

DISCUSSION PAPER N° IDB-DP-1075

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Preliminary Findings

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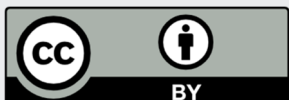
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The Causal Effects of Expected Depreciations*

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September 6, 2024

Abstract

We estimate the causal effects of a shift in the future expected exchange rate of a local currency against the US dollar on a representative sample of firms in a small open economy. We survey a nationally representative sample of firms and provide the one-year-ahead nominal exchange rate forecast published by the local central bank to a random sub-sample of firm managers. This information treatment is effective in shifting exchange rate expectations and perceptions. These effects are persistent and larger for non-exporting firms. Linking survey responses with administrative census data, we estimate a positive elasticity of current import expenditures to a future expected depreciation. Our estimates highlight the intertemporal margin of trade to anticipated changes in trade costs.

JEL classifications: E31, E71, F31, G41

Keywords: Expectations, exchange rate, firms, trade.

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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. Shifts in this price affect directly revenues and input costs of firms (Gopinath, Itskhoki, and Rigobon, 2010; Auer, Burstein, and Lein, 2021), and indirectly affects the implementation of economic policy and the determination of prices in general equilibrium (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 the reaction of firms 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 dominant role of the dollar in the country’s international trade (Gopinath et al., 2020). To solve the identification challenge, we introduce an information treatment to a random subsample of firms that induces exogenous variation in future expected depreciations across firms. Two ex-ante identical firms will have different expectations of the future exchange rate due to the information treatment. We use these exogenous shifters of exchange rate expectations to estimate the causal effects of an expected depreciation on various firm-level outcomes. Our identification approach uses variation in future expected depreciations induced by an RCT across firms in the same country, as opposed to using variation in exchange rate regimes across countries (Fukui, Nakamura, and Steinsson, 2023; Bouscasse, 2022; Candia and Pedemonte, 2021) or large unex-

¹“Nowcasts” and “perceptions” are used interchangeably throughout the paper. The nowcast denotes the perceived exchange rate at which firms anticipate conducting transactions using the local currency relative to the US dollar.

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

The dynamic aspect of the variation our randomized controlled trial induces 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 and other firms will receive news of a future expected decrease in input prices. 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, it will include an intertemporal elasticity of foreign input demand. Firms that receive an expected depreciation shock will anticipate their expenditures, while firms that receive an expected appreciation shock will postpone their import expenditures compared to similar firms in the control group. This intertemporal elasticity of foreign inputs demand is less studied in the international trade literature, it is conceptually related to the intertemporal elasticity of demand in the investment and durable consumption literature (House and Shapiro, 2008; McKay and Wieland, 2021) with the added benefit of having very clean identifying assumptions, and it is a crucial input to models of lumpy and durable import behavior as in Alessandria, Kaboski, and Midrigan (2010).

One of the main advantages of our approach is that it isolates the direct effects of changes in exchange rates from indirect general equilibrium (GE) effects and policy reactions that current exchange rate movements induce. To give an example, after an exchange rate depreciation, monetary policy rates will react as a function of the GE pass-through of the exchange rate into local inflation, and the shape and strength of the reaction of the local central bank to inflation shifts. Therefore, the estimated effects of an exchange rate movement in the time series will be the bundle of the direct, indirect (GE), and policy reaction effects. Our approach effectively shuts down the reaction of aggregate quantities and prices in the present, while conserving the expected direct and indirect effects of exchange rate shocks, working as a natural elasticity to target in models of international finance and trade with forward-looking firms (Alessandria, Arkolakis, and Ruhl, 2021; Egorov and Mukhin, 2023; Alessandria, Khan, and Khederlarian, 2024).

Our first main finding is descriptive and does not rely on the randomized intervention. Firm managers in Colombia are substantially more aware of the current exchange rate level than the current inflation rate. While there is substantial disagreement on the exchange rate's future level,

this disagreement is smaller than the one prevailing about the inflation rate's future level. These findings are consistent with the view that firms operate under imperfect information but are more attentive to the exchange rate than to other macroeconomic outcomes, such as the inflation rate, that are less payoff-relevant and less volatile.

We then proceed to measure the effects of the treatment on expectation formation. For firms in the control group, managers who perceive a high current value of the exchange rate also expect high future values. The slope between exchange rate perceptions and forecasts is indistinguishable from one for firms in the control group. Our treatment substantially weakens this relation. The slope between perceptions and expectations for firms in the treatment group is between 30 to 40 percent of the slope for firms in the control group, depending on the specification.² The treatment also weakens the relationship between perceptions and expectations for the inflation rate. The correlation between inflation perceptions and inflation expectations is between 50 to 66 percent smaller for firms in the treatment group. 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 are persistent for a few months. The difference in the weight of pre-treatment perceptions on future expectations lasts 2 to 4 months after treatment. Not only do we document persistent effects in forecast formation, but persistent effects in future nowcast formation. That is, the future perceptions of firms in the control group exhibit a notably stronger correlation with the pre-treatment perception compared to those of firms in the treatment group..

We link survey responses with administrative firm-level data to estimate the effect of the treatment on economic decisions at the firm level. We link the survey data with granular administrative records on the export and import decisions of the firms, along with information on the country of origin or destination, the value of the transaction in US dollars and Colombian pesos (COD), and detailed information on product categories.

We find significant effects of the exchange rate forecasts on exporting and importing behavior. The treatment decouples firm-level exports and imports in a post-treatment year (12 months starting when the intervention started) from their pre-treatment levels (previous 12 months). We find that firms reset their unit prices, particularly so for exports to destinations using a currency

²We estimate this treatment effect using ordinary least squares (OLS) or Huber robust regression, which controls for outliers and influential observations.

different from the USD, consistent with Boz et al. (2022). Under the dominant currency pricing, expenditure switching is stronger for destinations that do not use the USD, increasing the incentives to reset prices to those destinations.

Finally, we put together all the previous results and estimate the intertemporal elasticity of firm-level outcomes to an expected depreciation using the treatment intensity as an instrument. This strategy is similar in spirit to Coibion et al. (2023). We estimate that a 1 percent future expected depreciation (appreciation) increases (decreases) realized imports by 6 percent in the year following our intervention.

The elasticity we measure combines changes in the intensive and extensive margin across origins and products. In robustness exercises, we keep fixed the origin of imports, by unpacking firm exports into firm-origin exports, and estimate an elasticity of 2. We also show that most of the action comes from changes in the timing of imports of the most important products for the firm.

Throughout the paper, we reject the economic null hypothesis that firm managers incorporate all public information to form their expectations, perceptions, and actions. Documenting information frictions for the exchange rate is particularly informative, since we introduce an information treatment about a payoff-relevant and volatile economic variable, two ingredients that predict high attention by price setters. We also show relevant margins of heterogeneity to the same piece of information, further confirming the role of information frictions. The treatment is more effective in shifting the expectations of firms that do not export, which aligns with the intuition that exporting firms are more sophisticated and interact more often with international markets.

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

While there is a large literature documenting the expectation formation process of firms, there is little evidence of the effect of those expectations on actual decisions. The relatively small literature documenting the effects of expectation formation on decisions arises from the difficulty of linking survey and administrative data. There are notable exceptions. Coibion, Gorodnichenko,

and Kumar (2018) and Coibion, Gorodnichenko, and Ropele (2020) estimate that changes in firms' inflation expectations, driven by an information treatment, affect firms' pricing and employment decisions. Other notable examples are Savignac et al. (2021), Abberger et al. (2023), and Buchheim, Link, and Mohrle (2023).

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

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

Alessandria, Kaboski, and Midrigan (2010) highlight the role of inventory management problems for importers. They document that imports are lumpy and that importer firms have higher inventory ratios than firms that do not import. They model this feature of imports and 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 the imports dynamics. Our findings at the

firm level confirm that those considerations are relevant to explain firms' behavior when facing uncertainty about the future price of the exchange rate.

