentage of firms engaged in international trade that access currency hedging through the forwards market remains quite low. By 2016, only 7 percent of exporting firms and 4 percent of importing firms traded these derivatives. As in Chile, the market is also concentrated in large firms: by 2016, 79 percent of the forwards' value was negotiated by only 100 firms Alfonso-Corredor (2018). In Table 13 and Figure 7 in Online Appendix A, we show that while the firms in our sample that export and import are relatively larger than the average firm in those categories in Colombia, the distribution of firms in our sample and the distribution of the universe of firms overlap considerably. Additionally, Alfaro, Calani, and Varela (2021) explain that given the difficulties of matching maturities, even firms that access those financial

instrument, cannot perfectly hedge against changes in the exchange rate.

When analyzing the treatment's effect on exports and imports, we time-aggregate the monthly data to an annual frequency, adding the transaction's value for a pre-period of 12 months before treatment and a post-period treatment of 12 months after. Time aggregation is necessary because firm exports and imports are notoriously lumpy, with periods of inaction followed by large spikes. Among the 680 firms in our sample, 285 (42 percent) have exported at some point during the historical data to which we have access (2012–2022), and 480 (71 percent) 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 due to its significant trade with countries that use and do not use the USD as their currency. Besides the United States, trade partners that use the USD as legal tender include Ecuador, Panama and El Salvador, among others. Between 2021 and 2022, 39 percent of Colombia's exports and 26 percent of its imports were with fully dollarized countries. Conversely, many of Colombia's important trade partners, particularly in Latin American, do not use the USD. When local firms use the USD as their invoicing currency, as in the case of Colombia, a depreciation of the USD creates a differential expenditure switching motive for customers in countries that do not use the USD. This is a key prediction of the DCP, as argued by Gopinath et al. (2020). Notably, Gopinath et al. (2020) also use the same underlying micro data as us.

To provide additional evidence on the randomization of the treatment assignment, we perform balance tests between the treatment and control groups on exporting behavior before treatment assignment. Table 12 shows no discernible statistical differences in the level of overall exports, the level of exports to destinations that use the USD, the level of exports to destinations that do not use the USD, and the level of overall imports. The table also shows results on 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 also export roughly 22 percent of their exports to destinations that use the USD. 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.

We next estimate the elasticity of firm outcomes to a 1 percent depreciation, using a two-stage least squares regression. We follow Coibion et al. (2023) and Coibion, Gorodnichenko, and Weber (2022). In particular, we run the following regression:

$$Y_{i,t,t+12} = \alpha + \beta \log S^{e}_{i,t,t+12} + \gamma Y_{i,t-12,t} + x'_{i,t}\theta + \varepsilon_{i,t}, \tag{2}$$

where $Y_{i,t+12,t}$ is either imports or exports of the firm i between the period t when the experiment started up to 12 months after. $Y_{i,t,t-12}$ is also either imports or exports, but for the year before the experiment. $\log S^{e}_{i,t,t+12}$ is the logarithm of the 12 month ahead expected exchange rate. $x_{i,t}$ is a set of controls that includes a dummy that takes a value of one of the firm was treated in a certain month, a industry fixed effect and the prior (nowcast) of the firm. 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 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[15] In every regression. The interpretation of the coefficient of interest is an elasticity of a firm outcome, for example imports, to a 1 percent exogenous expected depreciation, where the variation is induced by the treatment. Table 3 shows the results.

Column (1) of Table 3 presents our main results. A 1 percent expected future depreciation has a causal effect of an increase of 6.2 percent on firm imports. The

[15] As in Coibion et al. (2023), Baumann et al. (2024) and Coibion et al. (2024), among others, we use Huber (1964) regression in the first stage and jacknife regression in the second stage to remove highly influential observations.

	(1)	(2)	(3)	(4)
$\log S^{e}_{i,t,t+12}$	6.241**	4.697	7.101**	-0.840
	(2.775)	(3.118)	(3.495)	(6.869)
$\log \text{Imports}_{i,t-12,t}$	0.989***	0.999***	0.950***	
	(0.015)	(0.014)	(0.022)	
$\log \text{Exports}_{i,t-12,t}$				0.953***
				(0.021)
Dependent Variable	Imports	Imports	Imports	Exports
Sample	All	Exporters	Non Exporters	All
Controls	Yes	Yes	Yes	Yes
Observations	360	155	146	168
R-squared	0.947	0.980	0.935	0.956
F (mean)	15.87	2.744	7.035	3.570

Table 3: Expected Depreciation Effect on Trade Decisions

Note: This table shows the results of regressions 2 for the exchange rate's effect on exports and imports decisions. Column (1) displays results for the IV for log imports, while Column (2) displays results for the sample of importers that did not export in the baseline period. Column (3) shows results for imports among the sample of imports that were also exported in the baseline period, and Column (5) shows results for log exports. 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, industry fixed effects and the exchange rate nowcast. We include Huber regression for the first stage and jacknife for the second stage. Robust standard errors are in parentheses.

effect is statistically significant, and the F-stat of the first stage is equal to 15.9. Columns (2) and (3) unpack the results of Column (1). 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. This is consistent with the results in Column (4), which show that the results for exports are small and not statistically different from zero. Additionally, the F-stat is very low, indicative of a weak instrument problem. This is consistent with the results of Figure 4, where we find that the treatment has no effect on the posterior exchange rate of exporters.

The F-stats presented for imports are above the rule-of-thumb values of 10 often used in the literature. However, due to heteroskedasticity and autocorrelation that invalidate standard metrics, we run weak instrument tests robust to heteroskedas-

ticity and autocorrelation, developed by Olea and Pflueger (2013). The effective F-statistic for imports is equal to 15.87, larger than the threshold for a worse-case scenario bias of 10 percent, which is equal to 13.65. We also provide weak instrument robust Anderson-Rubin (AR) confidence intervals. We reject elasticities lower than 0.42 and higher than 11.41. For importers, we reject values lower than 2.26 and higher than 15.54. We confirm that the instrument is weak for exporters and the AR confidence intervals include the full real line for their imports and any value lower than 20 for exports.

7 Discussion

In this section, we discuss the implications of our main findings. A firm-specific future expected appreciation (depreciation) decreases (increases) firm imports. The elasticity of imports to expected depreciations that we estimate combines different margins and combines direct effects of the exchange rate on the firm in partial equilibrium, but also how the firm thinks policy and other agents will behave given the new expected path of the exchange rate.

Using the estimated elasticity, we can infer how much firms can save in term of import cost. Using a very simple framework, where firm only substitute between two period, goods don't depreciate and firm are small enough to not change import prices, we find that a 10 percent correctly estimated depreciation can decrease import costs by 2.9 percent, relative to a firm with constant import that did not anticipated the change.[16] This effect can be lower under other assumption, such as inventory costs.

