The Causal Effects of Future Expected Depreciations

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Motivation

- Exchange rate vis-à-vis the USD is a crucial price for small open economies
- Direct and indirect effects on firms, households, and fiscal and monetary authorities
- Qualitative understanding of mechanisms at play
    - Policy objectives
    - Future expected revenues and costs
    - Valuation of debt and wealth
- Three main challenges preventing empirical assessment
    - Path of NER and unobserved fundamentals potentially correlated
    - Not readily available datasets about $\mathbb{E}_t S_{t+1}$ of price-setters
    - Difficult to separate direct effects from time-varying policy reactions or GE effects

Our Approach

Estimate the elasticity of firm-outcomes to exogenous future expected depreciations

1. Measure NER perceptions and expectations for a panel of firm managers in a SOE
2. RCT to induce exogenous variation in firm exchange rate expectations
3. Measure the size and persistence of expectation formation effects
4. Measure the effects of the treatment on the distribution of trade outcomes
5. Compute the elasticity of imports to expected depreciations

Results are a PE elasticity of firm-outcomes to expected future depreciations.

Empirical Challenges

- OVB and reverse causality concerns: path of potentially unobserved shocks
- Two main approaches
  - Large Depreciations: Burstein et al (2005), Cravino and Levchenko (2017)
  - Heterogeneity in exchange rate regimes: Candia and Pedemonte (2022), Bouscasse (2022), Fukui et al (2023)
- Difficult to separate direct effects from GE effects and policy reaction functions
- Strong identifying assumptions
- This paper: information shock to firms exploiting deviations from full information
  - Treat a subset of firms with public information
  - Isolate other aggregate effects

Context: Colombia

- Emerging economy with a floating exchange rate

- Inflation targeting, low and stable inflation

- 98% of exports invoicing in USD Gopinath et al. (2020)

- *[...] de jure managed floating exchange rate regime* Ilzetski, Reinhart, Rogoff (2010)

▸▸ Relative Volatility of the NER   ▸▸ Correlation with the Inflation Rate   ▸▸ Correlation with Oil Prices

Survey, Randomization, and Research Design

Survey

- We create new measure of firm expectations and beliefs for the USD exchange rate and local CPI inflation
- Using the leading business sentiment survey of the country as a starting point
- Roughly 500 firms per month
- Unbalanced panel
- Nationally representative for manufacturing and retail sectors

Questions

Pre-Treatment Questions

1. *If you were to buy US Dollars this week, What is the exchange rate at which you would be able to do so?*

2. *What is your perception of the percentage change of the CPI that occurred in the last 12 months?*

Post-Treatment Questions

1. *If you were to buy US Dollars in the financial sector in 12 months, what is the exchange rate at which you could buy them?*

2. *At what percentage value do you think that the prices in the economy, measured by the Consumer Price Index (CPI), will increase or decrease in the following 12 months?*

CPI Inflation: Expectations and Perceptions
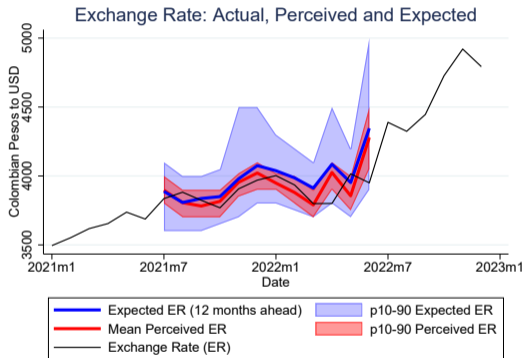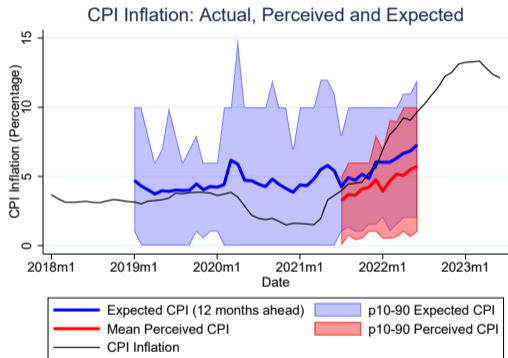
Firm Managers vs. Professional Forecasters