2 The Survey: Questionnaire and Time Frame

Since 1979, the Managerial Expectations Survey, known as the EOE for its name in Spanish (Encuesta de Opinión Empresarial), has been conducted monthly by surveying managers from a nationally representative sample of firms in the manufacturing and retail sector. The Colombian think tank Fedesarrollo and the Central Bank of Colombia conduct the survey. The sampling universe of firms comes from the universe of all companies reporting to the National Manufacturing Survey,³ to the Foreign Exchange Risk survey conducted by the Central Bank of Colombia, and to the Financial Superintendency of Colombia. The survey 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 their firms' behalf.

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

We modified existing questions and added new questions, and an information treatment to this survey. Starting in January 2019, we suggested a modification of a qualitative question that captured whether firms expected the inflation rate to increase, decrease, or stay the same into a question that measures a numerical expectation for the inflation rate one year in the future.

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

³Collected by DANE, the National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística in Spanish)

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

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

1. If you were to buy dollars this week in the financial sector, what is the exchange rate at which you could purchase them? (Value in pesos; do not use commas or points)
2. At the end of the current month, by what percentage do you think the CPI will have changed in the last 12 months? (Percentage value; in case of a decrease, use a negative number)
3. What exchange rate would you expect if you were to purchase dollars in the financial sector in 12 months? (Value in pesos; do not use commas or points)
4. How much do you anticipate the prices of Colombia's economy, as measured by the 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 exchange rate between the US dollar and the Colombian peso obtained from a monthly and publicly available professional forecasters survey of the Central Bank of Colombia.⁵ Appendix D details the time-series properties of the COP/USD nominal exchange rate, as well as time-series properties of average forecast from the survey. We assigned 50 percent of the whole universe of potential survey participants to a treatment group and

⁴In 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).

⁵Encuesta Mensual de Expectativas de Analistas Económicos (EME), available at <https://www.banrep.gov.co/es/estadisticas-economicas/encuesta-mensual-expectativas-analistas-economicos>.

the remaining 50 percent of firms to a control group. We implemented the treatment after eliciting nowcasts and before eliciting forecasts, that is, between questions 2 and 3 in the list of questions above. Table 6 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.

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

The treatment consists of information delivered to firms after they answer the second question and before they answer the third question listed above. Firms in the control group did not receive any information between the second and third questions listed before. The treatment information reads as follows, translated from the original text in Spanish: “According to the latest Survey of Analyst Expectations conducted by the central bank, the exchange rate in July 2022 is expected to be 3,650 pesos per dollar.”⁶

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

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 at keeping inflation within 2–4 percent, with 3 percent as the target value. According to the classification of Ilzetzi, Reinhart, and Rogoff (2019), Colombia has a *managed floating exchange rate regime*.

Figure 1 shows the 12-month inflation rate of Colombia since 1991, the year in which the cur-

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

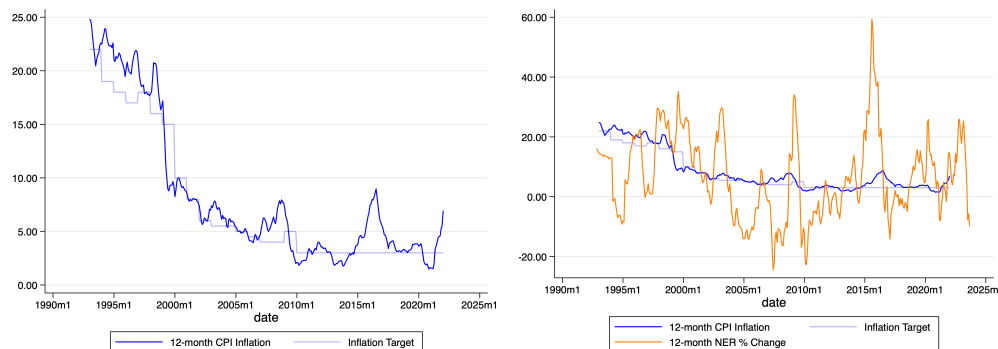


Figure 1: The 12-Month CPI Inflation Rate, Inflation Target, and 12-Month COP/USD Change in the Nominal Exchange Rate

Note: Panel (a) plots the official 12-month CPI inflation rate for Colombia, along with the center point of the inflation target. Panel (b) 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.

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

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 documents the cross-sectional average and the cross-sectional dispersion of the perception and one-year-ahead forecast of 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), there is little evidence on how inattentive firms are to exchange rates. We provide information about the level of firms' inattention to aggre-

⁷When 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 deputy-directors, and the Minister of Finance. The Colombian president nominates two members in the middle of his or her mandate, which lasts for four years. Therefore, a president will have appointed three out of seven members.

gate national and international variables.

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

Surveys usually contain outliers and non-responses. We trim observations, for nowcast and forecasts, that are below the 1st or above the 99th percentile of the distribution (for the inflation rate, this corresponded, in August 2021 to observations below -2 percent and above 30 percent). Table 5 in Appendix A reports several summary statistics of each variable in July 2021, the baseline of our survey before treatment assignment.

Figure 2 illustrates our first finding. Panel (a) shows the realization and different moments of the cross-sectional distribution of nowcasts and forecasts of the COP/USD exchange rate. In particular we will discuss the average as well as the range between the 10th and the 90th percentile for nowcasts and forecasts. First, firms correctly perceive, on average, the current level of the exchange rate, as the solid red line tracks the solid black line. Second, the average forecast (solid blue line) closely tracks the average perception (solid red). Third, there is considerably greater cross-sectional dispersion in exchange rate forecasts compared to exchange rate perceptions (the blue-shaded areas are wider than the red-shaded areas).

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

The cross-sectional dispersion of the exchange rate is significantly smaller than that for inflation as we show in Table 1.⁸ While we cannot disentangle the reason for the lower dispersion, the exchange rate against the dollar is typically reported in the economic section of every daily TV news show and every major newspaper. The nominal exchange rate against the US dollar is also visibly posted at currency exchange retailers (*casas de cambio* in Spanish), similar to gas prices in 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.

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.⁹ 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

⁸Table 7 in Appendix A shows the same statistics, separating the treatment and control groups.

⁹Data for professional forecasters come from the EME survey, which is detailed in Section 2.

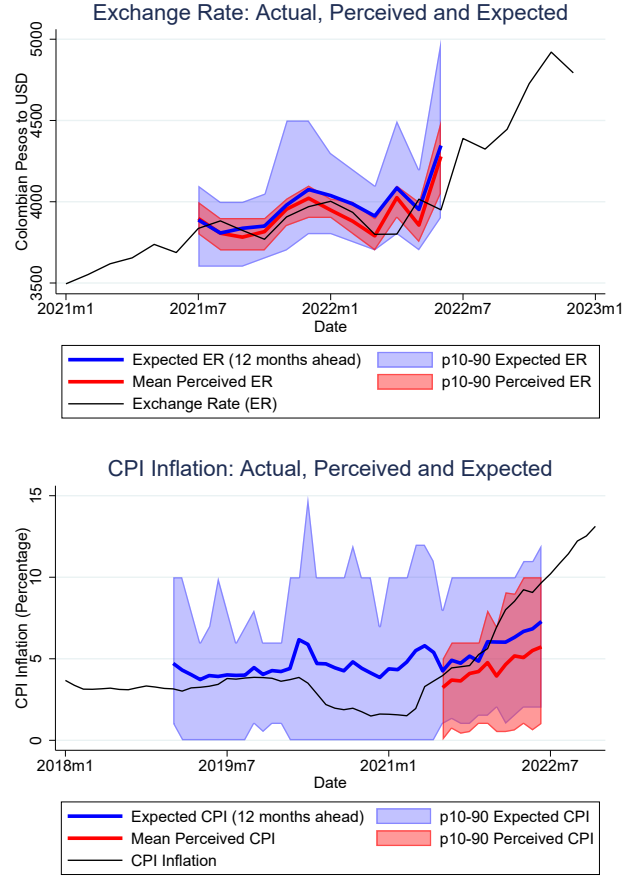


Figure 2: Perceptions and Expectations of the CPI Inflation Rate and the Nominal Exchange rate in Colombia.