We identify at least three mechanisms driving firms' reactions in our setting. Using an expected depreciation as an example—though the reverse holds for an expected appreciation—first, a future expected depreciation increases future marginal

[16]We estimate that difference in cost as the elasticity, times the percentage change in the exchange rate, times the amount saved, that is the imports times the difference in the exchange rate, over the total imports of a firm that imported the same amount in both periods.

costs, which decreases firm size and demand for imported inputs. Second, an increase in the price of imported inputs induces substitution away from imported inputs to local inputs, reflecting the standard trade elasticity. Finally, an expected future depreciation increases incentives to anticipate expenditures before prices rise, increasing present demand for inputs. We estimate a positive elasticity, implying that the third channel is stronger than the sum of the first two. This mechanism aligns with models of storable or durable imports or inventories, as discussed in Alessandria, Kaboski, and Midrigan (2010). In such models, firms anticipate higher depreciations or higher tariffs by increasing current import demand (Alessandria, Arkolakis, and Ruhl, 2021; de Soyres et al., 2023), and their ability to anticipate higher future costs is a function of adjustment and storing costs. Our findings support this mechanism.[17]

We evaluate the intertemporal substitution mechanism by exploiting the time series of the import data. Crucially, intertemporal substitution entails the prediction that higher current expenditures in the present should be counteracted by lower future import expenditures. Specifically, we run regression:

$$Y_{i,t_0,t+h} = \alpha + \beta \log S^{e}_{i,t,t+12} + \gamma Y_{i,t-12,t} + x'_{i,t}\theta + \varepsilon_{i,t}, \;\; \forall h \in [0, H] \tag{3}$$

As in the previous section $Y_{i,t_0,t+h}$ represents the imports if firm i between time t_0 and $t+h$. As imports are infrequent for many firms, we select a period $t_0 < t$, in order to have enough firms with positive imports and keep the sample over time. In particular, we pick t_0 to be January 2021, so for $h = 0$ we have five months of data, with some overlap with the control $Y_{i,t-12,t}$.[18] We select H, so we go until

[17] In fact, this literature has documented that firms are more prone to store imported inputs compared to domestic ones, and that imported input expenditures are concentrated in durable and storable categories.

[18] We did not change this control for comparison and to avoid the worst period of the pandemic in March and April 2020. The results are robust to, for example, choosing 2020 and compare it with 2021 and on. Because of this difference in the timing of the pre-period, the point estimates on the im-

November 2022, last month with available data. Figure 6 shows the results.

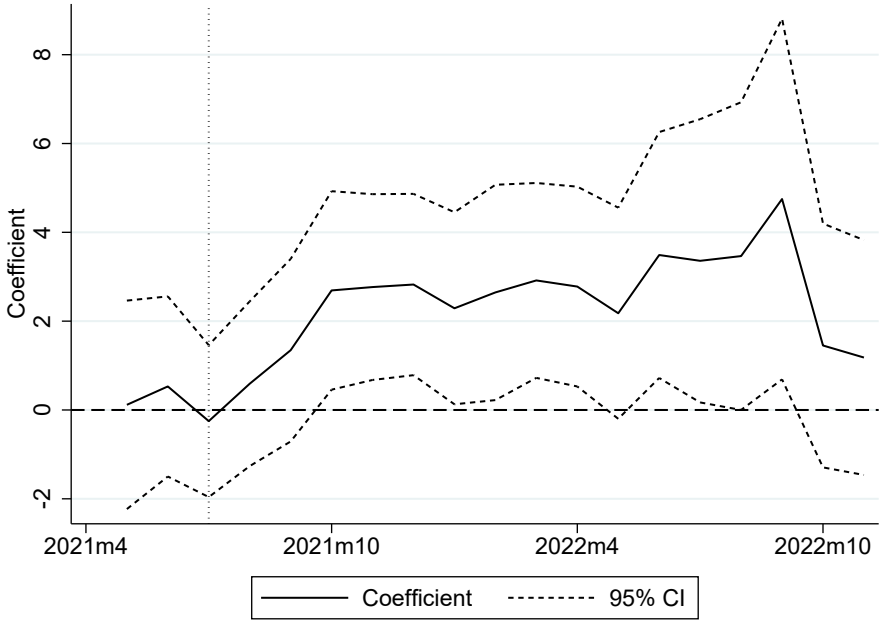


Figure 6: Import Elasticity to Expected Depreciation at Different Horizons
Note: This Figure computes an Impulse Response Function of cumulative import demand caused by a one percent expected future depreciation. Dashed line report 95% confidence intervals.

We estimate statistically significant effects on import demand starting in October 2021, a couple of months after our intervention. The effect is persistent for up to 11 months and then returns to zero, consistent with the interpretation that our estimates reflect intertemporal substitution. A crucial aspect of this research design is that it measure cumulative effects on imports, so a return to zero implies that an initial increase in import demand is compensated by a subsequent decrease relative to the control group. In November 2022 there are no statistically meaningful differences in cumulative import expenditures.

One of the main advantages of our research design is our ability to isolate variation from various GE and policy reaction channels, while at the same time introducing a source of exogenous variation linked with a macroeconomic variable.

pulse response function will be different from the ones found in Table 3 in terms of the magnitudes.

This experiment allows firms to form their own views about the nature of the economy, but keep the external environment fixed. By exploiting deviations from full information and an information treatment, we find that an increase in the expected exchange rate increases imports in the cross-section of firms. Other studies have explored this strategic anticipatory behavior, particularly concerning other future costs such as tariffs (Alessandria, Khan, and Khederlarian, 2024).

Interpreting our results as an estimate of the inter-temporal elasticity of trade outcomes to depreciations requires the identifying assumption that our instrument does not affect other determinants of import demand that we are not controlling for, a standard exclusion restriction in instrumental variables research designs. Exclusion restrictions are not testable, but we provide evidence that the exclusion restriction is not violated by a very natural and salient alternative explanation, that our treatment shifts expected inflation, and those inflation shifts induce changes in import demand.

We estimate regression 2, but instead of using the exchange rate expectations as our endogenous variable, we use inflation expectations. Table 4 shows the results.

The elasticity of import demand to changes in expected inflation in Table 4 is small and statistically insignificant. We cannot rule out that there are other economic outcomes that firm managers are learning indirectly from when we provide information about the exchange rate and that we did not measure. However, obtaining null results from inflation expectations is a strong piece of evidence that is consistent with our interpretation.

Our paper contributes to recent work estimating the elasticity of imports to changes in future costs. For instance, Khan and Khederlarian (2021) estimate an import elasticity to expected changes in tariffs due to NAFTA, finding an import elasticity of 6 percent, consistent with our findings.

Our evidence highlights firms' optimizing behavior in timing their international expenditures as a function of exchange rate fluctuations. Typically, it is

	(1)	(2)	(3)	(4)
$\pi^{e}_{i,t,t+12}$	-0.000	-0.032	-0.186	-6.480
	(0.208)	(0.108)	(0.595)	(62.597)
$\log \text{Imports}_{i,t-12,t}$	0.927***	1.002***	0.917***	
	(0.028)	(0.025)	(0.071)	
$\log \text{Exports}_{i,t-12,t}$				1.079
				(1.230)
Dependent Variable	Imports	Imports	Imports	Exports
Sample	All	Exporters	Non Exporters	All
Controls	Yes	Yes	Yes	Yes
Observations	265	167	157	123
R-squared	0.937	0.965	0.887	-8.212
F (mean)	0.77	1.985	0.642	0.008

Table 4: Expected Inflation Effect on Trade Decisions

Note: This table shows the results of regressions 2 for the Inflation rate expectations effect on exports and imports decisions. Column (1) displays results for the IV for log imports, while Column (2) displays results for the sample of importers that did not export in the baseline period. Column (3) shows results for imports among the sample of imports that were also exported in the baseline period, and Column (5) shows results for log exports. The independent variable is the log of the expected inflation. We include time fixed effects for the date when the firm was first surveyed, industry fixed effects and the inflation nowcast. We include Huber regression for the first stage and jacknife for the second stage. Robust standard errors are in parentheses.

challenging to separate the causal effects of exchange rate changes from other indirect GE effects when economies face large devaluations. In our experiment, we estimate an elasticity of imports to expected exchange rate shifts while keeping other prices in the economy constant, which can inform firm dynamics during such episodes.

The intertemporal import elasticity to expected depreciations has significant implications for macro and trade outcomes. Estimates of trade elasticities that ignore the timing of purchases may be overestimated if the shifts in input costs are anticipated. The intuition is that optimizing firms reallocate their import expenditures across time, creating the appearance of large substitution between foreign and local inputs if the analysis focuses only on the period after input costs have materialized. We find that these considerations are important for exchange rates

and imports. Additionally, we document relevant heterogeneity in exchange rate perceptions and forecasts, highlighting the importance of the distributive effects of aggregate shifts and the role of policy communication.