	Average	Standard Deviation	Forecast Error
Nowcast Exchange Rate			
Firms	$3921	$204.9	$45.43
Forecast Exchange Rate			
Professional Forecasters	$3734	$133.2	$854.4
Firms	$3980	$329.4	$634.4
Nowcast Inflation			
Firms	4.48%	4.23%	2.18%
Forecast Inflation			
Professional Forecasters	4.10%	0.55%	8.19%
Firms	5.76%	4.60%	6.54%

Less disagreement and lower forecasting errors the exchange rate. Inflation in line with German data (Link, Peichl, Roth, Wohlfart, 2023)

Research Design

- We randomly assign firms into Treatment and Control groups ‣ Balance
- Stratified randomization to ensure balance in three dimensions
    1. Prioritized firms
    2. Main Sector: Industry vs. Retail
    3. Exporter vs. Non-Exporter
- Elicit perceptions of CPI inflation and USD exchange rate
- For firms in T, provide the information treatment
    - Average NER forecast printed in the monetary policy report
- Elicit forecasts of CPI inflation and USD exchange rate

Treatment

Firms in the treatment group receive a piece of public information contained in an annex of the monetary policy report:

According to the last Survey of Analyst Expectations conducted by the Central Bank, the exchange rate in July 2022 is expected to be 3650.

Anexo

Anexo 1
Proyecciones macroeconómicas de analistas locales y extranjeros[a/b/]

	Unidades	jul-21	dic-21	jul-22	dic-22	jul-23
IPC total	Variación mensual (media)	0,04	n. a.	n. a.	n. a.	n. a.
IPC sin alimentos	Variación mensual (media)	0,14	n. a.	n. a.	n. a.	n. a.
IPC total	Variación anual (media), fin de período	3.67[c/]	3,73	3,18	3,27	3,14
IPC sin alimentos	Variación anual (media), fin de período	2.68[c/]	2,97	3,07	3,06	2,96
Tasa de cambio nominal	Pesos por dólar, fin de período	3.780	3.650	3.650	3.600	3.516
Tasa de política	Porcentaje, fin de período	1,75	2,00	2,75	3,25	3,75

⏭ Statistical Properties of the Forecast

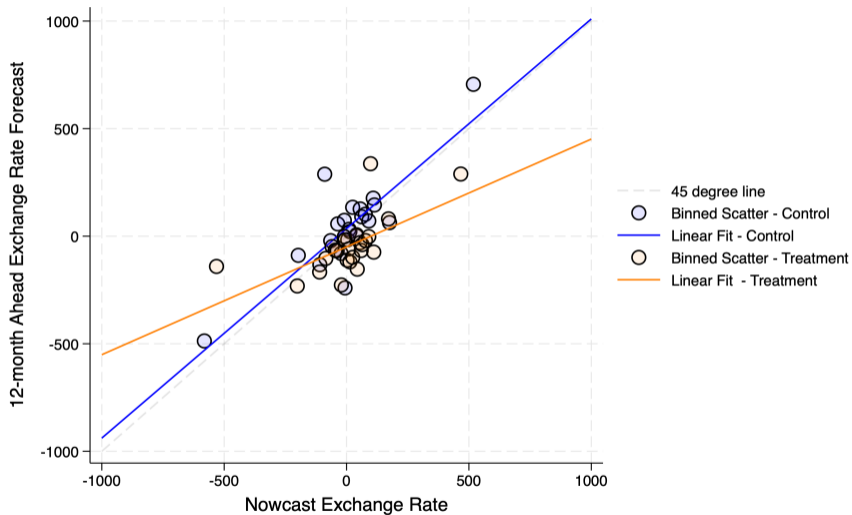Treatment Effects on Expectation Formation