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.

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

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

We estimate the causal effects of the information treatment on the formation of firm-level expectations and perceptions following the approach outlined by Coibion, Gorodnichenko, and Weber (2022), Armantier et al. (2016), Cavallo, Cruces, and Perez-Truglia (2017) and Coibion, Gorodnichenko, and Kumar (2018), the gold standard in this literature. We measure the differential effect of a prior belief of a given economic variable on the formation of expectations of the same variable between treatment and control groups. Since treatment assignment is random and therefore exogenous to the firm, the differential effect of the prior on the forecasts captures the weight that managers in the control group place on the signal contained in the treatment.

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

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

Ideally, a researcher would have access to a prior and posterior belief of the same variable. In this case this would amount to a pre-treatment and post-treatment measure of exchange rate forecasts at the firm level. However, there are practical concerns associated with asking the same question twice to a given respondent in a survey. The literature has approached this issue by either asking for a probability distribution first and then asking for an expected value, or by asking for a variable that correlates at the firm level with the forecast. We follow the latter approach and use the nowcast measure as a proxy for the prior in the equation above. It is not obvious ex-ante that nowcasts and forecasts are strongly correlated at the firm level. We will document a strong correlation between nowcasts and forecasts at the individual level for firms in the control group, validating our use of the nowcast as a proxy for the prior belief about future exchange rate forecasts.

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

$$X_{i,t+h,t+h+\tau}^e = \beta_t + \beta_1 T_{i,t} + \beta_2 X_{i,t,t}^e + \beta_3 T_{i,t} \times X_{i,t,t}^e + \epsilon_{i,t}, \quad (1)$$

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

A key regressor in specification 1 is $X_{i,t,t'}^e$, the nowcast of variable X by firm i in period t . As shown in Weber et al. (2023), the sum of coefficients $\beta_2 + \beta_3$ captures the weight assigned to the prior by firms in the treatment group, and β_2 captures the weight assigned to the prior by firms in the control group. 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 firm in the treatment group and would put less weight on their prior. Under the reasonable assumption that firms do not receive differential information about the economy as a function of their treatment status in the time elapsed between when the nowcasts and the forecasts are elicited (a matter of a couple of minutes), we can assign the extent of learning to our treatment.

5.1 On-Impact Causal Effects

We start this section 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. We will later 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. We also consider effects for $X = \pi$, the rate of CPI inflation for the Colombian economy, in Appendix C. We compute one-year-ahead expectations, so $\tau = 12$ and $h = 0$ in equation 1. We use the expectations formed in the month in which firms receive the treatment.

We 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 outliers and influential observations. We report standard errors clustered at the time the firms were treated and include time fixed effects to absorb variation driven by aggregate shocks that may be correlated with the temporal pattern in which firms participate in the survey. Since we are measuring the causal effects of the treatment on impact, we only use one observation per firm, and our benchmark sample consists of 681 firms.

Columns (1) and (2) of Table 2 estimate regression 1 for the exchange rate using information from 681 firms for OLS and 659 using Huber robust regressions.¹⁰ The first row shows our estimates of $\hat{\beta}_2$, the weight on the nowcast for firms in the control group. This coefficient is interpreted as a slope coefficient. Firms in the control group that perceive an exchange rate of 1 COD higher also forecast a 1 COD higher exchange rate one year from now. We cannot reject the null hypothesis that this coefficient is equal to one. That firms in the control group show a strong correlation

¹⁰The number of observations change because the robust regression drops influential observations.

	Exchange Rate	
	(1)	(2)
Prior	0.978*** (0.152)	0.958*** (0.082)
Prior x Treatment	-0.601** (0.163)	-0.672*** (0.089)
Treatment	2,208*** (604.1)	2,496*** (334.1)
Constant	143.2 (569.6)	196.1 (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 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 equals one if the firm is assigned to the treatment group, and zero otherwise.

between nowcasts and forecasts validates our choice of asking for perception variables as a proxy for the prior belief of firms about future exchange rates.

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

Figure 3 offers a graphical representation of the results in Column (1) of Table 2. The figure is a binned scatterplot of the nowcast of the exchange rate after controlling for time fixed effects on the x-axis, and the one-year-ahead exchange rate forecasts after controlling for time fixed effects. The relation between perceptions and forecasts for firms in the control group, here plotted in blue circles and a blue line, is best represented by a 45-degree line. We do not need to take a stance on the drivers of dispersion in nowcasts across firms for our research design. The relationship be-

tween nowcasts and forecasts for firms in the treatment group is depicted in orange. The relation between nowcasts and forecasts for the treatment group is weaker than for firms in the control group, and this effect is a causal effect of the treatment. Firms in the treatment group use their perceptions less when forming their exchange rate expectations.

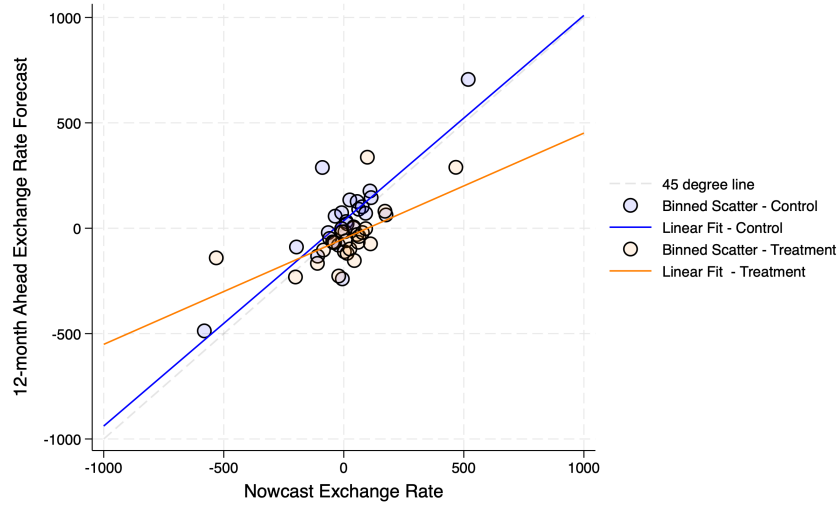


Figure 3: Relationship of Perceptions and Forecasts for Treated and Control Groups: Nominal Exchange Rate

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 firms in the control group, 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.

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

We repeat our estimations after splitting the firms in the sample in two dimensions to inquire about the quantitative relevance of heterogeneous effects. The two sample splits are a broad sectoral definition and the exporting status of the firm. These two variables were self-reported by the firms before treatment. We split the sample into firms in the industrial sector and firms in the retail

sector. Firms in the industrial sector may self-report themselves to be exporters. We stratified the randomization behind the treatment in these two dimensions to ensure that treatment assignment is balanced in these dimensions.

Figure 4 plots the main coefficient of interest of the regressions, and the regression tables are in Appendix A. For brevity, we discuss only the estimations using robust regressions in the main text, but Appendix Tables 8 and 9 in Appendix A also include estimations using OLS. The extent of decoupling of expectations from perceptions is stronger for firms in the industrial sector than for firms in the retail sector. For inflation, we estimate a coefficient $\hat{\beta}_3 = -0.33$ for firms in the retail sector, and $\hat{\beta}_3 = -0.5$ for firms in the industrial sector. For the exchange rate we estimate a coefficient $\hat{\beta}_3 = -0.54$ for firms in the Retail sector and -0.82 for firms in the industrial sector.