8 Conclusions

In this study, we measure and evaluate the effect of firm expectations on their decisions in an emerging economy. Our findings reveal that while Colombian firms are relatively informed about the inflation rate, similar to firms in developed countries, they are much more informed and exhibit less disagreement about the exchange rate compared to the inflation rate. We also find that receiving information about the forecast of the exchange rate by professional forecasters influences firms' own expectations of the exchange rate, prices, and their economic decisions.

We introduce a treatment that affects trade decisions, documenting that a relatively cheap information treatment that informs firms about the future forecast of exchange rate effectively manages their expectations and influences their decisions. This occurs even when the treatment involves information about a payoff-relevant, volatile variable, such as the nominal exchange rate of the local currency against the USD.

By linking our sample with administrative records on firm activities, we estimate the effect of the information treatment on firms' decisions, a key step to establish the causal effect of exchange rate expectations on the economy. We find that simple information treatments effectively influence both expectations and decisions.

We also explore the role of limited attention in international economics—most models examining firms' decisions focus on their pricing decisions—but do not explore how departures from full-information rational expectations can affect those findings. We find that in a country where virtually all international trade transactions are invoiced in USD, changes in exchange rate expectations alter both the

size and timing of these transactions.

Overall, our findings suggest that due to deviations from full information, central banks have the scope to focus their communication on salient prices to influence firm decisions, even those of managers of relatively large and sophisticated firms.

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Online Appendix

A Additional 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 5: 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 6: 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 7: 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 8: Treatment Effect for Retail Sector

Note: This table shows results of equation 1 for the retail sector. It shows results for the nominal exchange rate, and the inflation rate. The regression is estimated only for firms' initial month. Columns (1) and (3) use OLS. Columns (2) and (4) use Huber robust regressions. we use robust standard errors.

	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 9: Treatment Effect for Industry Sector

Note: This table shows results of equation 1 for the industrial sector.It shows results for the nominal exchange rate, and the inflation rate. The regression is estimated only for firms' initial month. Columns (1) and (3) use OLS. Columns (2) and (4) use Huber robust regressions. we use robust standard errors.

	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 10: Treatment Effect for Exporters in Industry Sector

Note: This table shows results of equation 1 for the exporting firms in the industrial sector. It shows results for the nominal exchange rate, and the inflation rate. The regression is estimated only for firms' initial month. Columns (1) and (3) use OLS. Columns (2) and (4) use Huber robust regressions. we use robust standard errors.

	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 11: Treatment Effect for Non-Exporters in Industry Sector

Note: This table shows results of equation 1 for the non-exporting firms in the industrial sector. It shows results for the nominal exchange rate, and the inflation rate. The regression is estimated only for firms' initial month. Columns (1) and (3) use OLS. Columns (2) and (4) use Huber robust regressions. we use robust standard errors.

	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 12: 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.

	Obs	Mean	Std Dev	p5	p25	Median	p75	p95
Exports								
Sample	259	645,581	3,311,412	379	4,668	33,874	168,887	2,131,863
Total	9,971	284,703	6,341,978	135	804	4,209	27,735	505,458
Imports								
Sample	466	669,623	2,175,555	1,320	25,011	114,956	437,095	2,533,204
Total	32,150	120,637	1,280,824	88	676	3,689	21,592	284,168

Table 13: Exports and Imports of Sampled Firms Compared to Rest of the Economy

Note: This Table shows the number of observations (Obs), mean, standard deviation (Std Dev), 5th, 25th, 50th, 75th and 95th percentiles (p5, p25, Median, p75, p95) for the firms in our survey (Sample) and all firms in the Colombian economy (Total) for the baseline period. Exports and Imports are in US dollars.

B Additional Figures

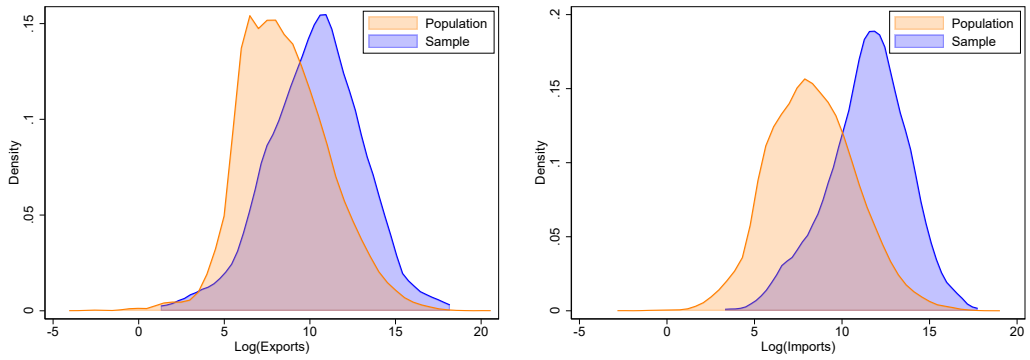

Figure 7: Distribution of Exports and Imports

Note: The figure shows the distribution of the total exports (left panel, in logs) and total imports (right panel, in logs) for the firms in our survey (Sample) and for all Colombian firms (Population), for the baseline period. Exports and imports are in US dollars.

C The Survey

Since 1980, the Colombian economic think tank Fedesarrollo and the Central Bank of Colombia have conducted the Business Opinion Survey (BOS), targeting both manufacturing and retail sectors within the country. Drawing on the methodology used by the European Union (European Commission, 2024), data are collected through a series of specific questionnaires for each sector. This data is later used to calculate compounded indicators that track cyclical movements in firms' confidence, and their expectations about macroeconomic variables.

C.1 Survey Frequency, Sample Size, and Respondents

Two surveys are currently conducted on a monthly basis in the manufacturing and retail sector, while a quarterly module covers the construction sector. Surveys are administered by phone and online. As the survey is already well established and is popular among companies, surveyors are able to contact managers, chief financial officers or firm owners. This is a fundamental part of the process, since this allows

us to obtain expectations for the firms' decision makers. Each month, Fedesarrollo and the Central Bank of Colombia administer a total of 500 surveys, 300 directed towards the manufacturing sector and 200 towards the retail sector. The universe of companies likely to be surveyed comes from three main sources:

- National Administrative Department of Statistics (DANE) Manufacturing Survey database: This database, created by DANE to run their own monthly survey about manufacturing trends, is used to locate manufacturing firms.
- Central Bank Exchange Rate Risk Survey: Each month, the Central Bank of Colombia publishes a survey asking the private sector. This database provides information for the manufacturing and retail firms.
- Financial Superintendence of Colombia Reports : Every formal firm in Colombia must maintain accounting records. They report their financial balances and statements to the Financial Superintendence, who creates this large database with those inputs. Information for all economic sectors is available, including both manufacturing and retail.

C.2 Sectoral and Regional Representativeness

Results are representative for the manufacturing and retail sector. Regional representativeness is not achieved under the current methodology.

C.3 Timetable

Fieldwork for the two surveys is carried out in the first three weeks of each month, or until the required number of surveyed firms to guarantee representativeness is reached. Once the fieldwork for each month is complete, Fedesarrollo processes the collected information and publishes a complete report during the first two weeks of the next month. This document includes the results for confidence indexes and its components. Depending on the state of the economy, questionnaires can occasionally include additional pilot questions. For example, during 2020 and

2021 questions about layoffs following COVID-19 were included to rapidly assess changes in the labor market.

C.4 Monthly Business Survey Questionnaire

A. Manufacturing survey: contains 22 questions with a highly qualitative focus. On the first part, firms are asked about current production, stocks. In addition, the survey provides on a quarterly basis quantitative information on two variables that are not reported in conventional statistics, namely employment expectations and smuggling perception. Since 2021, investment plans are investigated in qualitative terms twice a year. In view of the scarcity of national account data on building activity, construction surveys are an important source of information concerning short-term developments in this sector. The construction survey provides qualitative information, with the exception of one quantitative question on the number of months of production secured.