Notation

- We estimate the following regressions

$$S_{i,t}^e = \beta_t + \beta_1 T_{i,t} + \beta_2 S_{i,t} + \beta_3 T_{i,t} \times S_{i,t} + \epsilon_{i,t}$$

- S^e denote forecasts about the realization of variable S
- β_3 the decrease in weights of priors
- Estimations using both OLS and Huber robust regressions

Exchange Rate Nowcasts and Expectations

Treatment effect on Exchange and Inflation Expectations

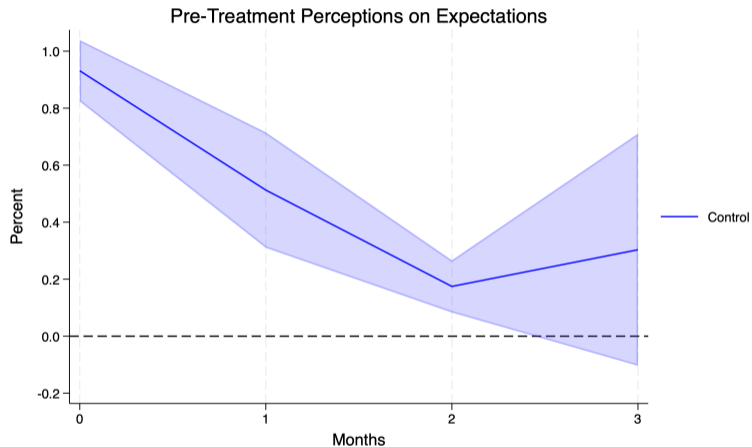|	12-Month Ahead Exchange Rate Forecasts	
	(1)	(2)
NER Nowcast	0.978***	0.958***
	(0.115)	(0.053)
NER Nowcast × Treatment	-0.601***	-0.672***
	(0.157)	(0.143)
Treatment	2,208***	2,496***
	(597.9)	(273.7)
Constant	143.2	196.1
	(439.1)	(200.6)
Regression	OLS	Huber
Time FE	Yes	Yes
Observations	681	659

Heterogeneity: Exchange Rates
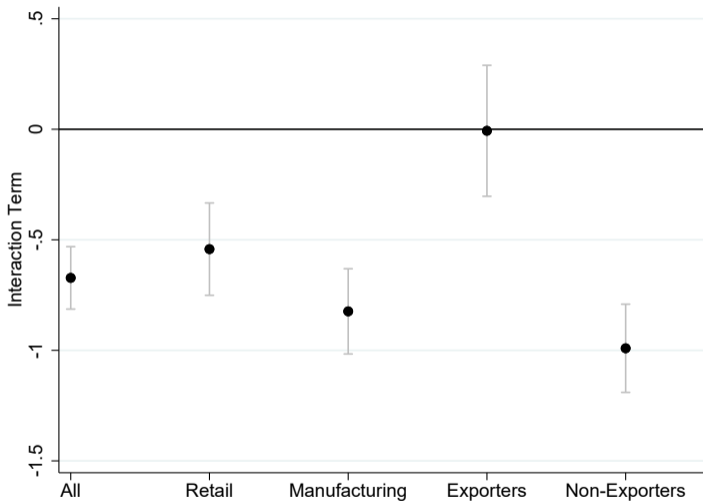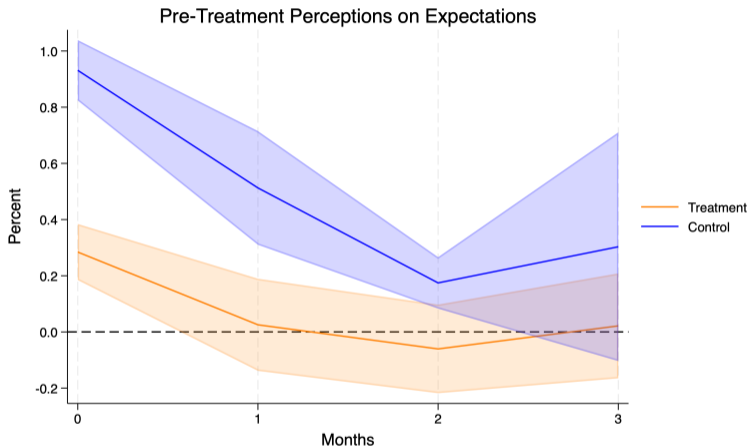
Dynamic Causal Effects