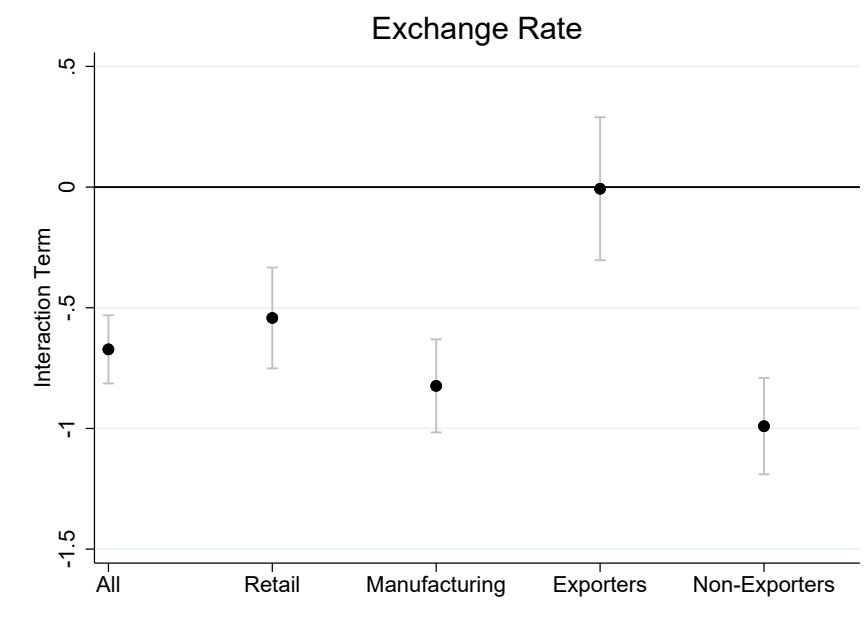


Figure 4: Heterogeneity in Treatment Effects

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 4 also repeats the analysis splitting firms in the industrial sector between exporters and non-exporter with the caveat that sample sizes are smaller.¹¹ Firms that self-report as exporters are presumably more sophisticated and informed firms that cater to the global market, and as such they should have smaller treatment effects. Our results confirm such intuition; in fact, we esti-

¹¹Details of the regressions are available in Tables 10 and 11 of Appendix A.

mate insignificant results and zero point estimates for the effects of the treatment on expectation formation for exporters. Mackowiak and Wiederholt (2024) discuss how a model of rational inattention can explain this type of behavior, in which they show that the cost of incorrect beliefs and 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 the panel structure of our research design is the possibility to estimate equation 1 for $h > 0$, tracing impulse response functions of the expectations $X_{t+h,t+h+\tau}^e$. Moreover, we can trace the impulse response functions of future nowcasts $X_{t+h,t+h}^e$. 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. The top panel 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. The red line shows the point estimate and associated confidence intervals for the control group. The weight that firms assign to the pre-treatment prior decays slowly as time progresses. In particular, the forecasts of exchange rates formed 2 months after the treatment are positively associated with the prior belief in the initial period. For firms in the treatment group not only is the importance of the prior at period 0 lower, as documented before, but starting 1 period after the treatment, there is no association between the pre-treatment prior and the formation of exchange rate expectations. Formation of inflation expectations for both treatment and control groups differs for 2 months after the treatment.

An important mechanism to understand the dynamic effects on expectation formation is the persistent effect of the treatment on the formation of future beliefs about the economic environment. The bottom panel of Figure 5 shows that the treatment not only changes the way firms form their expectations in the future, but it changes the way in which firms form their beliefs about the current state. In particular, firms in the control group have inertial nowcasts, with weights of the pre-treatment nowcast of roughly 0.2 on future nowcasts. There is no such inertia for firms in the treatment group. We interpret these results as providing support for the finding that the treatment

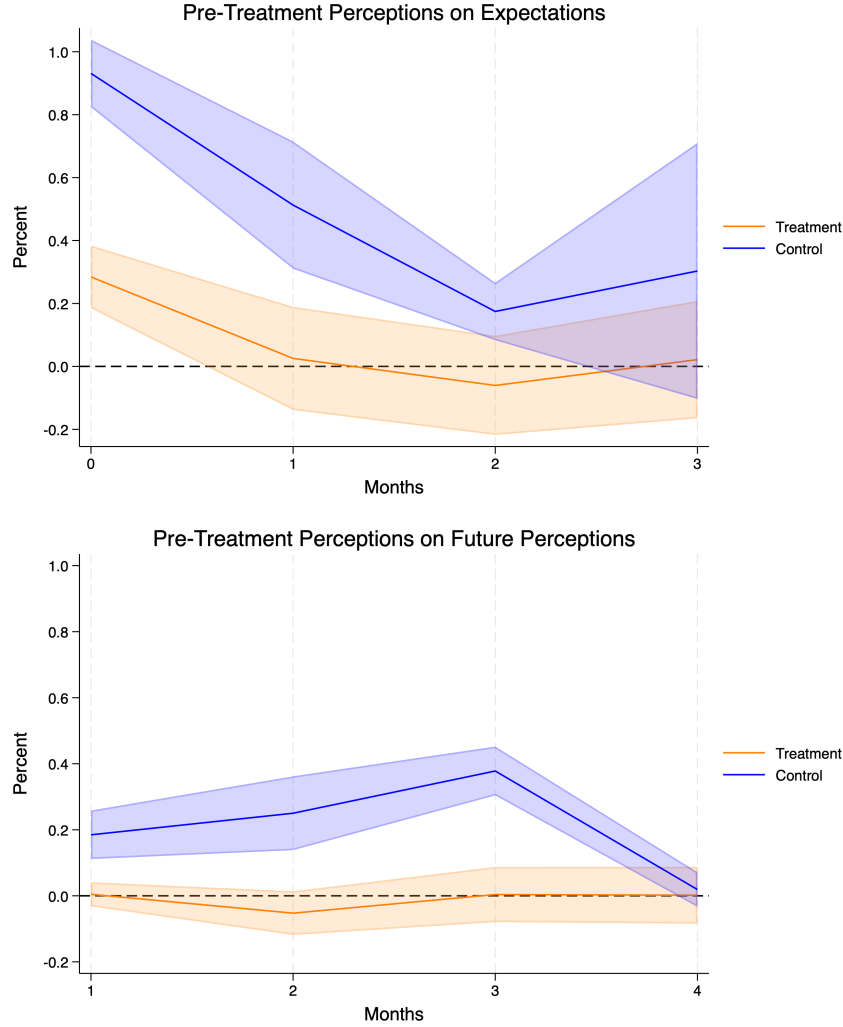


Figure 5: Persistence of Treatment Effects: Nominal Exchange Rates

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.

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 about exchange rate forecasts affect firm-level decisions. We link the firms we surveyed with detailed

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

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

When analyzing the effect of the treatment on exports and imports, we time-aggregate the monthly data to an annual frequency, adding the value of the transaction for a pre-period of 12 months before treatment and a post-period treatment of 12 months after. The reason for time aggregation is that firm exports and imports are notoriously lumpy, with periods of inaction followed by large spikes. We estimate results for both the intensive and extensive margin. 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). Among the same 680 firms, 480 (71 percent) of them have imported during the same period. Firms vary in the intensity and frequency with which they

export and import.

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

As an additional piece of evidence on the randomization of the treatment assignment, we perform balance tests between treatment and control groups on exporting behavior before treatment assignment. Table 12 shows that there are no discernible statistical differences in the level of overall exports, the level of exports to destinations that use the US dollar, the level of exports to destinations that do not use the US dollar, and the level of overall imports. Table 12 also provides information about the average importing and exporting behavior of firms in our sample. On average, firms run a negative trade balance, importing almost twice as much compared to their exports. They export roughly 22 percent of their exports to destinations that use the US dollar. This result combines the differences in the extensive and intensive margins of exports and imports. In particular, more firms are active importers than active exporters, which is partially explained by the presence of retail firms in our sample.

How does information about expected future exchange rates affect the dynamics of firm-level trade flows? We first report whether treated firms have differential autocorrelation of exports and imports compared to the control group in a specification that is analogous to our estimation of the treatment effects for the formation of expectations. Table in Appendix A shows that the autocorrelation of exports and imports of treated firms is lower compared to the control group. In 14 in Appendix A we report a similar dynamic for unit export prices.