B. Retail survey: contains 22 questions with a quantitative and qualitative focus. The first section asks about current production, stocks, consumers demand, and problems affecting business (numeric answers are available in percentages and ranges). The second section focuses on expectations of sales, economic situation, exchange rate and inflation (specific numeric answers are required for macroeconomic variables). The third section asks about sales prices, employment and profits, while the last section inquiries about the main activity of the business.

Manufacturing Survey

1. Regarding the main product, do you consider the economic situation of the company to be:

    - Good
    - Acceptable
    - Poor

- N/A

2. Compared to the previous month, the productive activity of your company during [month] was: (Exclude changes due to normal pauses in production, such as holidays, holidays, and maintenance)
    - More intense
    - Approximately the same
    - Weaker
    - N/A
3. At the end of this month, the stock of finished products without selling was:
    - Too large
    - Sufficient given the time of year
    - Too small
    - We do not maintain stocks
    - N/A
4. Compared to the previous month, the orders received (domestic and/or foreign) during [month]:
    - Increased
    - Remained unchanged
    - Decreased
    - N/A
5. At the end of this month [month], you had to fulfill a volume of orders (domestic and/or foreign):
    - Higher than at the end of the previous month

- Approximately the same as at the end of the previous month
- Lower than at the end of the previous month
- N/A

6. You consider the current volume of orders to be:

    - High
    - Normal
    - Low
    - N/A

7. Based on the current volume of orders (or current demand situation), you consider the installed capacity to produce to be:

    - More than sufficient
    - Sufficient
    - Insufficient
    - N/A

8. Discounting normal seasonal changes, it is anticipated that over the next three months your production will:

    - Increase
    - Remain approximately the same
    - Decrease
    - N/A

9. It is anticipated that over the next three months the net selling prices in the country will:

    - Increase more than in the previous quarter

- Remain the same as in the previous quarter
- Increase less than in the previous quarter
- Not increase
- N/A

10. Discounting normal seasonal fluctuations, do you consider that your economic situation over the next six months will be:

    - More favorable
    - Approximately the same
    - More unfavorable
    - N/A

11. Based on the order rate (or demand) you expect for the next twelve months, do you consider that your current installed capacity for production is:

    - More than sufficient
    - Sufficient
    - Insufficient
    - N/A

12. If you were to buy dollars in the financial sector this week, at what exchange rate do you think you could get them? (Value in pesos, do not use commas or periods as thousands separators)

13. At the end of the current month, by what percentage do you think the CPI (Consumer Price Index) will have changed in the last 12 months?(Percentage value; use a negative number if it is a decrease)

    Information Treatment: According to the latest Analysts′ Expectations Survey from the Central Bank, the exchange rate in [month] [year] will be X pesos.

14. If you were to buy dollars in the financial sector in twelve months, at what exchange rate do you think you could get them? (Value in pesos, do not use commas or periods as thousands separators)

15. By what percentage do you think the prices in the economy, measured by the Consumer Price Index (CPI), will increase or decrease in Colombia over the next 12 months? (Percentage value; use a negative number if it is a decrease)

Retail sector

1. How do you consider the current economic situation of your company or business?

    - Good
    - Acceptable
    - Bad
    - N/A

2. Compared to [previous month], were your sales in units this month:

    - Higher
    - Approximately the same
    - Lower
    - N/A

3. Compared to [month] of last year, were your sales in units this month:

    - Higher
    - Approximately the same
    - Lower
    - N/A

4. By what percentage did they increase:
    - Increased by more than 10
    - Increased between 6% and 10%
    - Increased between 1% and 5%
5. By what percentage did they decrease:
    - Decreased between 1% and 5%
    - Decreased between 6% and 10%
    - Decreased by more than 10%
6. How do you consider the current level of your stocks in units:
    - High
    - Normal for this time of year
    - Low
    - N/A
7. How do you consider the current demand for your products in the national market:
    - Good
    - Acceptable
    - Bad
    - N/A
8. Do you consider that during [month] your orders to suppliers were:
    - High
    - Normal for this time of year

- Low
- N/A

9. The main problem currently affecting you is related to:

    - Low demand
    - Smuggling
    - Supply of national products
    - Supply of foreign products
    - Accounts receivable turnover
    - Supplier credit
    - Bank credit
    - Financial costs
    - Other costs. Specify
    - Street sales
    - Direct factory sales
    - Qualified personnel
    - Others. Specify

10. Can it be anticipated that compared to [next month] last year, your sales in units next month will be:

    - Higher
    - Approximately the same
    - Lower
    - N/A

11. Can it be anticipated that in the next six months the economic situation of your company or business will be:

    - More favorable
    - Approximately the same
    - Less favorable
    - N/A

12. 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)

13. 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)

    Information Treatment: According to the latest Survey of Analyst Expectations conducted by the central bank, the exchange rate in [month] [year] is expected to be X pesos per dollar.

14. 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)

15. How much do you anticipate the prices of Colombia's economy, as measured by the consumer price index (CPI), to increase or decrease in the next 12 months? (Percentage value; in case of a decrease, use a negative number)

16. According to the latest Survey of Analyst Expectations conducted by the central bank, the exchange rate in [month] [year] is expected to be X pesos per dollar. We updated the month and the exchange rate forecast for firms treated in later months.

17. By what percentage do you believe the prices in the economy, measured by the Consumer Price Index (CPI), will increase or decrease in Colombia in the next 12 months?

D Treatment Effects on Inflation

This section expands on the results shown in section 5. In a broad sense, the results in this section estimate equation 1, but instead of using S, the nominal exchange rate as an outcome, it uses π, local CPI inflation.

	Inflation	
	(1)	(2)
Prior	0.771***	0.893***
	(0.064)	(0.043)
Prior x Treatment	-0.263**	-0.444***
	(0.071)	(0.038)
Treatment	1.062**	1.338***
	(0.274)	(0.098)
Constant	1.932***	0.956***
	(0.217)	(0.062)
Regression	OLS	Huber
Time FE	Yes	Yes
Observations	681	648

Table 14: Treatment Effect on Inflation Expectations

Note: This table summarizes our estimation of equation 1, for the inflation rate of headline CPI $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Column (1) estimates the regression using ordinary least squares. Column (2) estimates 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 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 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 also decouples 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 8 offers a graphical representation of the results in Column (1) of Table (14). The x-axis shows the nowcast of inflation in percentage points after controlling for time fixed effects, effectively de-meaning the variable. 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 control 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 weakens the relation between nowcasts and forecasts. The extent to which the orange and

blue lines have a statistically different slope is the object of interest of Table 14.

In a similar fashion to our study of heterogeneous treatment effects for the nominal exchange rate, Figure (9) studies the role of heterogeneity in the formation of inflation expectations of firms after they receive information about the nominal exchange rate.

The treatment effects are, on average smaller, and, exhibit less heterogeneity than the results on exchange rates.

Figure 10 conducts a similar exercise to that depicted in the main body in Figure 5 but using inflation nowcasts and expectations. 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 10 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.

E Statistical Properties of the Exchange Rate and the Exchange Rate Forecast

In this forecast we present information about the behavior of the exchange rate of the Colombian peso versus the US dollar, and statistical properties on the average forecast of financial analysts that we provide in the treatment.

E.1 Properties of the Exchange Rate

Throughout our paper, the exchange rate is quoted with the convention used in Colombia for the exchange rate, which is the number of pesos per dollar, so an increase in the exchange rate denotes a depreciation of the Colombian peso. Whenever we refer to *the exchange rate*, we use it as shorthand to refer to the peso-dollar nominal exchange rate.