- Estimate the persistence of treatment effects
  1. For the formation of expectations
  2. For the formation of beliefs of current states
- Usually the macro literature on informational treatment finds very transient effects
- So far we estimated effects on $S_{i,t+h}^e$ for $h = 0$
- Now repeat for expectations and perceptions forward in time ($h \geq 1$)

Dynamic Expectation Effects: Exchange Rate Forecasts

Pre-Treatment Perceptions on Expectations

$$S_{i,t+h}^{e} = \beta_t + \beta_1^h T_{i,t} + \beta_2^h S_{i,t} + \beta_3^h T_{i,t} \times S_{i,t} + \epsilon_{i,t}^h$$

Dynamic Expectation Effects: Exchange Rate Forecasts

Pre-Treatment Perceptions on Expectations

$$S_{i,t+h}^e = \beta_t + \beta_1^h T_{i,t} + \beta_2^h S_{i,t} + \beta_3^h T_{i,t} \times S_{i,t} + \epsilon_{i,t}^h$$

⟫ Nowcasts Exchange Rate   ⟫ Forecasts Inflation   ⟫ Nowcasts Inflation

Treatment Effects on Firm Decisions

Effects of Expected Depreciation

Measure the elasticity of current imports to future expected depreciations

- Link survey with administrative data of exports and imports ▸ Distribution Sample vs Whole Economy
- Estimate effects on the average effects of firm-level outcomes

$$\log Y_{i,1} = \alpha_t + \beta \log Y_{i,0} + \gamma \log S_{i,0,1}^e + \varepsilon_i \tag{1}$$

- $Y_{i,t}$: yearly exports or imports before treatment ($t = 0$) or after treatment ($t = 0$)
- Instrumenting $\log S_{i,0,1}^e$ with T_i and $\log S_{i,0,0}^e \times T_i$ (Coibion et al. 2023)
- Idea: use variation in exchange rate expectations induced by the treatment

Effects of Expected Depreciation on Exports and Imports

	First Stage		IV Estimates			
	$\log \text{Imports}_{0,1}$	$\log \text{Exports}_{0,1}$	$\log \text{Imports}_{0,1}$	$\log \text{Imports}_{0,1}$	$\log \text{Imports}_{0,1}$	$\log \text{Exports}_{0,1}$
T_i	-1.976***	-1.218				
	(0.458)	(0.859)				
$\log S^e_{i,t,t} \times T_i$	0.237***	0.146				
	(0.056)	(0.104)				
$\log S^e_{i,t,t+12}$			6.444**	9.738**	1.510	6.863
			(2.776)	(4.064)	(2.464)	(6.822)
$\log \text{Imports}_{i,t-12,t}$			0.977***	0.927***	0.997***	
			(0.024)	(0.032)	(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

⟫ Inference under weak instruments

Interpretation

- Elasticity of imports to future expected depreciations ≈ 6
- Larger for for non-exporters. Less informed $\rightarrow$ more affected by T