The results of Table 13 and 14 in Appendix A should be interpreted as the causal effects of the treatment on the dynamics of exports and imports. This regression is not informative on whether the treatment increased or decreased the patterns of trade of treated versus non-treated firms. We will estimate the causal effects of expected depreciations on the level, not the dynamics, of exports

	First Stage		IV Estimates			
	log Imports _{0,1}	log Exports _{0,1}	log Imports _{0,1}	log Imports _{0,1}	log Imports _{0,1}	log Exports _{0,1}
T_i	-1.976*** (0.458)	-1.218 (0.859)				
$\log S_{i,t,t}^e \times T_i$	0.237*** (0.056)	0.146 (0.104)				
$\log S_{i,t,t+12}^e$			6.444** (2.776)	9.738** (4.064)	1.510 (2.464)	6.863 (6.822)
$\log \text{Imports}_{i,t-12,t}$			0.977*** (0.024)	0.927*** (0.032)	0.997*** (0.030)	
$\log \text{Exports}_{i,t-12,t}$						0.960*** (0.047)
Sample	All	All	All	Non-Exporters	Exporters	All
N	452.0	237.0	452.0	221.0	231.0	237.0
F-Test			15.90	14.33	5.84	2.18

Table 3: Expected Depreciation Effect on Trade Decisions

Note: This table shows the results of regressions for the exchange rate's effect on exports and imports decisions. Column (1) shows the first stage of the instrument for the posterior exchange rate for the sample of imports, as in Coibion et al. (2023). Column (2) shows the first stage for the sample of exporters. Column (3) displays results for the IV for log imports, while Column (4) displays results for the sample of importers that did not export in the baseline period. Column (5) shows results for imports among the sample of imports that were also exported in the baseline period, and Column (6) 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 obtained in Column (1). Robust standard errors are in parentheses.

later on this section.

We next estimate the elasticity of firm outcomes to a 1 percent depreciation using a two-stage least squares regression. In the first stage, we follow Coibion et al. (2023) and estimate a regression of the log exchange rate forecast on the exchange rate nowcast interacted by the treatment assignment dummy. In the second stage, we estimate a regression of the log level of outcomes in the year after treatment on the log forecast of the exchange rate. In every regression we use the pre-existing level of the outcome as a control. The interpretation of the coefficient of interest is an elasticity of a firm outcome, for example imports, to a 1 percent exogenous expected depreciation.

Table 3 presents the results, with the first two columns displaying the results of the first stage. Consistent with the results discussed in previous sections, the treatment has weak effects on shifting exchange rate expectations, as is clear from the estimates in Column (2), which are not statistically significant. This is not the case for imports. We discuss our treatment of a weak instrument problem later in this section.

Column (3) presents our main results. A 1 percent expected future depreciation has a causal effect of an increase of 6.4 percent on firm imports. This effect is statistically significant, and the F-stat of the first stage is equal to 15.9. Columns (4) and (5) unpack the results of Column (3). The elasticity we estimate is explained by a large elasticity of imports to future expected depreciation of importer firms that do not export. The results for importers that export are statistically insignif-

icant and the instrument has a low F-stat, consistent with the results in Column (6). Column (6) shows that results for exports are similar in magnitude to imports (Column (3)) but not statistically significant. 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 had no effect on exporters' posterior exchange rate.

The F-stats we presented for imports are above 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 heteroskedasticity and autocorrelation developed by Olea and Pflueger (2013). The effective F-statistic for imports is equal to 14.7, larger than the threshold for a worse-case scenario bias of 10 percent, which is equal to 11.82. We also provide weak instrument robust Anderson-Rubin confidence intervals. We reject elasticities lower than 0.84. We confirm that the instrument is weak for exports, and the AR confidence intervals include the full real line.

We then explore the mechanism using the detailed variation we have in terms of origin and product. To do so, we run the same regression, dis-aggregating imports by level of origin and product at different levels. This level of variation allows us to control by origin and product-level fixed effects. By exploring within-origin or within-product-level variation, we can examine if imports increased or decreased by origin or product. As we already documented that the all import effect is positive, a negative coefficient in some of these levels would imply substitution between products or origin. It is important to highlight that, as we are using logs, this exercise only explains the intensive margin.

Table 4 presents the results. While import expenditures increase at the firm level after a firm-specific expected depreciation, import expenditures decrease in products-origins compared to the previous year. We find that they still increase when we only control by origin. This finding helps to understand the mechanism behind our main finding. In particular, it highlights the relevance of the intertemporal and product substitution margin.

7 Discussion

In this section, we discuss the main findings of the previous section. We found that a firm-specific future expected appreciation (depreciation) decreases (increases) firm imports. The elasticity of imports to expected depreciations that we estimate is a partial equilibrium elasticity that combines many structural parameters. We also find a negative within product elasticity, suggest-

	(1)	(2)	(3)	(4)
	log Imports _{<i>i,t,t+12</i>}	log Imports _{<i>i,t,t+12</i>}	log Imports _{<i>i,t,t+12</i>}	log Imports _{<i>i,t,t+12</i>}
$S_{i,t,t+12}^e$	2.806*	-1.879**	-2.530***	-2.681***
	(1.457)	(0.911)	(0.687)	(0.666)
log Imports _{<i>i,t-12,t-1</i>}	0.867***	0.880***	0.881***	0.878***
	(0.013)	(0.007)	(0.005)	(0.004)
Observations	3,622	8,543	13,941	18,804
R^2	0.722	0.755	0.757	0.767
Product Digits		2	4	6
Level of Variation	Origin	Origin x Product	Origin x Product	Origin x Product

Table 4: Expected Depreciation Effect on Trade Decisions by Origin and Product

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

ing product level substitution.

We find at least three mechanisms driving firms' reactions in our setting. We will use as an example an expected depreciation, but the reverse example holds after an expected appreciation. First, a future expected depreciation increases future marginal costs, decreasing firm size and the demand for imported inputs. Second, an increase in the price of imported inputs induces substitution away from imported inputs into local inputs, the standard trade elasticity. Finally, an expected future depreciation increases incentives to anticipate expenditures before prices increase, increasing present demand input. We estimate a positive elasticity, implying that the third channel is stronger than the sum of the first two channels. This mechanism is consistent with models of storable or durable imports or inventories as in Alessandria, Kaboski, and Midrigan (2010). In such class of models, firms anticipate higher depreciations or higher tariffs by increasing import demand in the present (Alessandria, Arkolakis, and Ruhl, 2021; de Soyres et al., 2023). The ability of firms to anticipate higher future costs is a function of adjustment and storing costs. Our findings support this mechanism.¹²

One of the main advantages of our research design is our ability to purge the variation from a variety of general equilibrium and policy reaction channels. By exploiting deviation from full information and an information treatment, we are able to show that an increase in expected exchange rate increase imports in the cross-section of firms. Other work have focused on this strate-

¹²In 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.

gic anticipatory decision focusing in other future costs as in tariffs (Alessandria, Khan, and Khederlarian, 2024). Notably, the estimated effects after changes in tariffs will be a function of general equilibrium effects triggered by tariff changes in the local and foreign economies.

Our work is related to recent work focused on estimating the elasticity of imports to changes in future costs. For instance, Khan and Khederlarian (2021) estimate an import elasticity to expected changes in tariff due to NAFTA. They find an import elasticity to expected changes in tariff of 6 percent, in line with our findings.

Our evidence highlights the optimizing behavior of firms in the timing of the expenditures of firms trading internationally as a function of shifts in exchange rates. Usually, it is difficult to isolate general equilibrium effects from the direct exchange rate effects when economies face large devaluations. In our experiment, we are able to estimate an elasticity of imports to expected exchange rate shifts while keeping constant other prices in the economy. This finding can inform firm dynamics in those episodes.

The intertemporal import elasticity to expected depreciations has important implication for macro and trade outcomes. Estimates of the trade elasticities that abstract from 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 econometrician focuses their attention only to a period after input costs have materialized. We document that these considerations are important for exchange rates and imports. Additionally, we document relevant heterogeneity in exchange rate perceptions and forecasts, highlighting the importance for the distributive effects of aggregate shifts, and highlights the role of policy communication.