Figure 11 presents the 12-month CPI inflation rate for the Colombian economy in red and right axis, and the 12-month percent change in the exchange rate in blue and the left hand axis using data from the year 2000. Two messages arise from the figure. First, the exchange rate is substantially more volatile than the inflation rate of the Colombian economy. While plus or minus 20% volatility is normal for the exchange rate, the bulk of the variation in inflation rates goes from 2 to 6 percent. The second message is that the two series co-move significantly. The contemporaneous correlation of CPI inflation and percent change in the exchange rate is equal to 32%.

The exchange rate comoves not only with macroeconomic aggregates like the inflation rate, but it comoves with the price of specific products that have a relevant weight in the industrial and export industry of the country. Colombia specializes in the exports of commodities, particularly oil and coal. Crude oil and refined petroleum accounted for 31% of exports in 2022.[19] Figure 12 shows the correlation of the 12-month change of the exchange rate with the 12-month percent change in

[19]Source: Observatory for Economic Complexity https://oec.world/en/profile/country/col

	(1)	(2)	(3)	(4)
	NER_t	NER_t	NER_t	NER_t
NER_{t-1}	0.997***	0.997***		
	(0.006)	(0.006)		
NER_{t-12}			0.948***	0.948***
			(0.022)	(0.057)
Observations	391	391	380	380
Standard Errors	Robust	Newey-West	Robust	Newey-West
P-Value Unit Root	0.64	0.65	0.02	0.36

Table 15: Statistical Properties of the Nominal Exchange Rate of the Colombian peso versus the US dollar

Note: *NER* is the nominal exchange rate of the Colombian peso versus the US dollar. Please see the text in this section for the convention of the exchange rate. Data come from the Central Bank of Colombia. The frequency is monthly and each observation corresponds to the average exchange rate within the month.

the price of the WTI oil price. As the figure shows, times of strong depreciations coincide with periods of falling oil prices, with a correlation of -34%.

Nominal exchange rates are notoriously difficult to forecast, so natural questions are whether the average forecast provided by financial analysts is superior to other forecasting rules, and whether the exchange rate of the Colombian peso versus the US dollar behaves like a random walk.

Table 15 presents evidence on the persistence of the nominal exchange rate. Columns 1 and 2 regress the level of the nominal exchange rate on its one-month lag. Column 1 computes robust standard errors, while Column 2 computes Newey-West standard errors. In both cases, it is not possible to reject the null hypothesis of a unit root. Columns 3 and 4 regress instead the level of the exchange rate on its 12-month lag, to explore whether time aggregation reduces the persistence of the exchange rate. It is not possible to reject the null of a unit root when using Newey-West standard errors.

Finally, we elaborate on the behavior and relative performance of the forecast we provide to firms in the intervention. As we highlighted in the text, we provided a publicly available forecast computed by averaging the 12-month-ahead forecast

of the exchange rate by individual financial analysts that is printed by the Central Bank in its monetary policy report.

Figure 13 plots the outcome of three forecasting rules. Each series at a given date plot the forecast made on that date. The first one, in red, is labeled the *Random Walk* forecast, which is by construction equal to the realization in each point in time of the nominal exchange rate. The second, labeled *Full Sample OLS* is the result of running a regression of the nominal exchange rate on 12 lags and use the estimated coefficients to create a forecast. The final one, in the thick blue line, forecast of financial analysts, which for short we call *PF Survey*, for Professional Forecast.

Two main messages arise from Figure 13. First, the Survey forecast to a large extent tracks the observed exchange rate, although in periods of high-frequency volatility, forecasters smooth their forecasts. Second, the benefits of the departures from the Random Walk Forecast do not translate into lower forecast errors. The caption of Figure 13 reports that the average forecast errors as a share of the exchange rate level is equal to 11% for the Random Walk Forecast and the Full Sample OLS, while it is equal to 12% for the Survey Forecast.

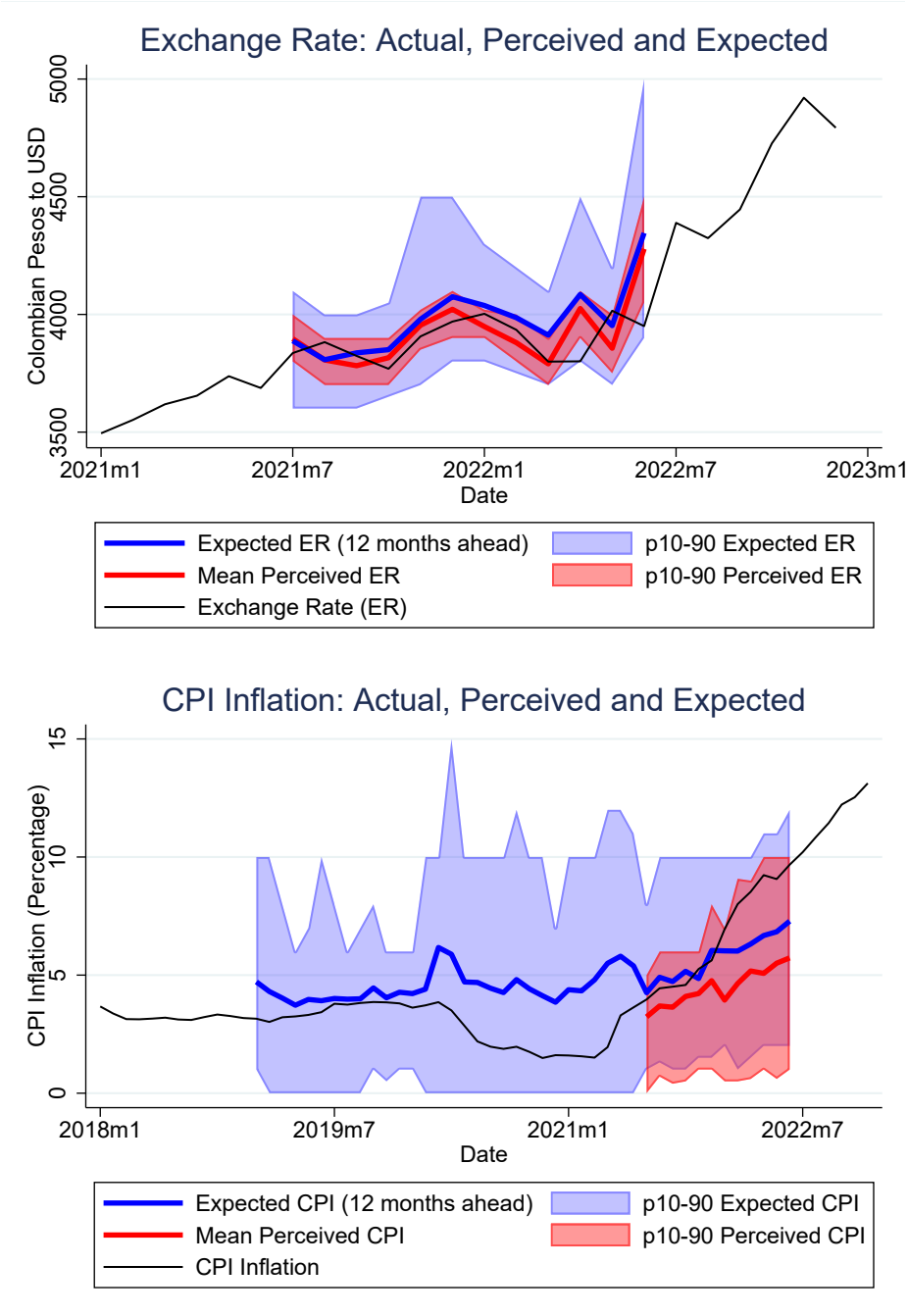

Figure 2: Perceptions and Expectations of the CPI Inflation Rate and the Nominal Exchange rate in Colombia

Note: This figure shows the behavior of the nominal COP/USD exchange rate in panel (a) and Colombian CPI inflation in panel (b). The solid black lines represent the realization of each variable, and the solid blue lines denote each variable's one-year-ahead expectation. The blue-shaded areas represent the 90th and 10th percentiles of the cross-section of forecasts, while the red-shaded areas depict the 90th and 10th percentiles of the cross-sectional distribution of nowcasts. The solid red line depicts the average nowcast of each variable. See the main text for a description of how we trimmed the raw data.