- Estimates combine:
    1. Intertemporal substitution in the timing of imports within and across products and origins
        - Positive
        - Studied in the trade/durable literature (Alessandria, Kaboski and Midrigan, 2011)
    2. Elasticity of import usage to costs
        - Substitution away from imported goods
        - Reduction in optimal firm scale
        - Both effects are negative
    3. Future expected Keynesian effects
        - Ambiguous sign of GE effects
- Relevant for effects of depreciations in the aggregate:
    - Expected depreciation important to understand reaction of net exports and to calibrate macro models
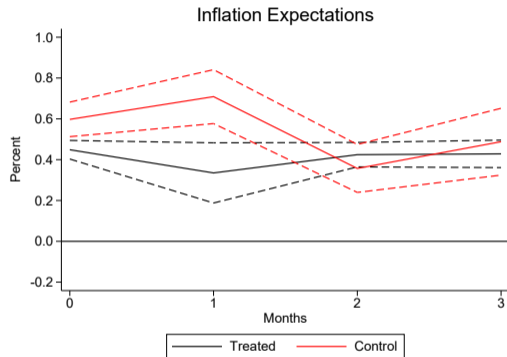
Conclusions

- Firms react to public, easy to find information on the exchange rate
- They adjust forecasts and beliefs
- Act on those beliefs resetting prices, and exports
- Differential effects to destinations that use the USD
- We estimate a positive elasticity of current import expenditures to future expected depreciations
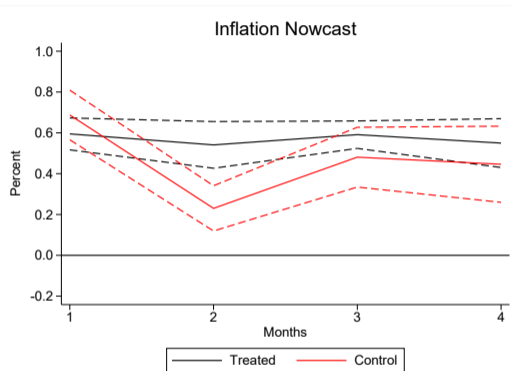
Thank you!

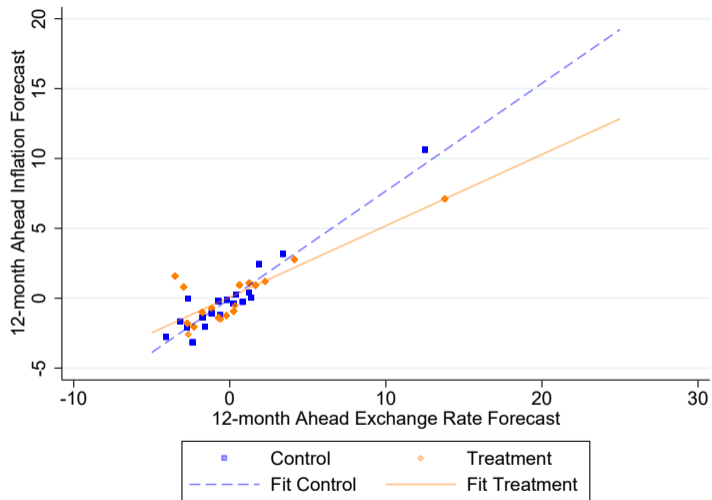# Dynamic Expectation Effects: CPI Inflation

Inflation Expectations

$$\pi^e_{i,t+h,t+h+12} = \beta_t + \beta_1^h T_{i,t} + \beta_2^h \pi^e_{i,t,t} + \beta_3^h T_{i,t} \times \pi^e_{i,t,t} + \epsilon_{i,t}^h$$