We introduced a treatment that affects trade decisions. We documented that a relatively cheap information treatment that informs about the future forecast of exchange rate is effective in managing firms' expectations and influencing their decisions, even when the treatment informs firms about a payoff relevant, volatile variable, as the nominal exchange rate of the local currency against the US dollar.

8 Conclusions

We measure and evaluate the effect of firm expectations on their decisions in an emerging economy. We show that while Colombian firms are relatively informed about the inflation rate, as in developed countries, they are much more informed and have less disagreement about the

exchange rate compared to the inflation rate. We also show that information about the exchange rate's forecast by professional forecasters influences firms' own expectations about the exchange rate, prices, and their economic decisions.

We link our sample to 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 to the economy. Simple information treatments are effective in influencing expectations and decisions.

We explore the role of limited attention in international economics—most models that look at firms' decisions focus on their pricing decisions—but do not explore how departures from full information rational expectations can affect those findings. We find that in a country where virtually the universe of international trade transactions are invoiced in US dollars, changes in exchange rate expectations alter the size, and the timing of those trade transactions.

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

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).

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

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*** (0.188)	0.901*** (0.065)	0.887*** (0.133)	0.807*** (0.056)
Prior x Treatment	-0.557** (0.247)	-0.542** (0.103)	-0.444** (0.137)	-0.338** (0.061)
I.Treatment	2,012** (905.8)	1,997*** (380.0)	1.288* (0.413)	0.911*** (0.139)
Constant	38.56 (703.0)	418.9 (240.7)	1.723** (0.391)	1.234*** (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 summarizes our estimation of equation 1, firms in the retail sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

	Exchange Rate		Inflation	
	(1)	(2)	(3)	(4)
Prior	0.920*** (0.129)	0.994*** (0.075)	0.727*** (0.043)	0.924*** (0.039)
Prior x Treatment	-0.633* (0.210)	-0.824*** (0.095)	-0.170* (0.054)	-0.503*** (0.033)
I.Treatment	2,358*** (795.1)	3,073*** (359.1)	1.041** (0.240)	1.628*** (0.238)
Constant	338.2 (481.2)	61.61 (281.6)	1.947*** (0.161)	0.812*** (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 summarizes our estimation of equation 1, firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

	Exchange Rate		Inflation	
	(1)	(2)	(3)	(4)
Prior	0.517 (0.249)	0.812*** (0.116)	0.863*** (0.064)	0.963*** (0.050)
Prior x Treatment	-0.186 (0.224)	-0.007 (0.179)	-0.321*** (0.048)	-0.580*** (0.056)
I.Treatment	664.6 (832.5)	-43.69 (668.1)	1.875** (0.448)	1.835*** (0.267)
Constant	1,860** (948.4)	748.2 (433.7)	1.342*** (0.182)	0.564*** (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 summarizes our estimation of equation 1, for exporting firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, and We use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

	Exchange Rate		Inflation	
	(1)	(2)	(3)	(4)
Prior	1.023*** (0.041)	1.031*** (0.052)	0.664*** (0.047)	0.929*** (0.031)
Prior x Treatment	-0.920*** (0.062)	-0.991*** (0.099)	-0.086 (0.081)	-0.241*** (0.061)
I.Treatment	3,430*** (219.5)	3,696*** (379.5)	0.294 (0.465)	1.001* (0.386)
Constant	-23.70 (162.7)	-68.81 (197.0)	2.421*** (0.156)	0.974*** (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 summarizes our estimation of equation 1, for non-exporting firms in the industrial sector. It shows our estimation for the nominal exchange rate between the Colombian peso and the United States dollar $X = S$, and the inflation rate of headline CPI inflation $X = \pi$. The regression is estimated only for the initial month of each manager in our panel. Columns (1) and (3) estimate the regression using ordinary least squares. Columns (2) and (4) estimate the regression using Huber robust regressions. All the specifications include time fixed effects, we use robust standard errors. Prior is the current perception of the variable, and Treatment is a variable that takes the value of one if the firm is assigned to the treatment group, and zero otherwise.

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

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.

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

Table 13: Treatment Effect on Trade

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

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

Table 14: Treatment Effect on Unit Prices

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

B Fedesarrollo Business Opinion Survey

Business surveys are essential to economic surveillance, specially to obtain anticipated indicators of economic activity in the private sector. As a complement to statistics published by official sources, usually with considerable lags, these data are widely used to investigate sector specific trends or turning points. Detailed sectoral information, high frequency, and punctual release confirm their main characteristics. As business surveys expanded among countries during the last decades, the quality of their information and the scope of their samples also did. Surveys for multiple sectors became available, as well as richer questionnaires. The recent surge in their popularity among economic scholars reflects these improvements.

Since 1980, the Colombian economic think-tank, Fedesarrollo, and the Central Bank of Colombia conduct the Business Opinion Survey (BOS), targeting both manufacturing industry and retail sectors within the country. Drawing on the methodology used by the European Union (European Commission, 2024), data is 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.

Each month Fedesarrollo publishes the Business Tendency Survey Bulletin with updates of the Industrial Confidence Index (ICI) and the Retail Confidence Index (RCI). Both variables result from combining answers about perception of the current economic situation, level of stocks,

and expectations of production in the following three months. These are the only three variables publicly available from all the questionnaire.

1. Survey frequency, sample size, and respondents Two surveys are currently conducted on a monthly basis in the industrial and retail sector, while a quarterly module covers the construction sector. Surveys are administered telephonically and via web. 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 they are more informed about the topics covered by the questionnaire and are also the ones who make relevant decisions for their companies. Each month, Fedesarrollo and the Central Bank of Colombia administer a total of 500 surveys, 300 directed towards the industrial sector and 200 towards the trade sector. The universe of companies susceptible 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 specially used to locate industrial firms.
- Central Bank Exchange Rate Risk Survey Each month, the Central Bank of Colombia publishes a survey asking the private sector about their exchange rate expectations. This database provides information for industry and retail.
- 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 industry and retail.

2. Sectoral and regional representativeness

Results are representative for the industrial and retail sector. Six Colombian regions are surveyed according to the size of their population: Bogota, Antioquia, Valle del Cauca, Atlantic Coast, Santander, Viejo Caldas, and Others. Regional representativeness is not achieved under the current methodology. Tables 1 and 2 show the regional average of surveyed firms for 2024.

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.

	Total Big	Size SandM	NA	Exporter	
Bogota	103	44	55	4	56
Antioquia	84	33	48	3	57
Valle del Cauca	32	17	15	0	22
Atlantic Coast	20	9	11	0	13
Santander	16	3	13	0	10
Viejo Caldas	35	11	23	1	12
Other	10	7	1	2	6
Total	300	124	166	10	176

Table 15: Industry sector regional surveys

Note: This table provides information about the surveyed

	Total
Bogota	79
Antioquia	38
Valle del Cauca	16
Atlantic Coast	9
Santander	8
Viejo Caldas	33
Other	17
Total	200

Table 16: Trade sector regional surveys

Note: This table provides a summary of

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.

4. Monthly business survey questionnaire:

A. Industry 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. Trade survey: is the longest survey of Fedesarrollo, contains 22 questions 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 inquires about the main activity of the business.