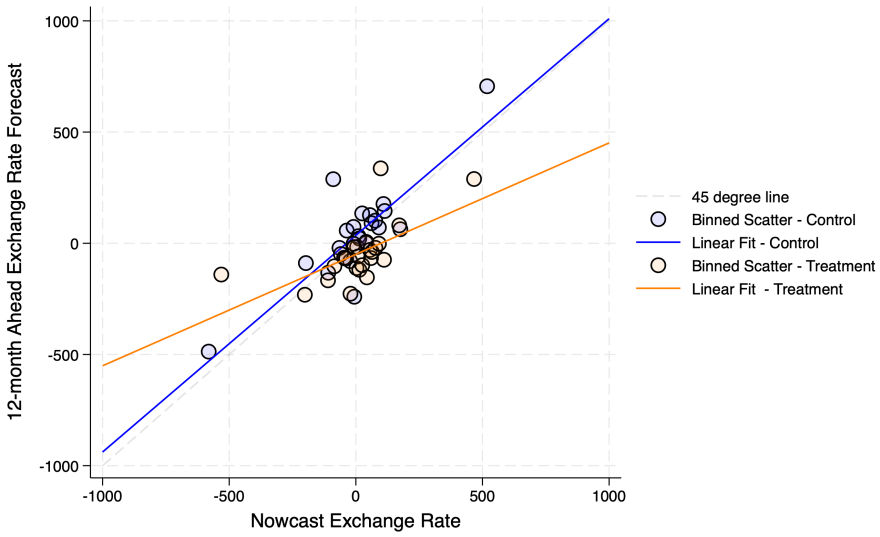

Figure 3: Relationship of Perceptions and Forecasts for Treated and Control Groups: Nominal Exchange Rate

Note: This figure shows the cross-sectional relationship between inflation perceptions on the x-axis and 12-month-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 control firms, and the solid orange line shows the best linear fit. The x- and y-axis are expressed in percentage points relative to the monthly average.

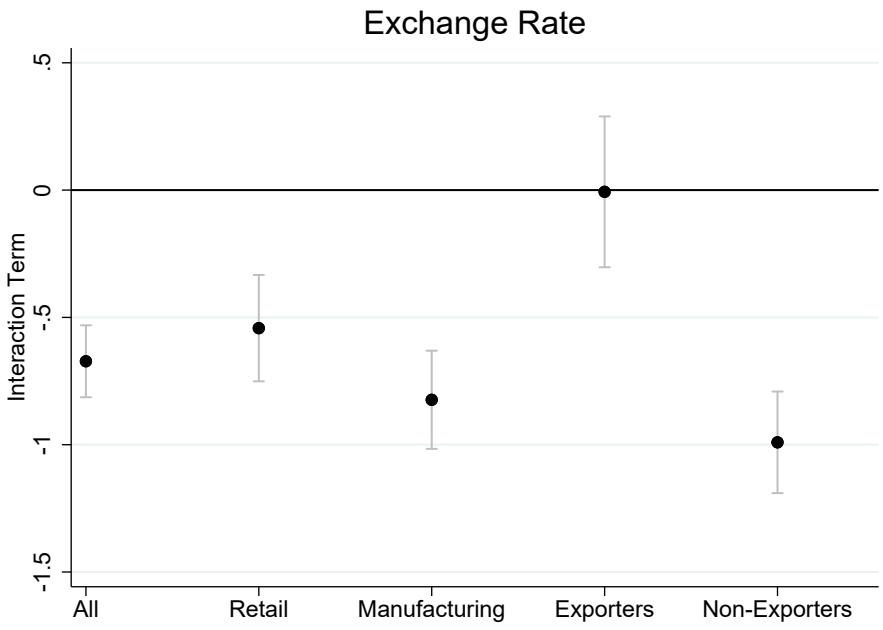

Figure 4: Heterogeneity in Treatment Effects

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

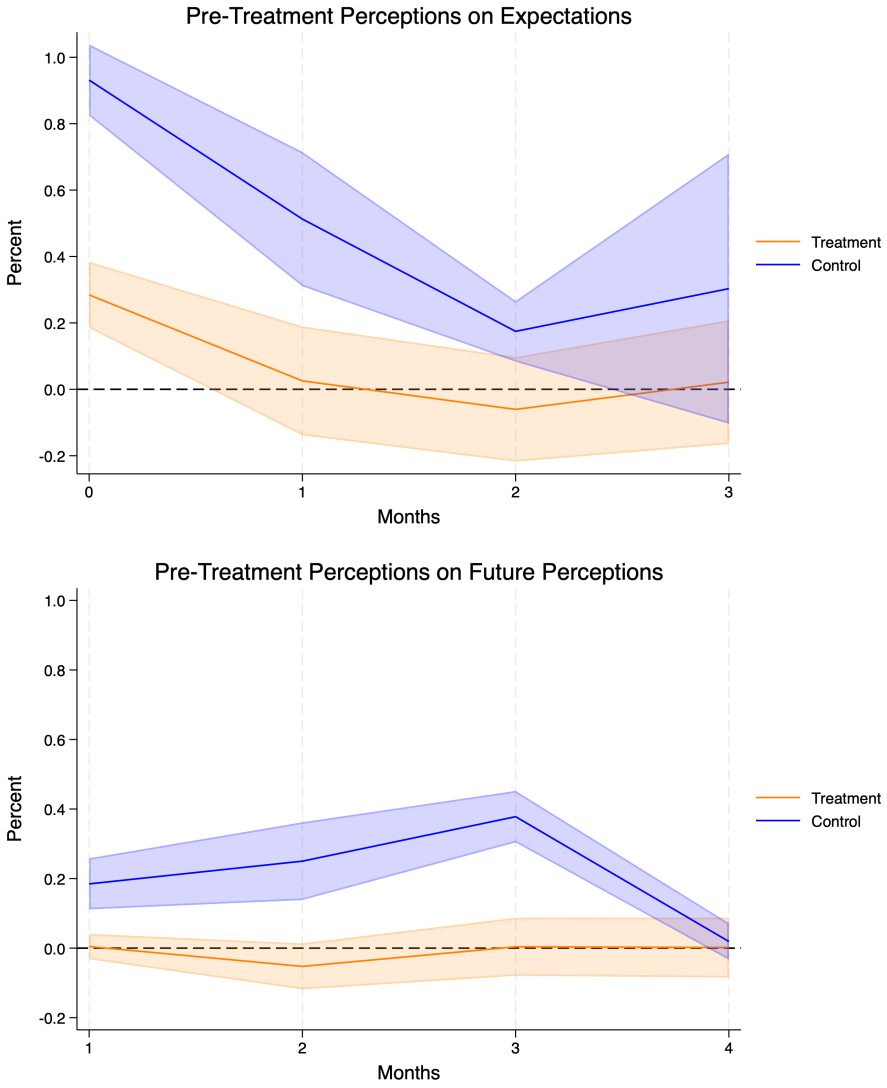

Figure 5: Persistence of Treatment Effects: Nominal Exchange Rates

Note: Panel (a) shows our estimation of equation 1 for $h \in [0,3]$ and $S = X$, that is, the one-year-ahead exchange rate forecast formed in h periods after treatment. The solid orange line shows the point estimate $\hat{\beta}_2^h$ and its associated 95 percent confidence bands in orange-shaded areas. The solid blue lines represent the estimates for $\hat{\beta}_2^h + \hat{\beta}_3^h$ and the associated confidence intervals in blue-shaded areas. Panel (b) presents analogous results for the estimation of equation (1), that is, the impulse response functions of priors formed τ periods after treatment. We include time fixed effects in every regression and use robust standard errors.