▶ Back

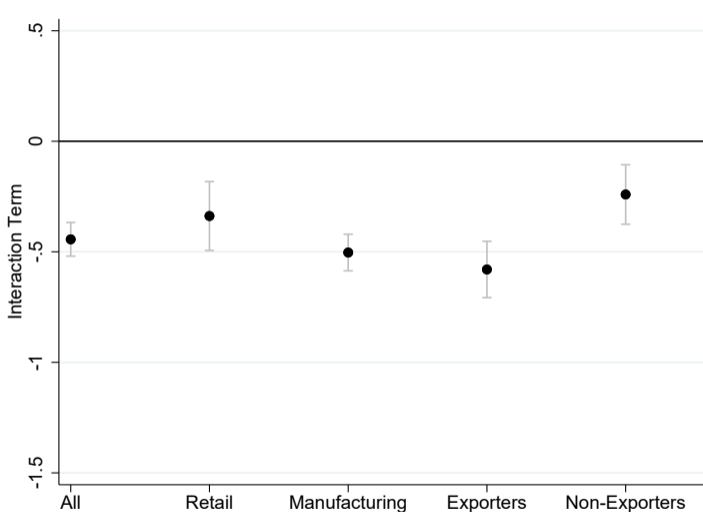# Dynamic Perception Effects: CPI Inflation

$$\pi_{i,t+h,t+h}^e = \beta_t + \beta_1^h T_{i,t} + \beta_2^\tau \pi_{i,t,t}^e + \beta_3^h T_{i,t} \times \pi_{i,t,t}^e + \epsilon_{i,t}^h$$

Inflation Nowcasts and Expectations

Heterogeneity: Inflation Rates

# Treatment Effects on the Distribution of Export Unit Prices

	All Exports	Exports (USD)	Exports (Others)
	(1)	(3)	(2)
$P_{i,pre}$	0.877***	1.035***	0.889***
	(0.009)	(0.000)	(0.006)
$P_{i,pre} \times T_i$	-0.739***	-0.068***	-0.510***
	(0.009)	(0.019)	(0.006)
T_i	34.212***	3.276	12.355***
	(5.782)	(2.180)	(3.773)
Huber Regression	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	183	153	140

Relative Volatility of the Exchange Rate

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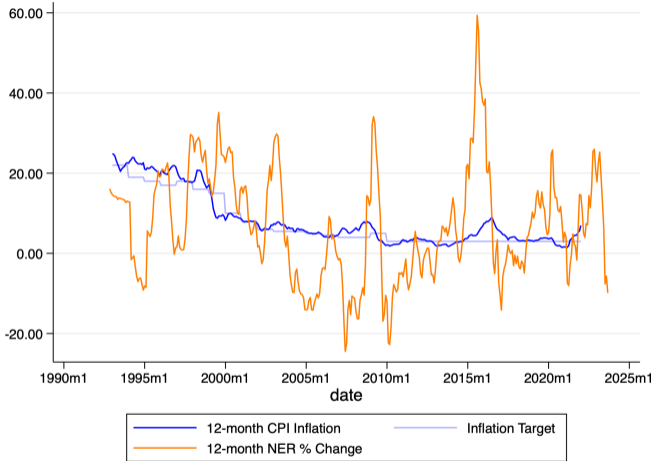
Correlation with CPI Inflation

correlation of growth rates equal to: .32
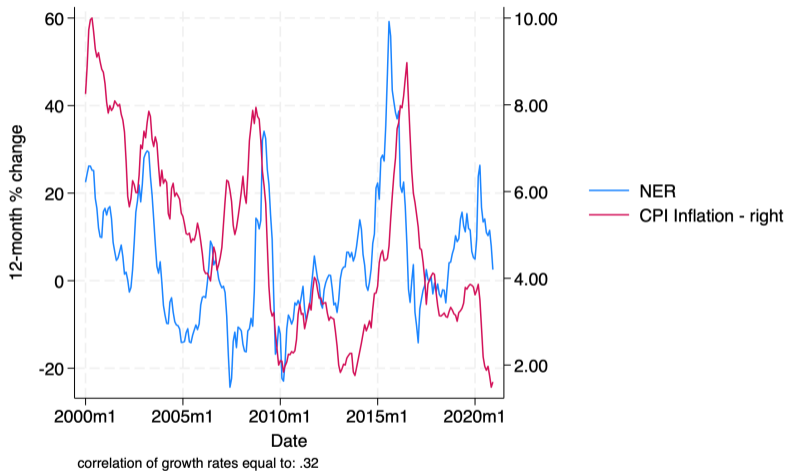
Correlation with the Price of Oil