2. Industry Assessment of economic situation

Production, last three months Production, next three months Prices, next three months Monthly stock Orders Installed capacity Exchange rate, end of month Inflation, annual Investment assessment Exporter

Services Assessment of economic situation Sales, past three months Sales, next three months Monthly stock Orders Assessment of demand Sales prices, next three months Employment Profits, last six months Trade type

Industry

1. Regarding the main product, 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, festive days, 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)

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)

SPECIAL QUESTIONS OF INSTALLED CAPACITY AND INVESTMENT

16. With the current installed capacity, could you increase production (without reducing other lines)

- Yes (Continue with 17)
- No (Go to 18)

17. Approximately by what percentage?

18. If not, what are the reasons that have prevented this increase?

- Lack of demand
- Insufficient working capital

- Shortage of national raw materials
 - Shortage of imported raw materials
 - Technical problems
 - Other. Please specify:
19. In [month], the utilization of installed capacity for production was approximately (full capacity is equal to 100):
20. Current economic conditions for investment are:
- Favorable
 - Neutral
 - Unfavorable
 - N/A
21. For your investment decisions, the current political and social situation is:
- Favorable
 - Neutral
 - Unfavorable
 - N/A
22. The investment programs of your company for the past quarter:
- Were fulfilled
 - Were involuntarily delayed
 - Were voluntarily postponed or modified
 - Were accelerated
 - Do not have investment programs
23. If there were delays in the investment programs (answered "Were involuntarily delayed" in the previous question), please indicate the causes:
- Unexpected rise in investment cost
 - Difficulties in obtaining credit resources

- Delay in the issuance of shares
- Insufficient own resources
- Difficulties in importing equipment
- Difficulties in supplying national equipment
- Difficulties in the development of works and constructions
- Technical and organizational difficulties
- Delays in official permits and licenses
- Other. Please specify:

24. If there were postponements or modifications in the investment programs (answered "Were voluntarily postponed or modified" in question 37), please indicate the causes:

- Deterioration in demand conditions
- Increase in competition from imported products
- Tax increases
- Excessive rise in investment cost
- Decrease in expected investment return due to increase in production costs
- Increase in financial costs
- Inability to import equipment
- A more profitable investment alternative emerged
- Other. Please specify

25. Does your company export?

- Yes (CONTINUE)
- No (END)

26. The percentage of production dedicated to exports is:

Trade 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

EXPECTATIONS

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)
- 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? SPECIAL QUESTIONS

18. Did your net sales prices (for your main product) increase in the last quarter:

- Yes
- No

MAIN ACTIVITY

19. The largest percentage of sales corresponds to:

- Sales of national products
- Sales of imported products
- Wholesale sales
- Retail sales

20. Is your company classified as a department store:

- Yes
- No

ADDITIONAL QUESTIONS

21. Can it be anticipated that in the next three months your net sales prices (for your main product) will increase by:

- More than the previous quarter
- The same as the previous quarter
- Less than the previous quarter
- N/A

22. Compared to [month] of last year, the number of people employed by your company during this month is:

- Higher

- The same
- Lower
- N/A

23. In the last six months the profits (total income minus direct costs, general expenses, and taxes) of your company's commercial activity, compared to the immediately previous semester, were:

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

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

Table 17: 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 6 offers a graphical representation of the results in Column (1) of Table (17). 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 17.

In a similar fashion to our study of heterogeneous treatment effects for the nominal exchange rate, Figure (7) 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

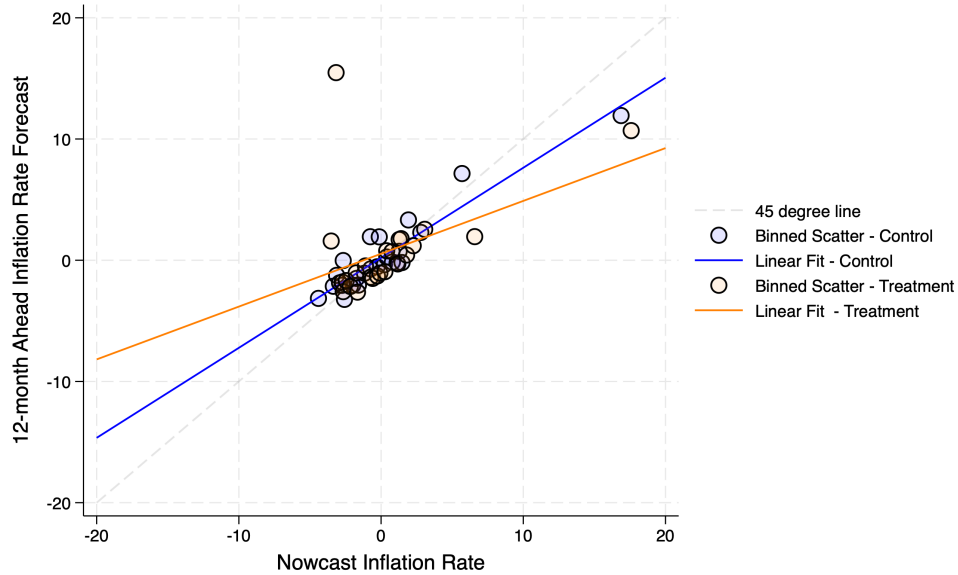


Figure 6: Relation of Perceptions and Forecasts for Treated and Control Groups: Inflation

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.

on exchange rates.

Figure 8 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 8 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.

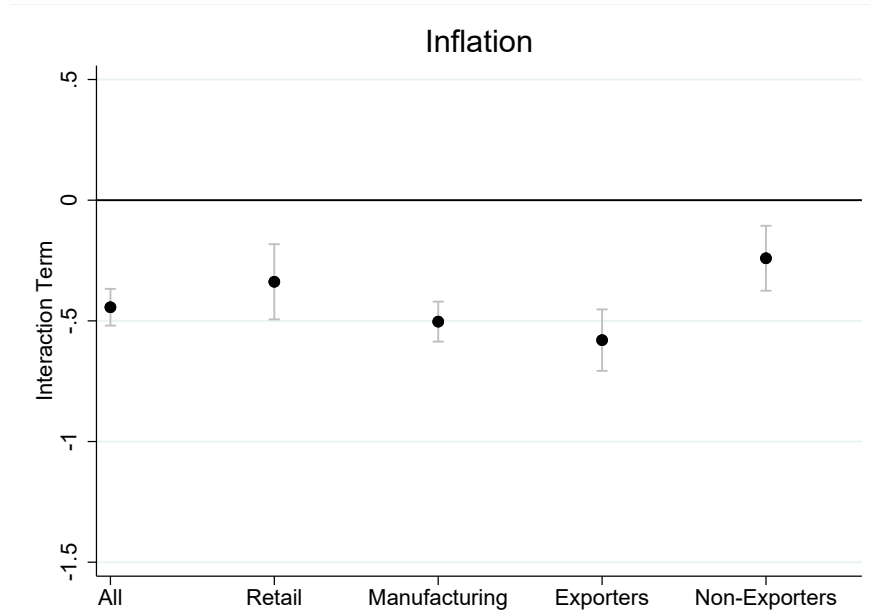


Figure 7: Heterogeneity in Treatment Effects on Inflation Expectation Formation

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.

D 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.

D.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 a short-hand to refer to the peso-dollar nominal exchange rate.