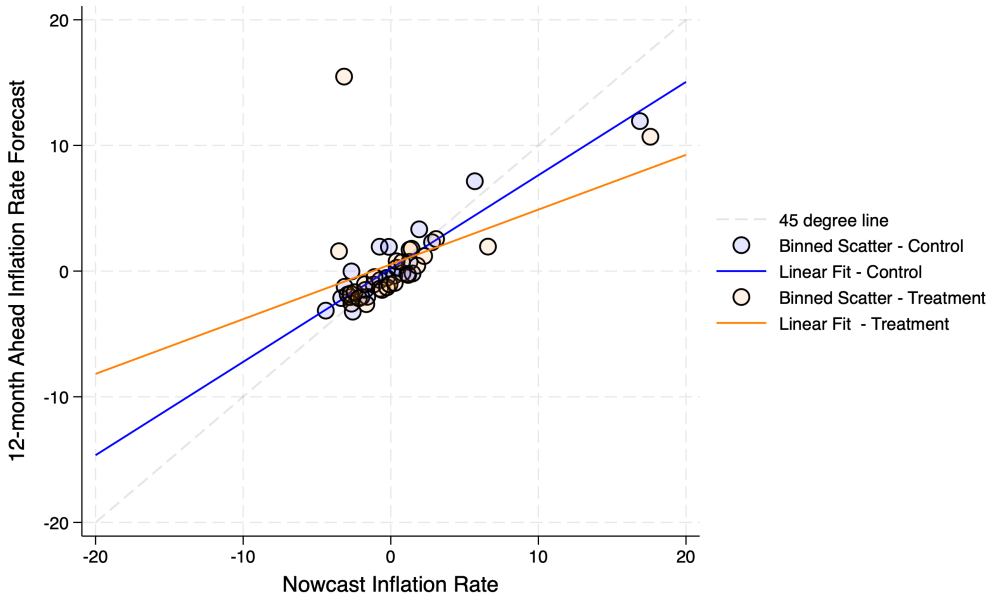

Figure 8: Relation of Perceptions and Forecasts for Treated and Control Groups: Inflation

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.

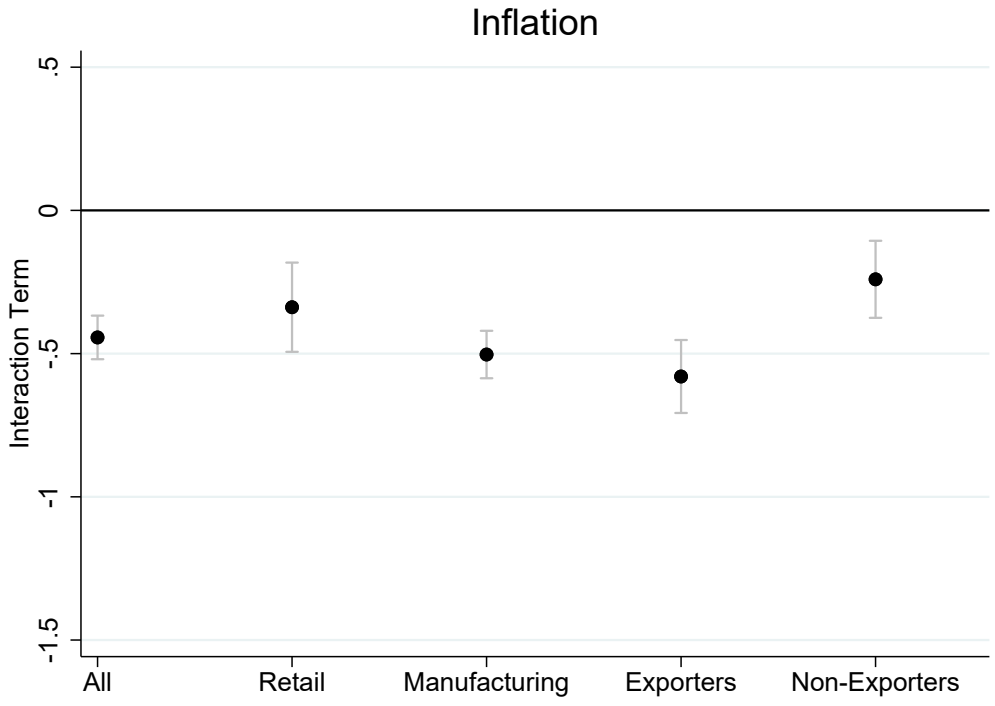

Figure 9: Heterogeneity in Treatment Effects on Inflation Expectation Formation

Note: The figures show the differential weight in the prior between Treatment and Control groups, $\hat{\beta}_3$, for all firms, retail firms, manufacturing firms, manufacturing exporters, and manufacturing non-exporters. The outcome variable is inflation expectations. Treatment assignment is stratified at each of these characteristics. 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 uses robust standard errors.

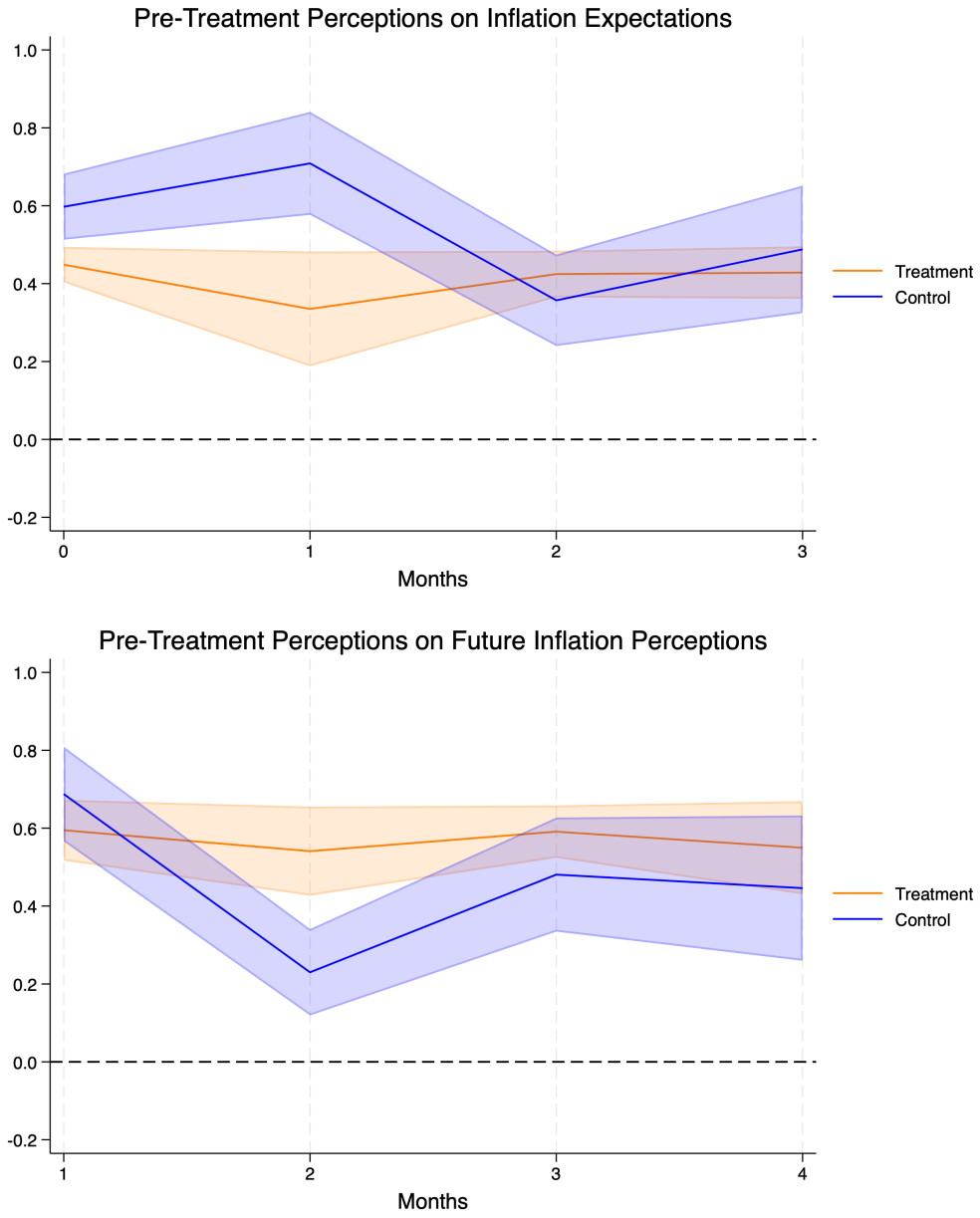

Figure 10: Persistence of Treatment Effects: Inflation Rates

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 τ periods after treatment. We include time fixed effects in every regression and use robust standard errors.

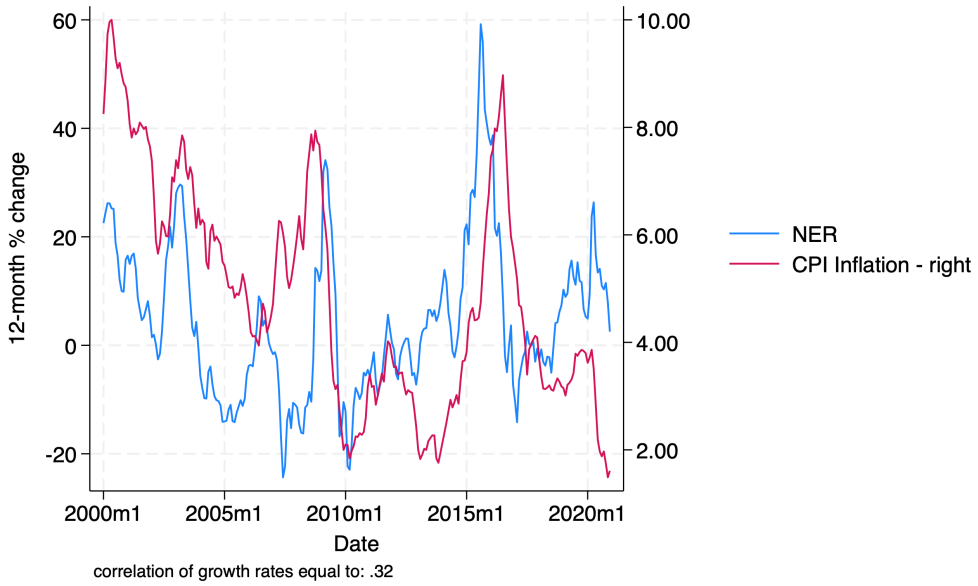

Figure 11: Percent Changes USD COP Exchange Rate and CPI Inflation

Note: The Figure shows the 12-month percentage change of the nominal exchange rate between the USD and the Colombian Peso (left axis) and the Colombian 12-month CPI inflation (right axis).

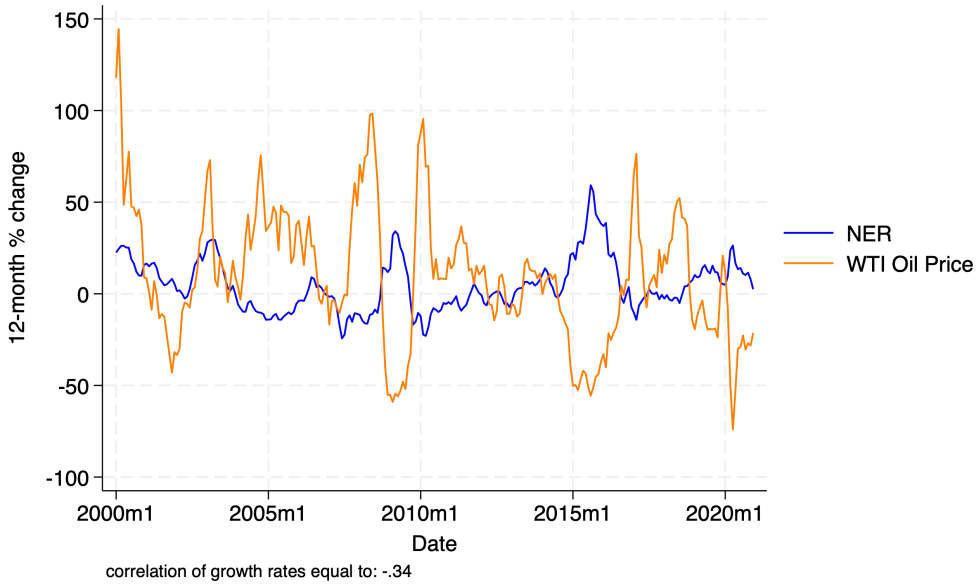

Figure 12: Percent Changes in the USD COP Exchange Rate and Oil Prices

Note: The Figure shows the 12-month percentage change of the nominal exchange rate between the USD and the Colombian peso and the WTI oil price.

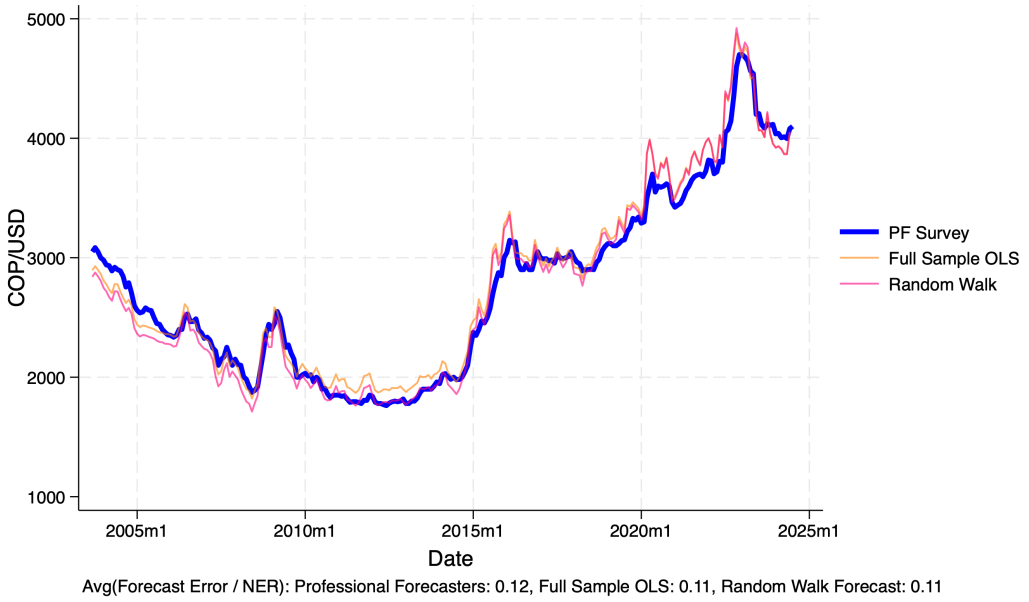

Figure 13: Forecast Errors of Different Forecasting Rules

Note: This figure shows the behavior of three forecasting rules. The Professional Forecaster Survey in blue, the Random Walk Forecast in red, and a fitted OLS autorregresive regression .