Figure 9 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 substan-

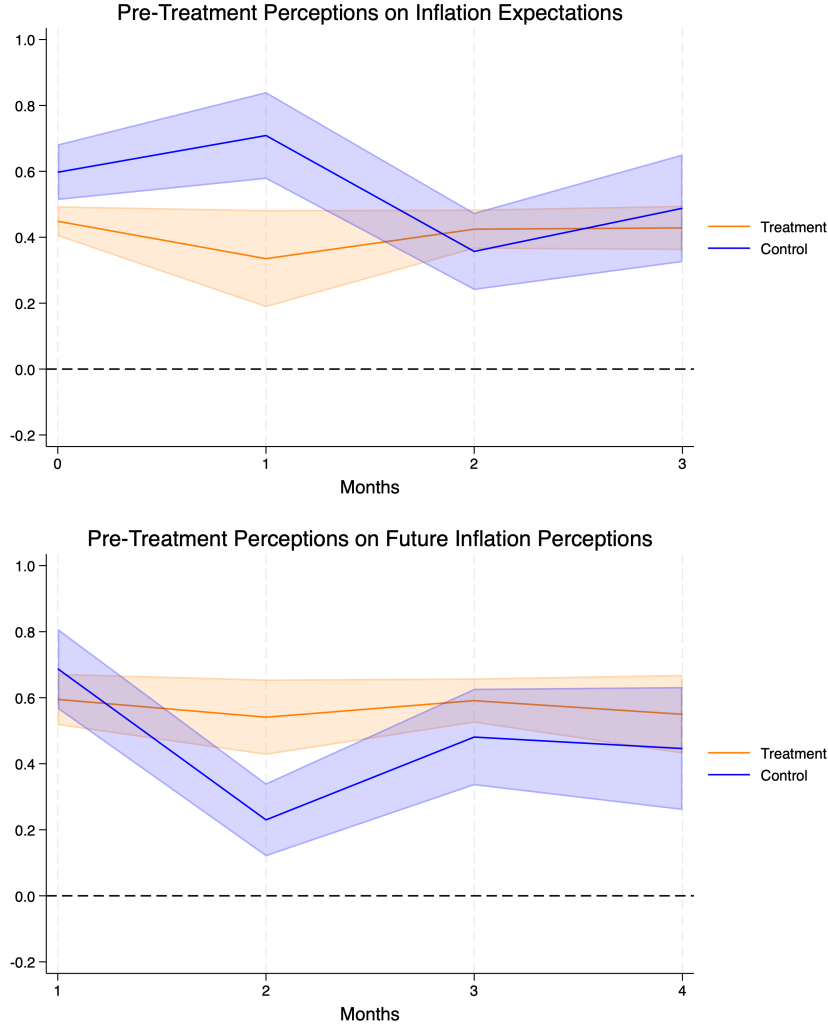


Figure 8: Persistence of Treatment Effect - Inflation Rates

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

tially 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 comove significantly. The contemporaneous correlation of CPI inflation and percent change in the exchange rate is equal to 32%.

Not only the exchange rate comoves 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

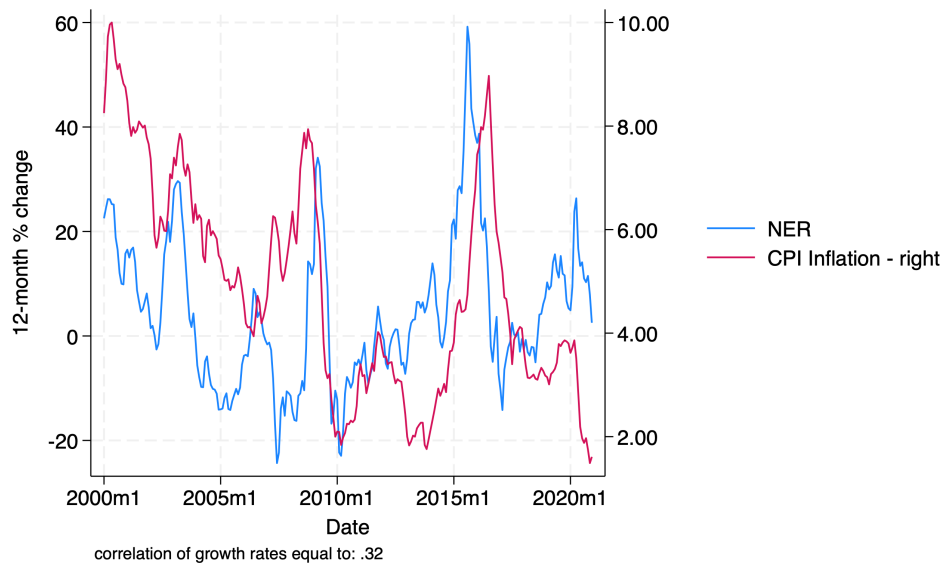


Figure 9: Percent Changes USD COP Exchange Rate and CPI Inflation

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).

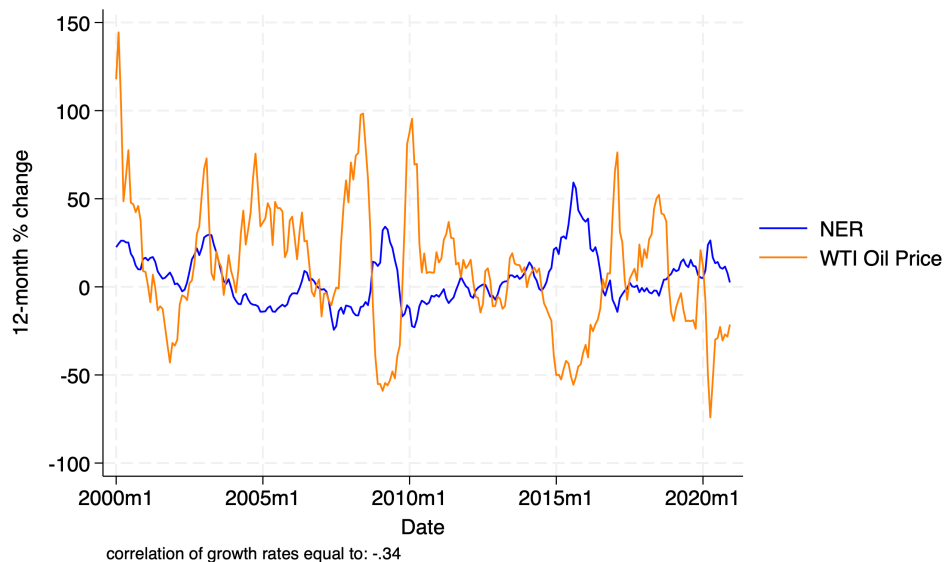


Figure 10: Percent Changes in the USD COP Exchange Rate and Oil Prices

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 .

	(1) NER _t	(2) NER _t	(3) NER _t	(4) NER _t
NER _{t-1}	0.997*** (0.006)	0.997*** (0.006)		
NER _{t-12}			0.948*** (0.022)	0.948*** (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 18: 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 comes from the Central Bank of Colombia. The frequency is monthly and each observation corresponds to the average exchange rate within the month.

and coal. Crude oil and refined petroleum accounted for 31% of exports in 2022.⁷ Figure X shows the correlation of the 12-month change of the exchange rate with the 12-month percent change in the price of the WTI oil price. As it is evident from the figure, 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 has is superior from other forecasting rules, and whether the exchange rate of the Colombian peso versus the US dollar behaves like a random walk.

Table 18 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 11 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

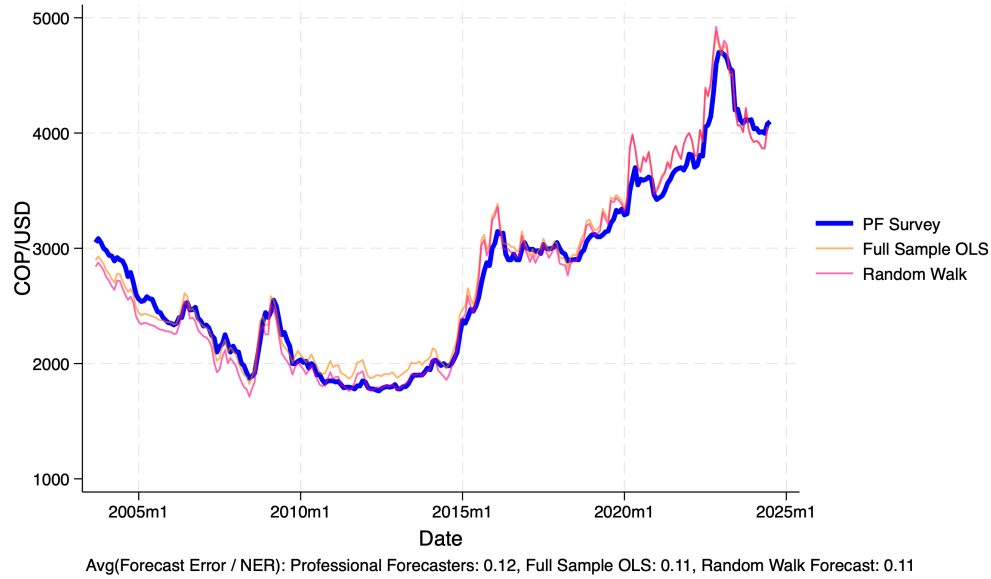


Figure 11: Forecast Errors of Different Forecasting Rules

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 autoregressive regression .

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, that for short we call *PF Survey*, for Professional Forecast.

Two main messages arise from Figure 11. 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 11 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.

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