correlation of growth rates equal to: -.34

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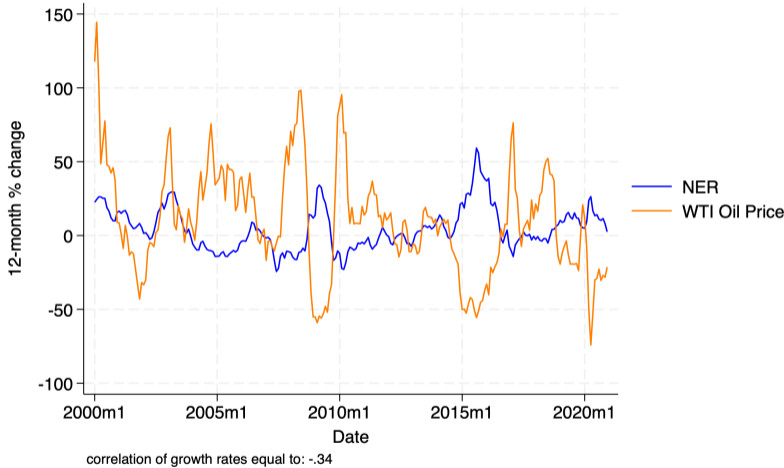
Statistical Properties of the Forecast

Avg(Forecast Error / NER): Professional Forecasters: 0.12, Full Sample OLS: 0.11, Random Walk Forecast: 0.11

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Weak Instruments

- For imports
  - Montiel-Olea and Pflueger (2013) weak instrument test
    - Effective F Stat: 14.7
    - Critical value for a worst-case bias of 10%: 11.81
  - AR Confidence Intervals: Reject elasticities lower than 0.83
- For Exports:
  - Montiel-Olea and Pflueger (2013) weak instrument test
    - Effective F Stat: 2.57
    - Critical value for a worst-case bias of 10%: 6.39
  - AR Confidence Intervals: $(-\infty, \infty)$

Results for exports a good smell test. The treatment does not change move exchange rate expectations for that sub-group ▸ Back
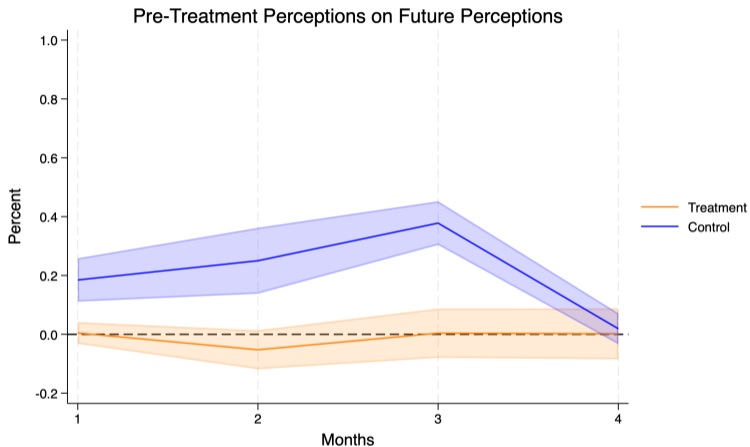
Weighted Product Regressions

	(1) log Imports	(2) log Imports	(3) log Imports	(4) log Imports	(5) log Imports	(6) log Imports
$S^e_{i,t,t+12}$	2.557	-1.879**	3.210	-2.530***	4.698	-2.681***
	(2.416)	(0.911)	(2.519)	(0.687)	(4.352)	(0.666)
$\log \text{Imports}_{i,t-1}$	0.982***	0.880***	0.997***	0.881***	0.989***	0.878***
	(0.018)	(0.007)	(0.016)	(0.005)	(0.016)	(0.004)
Observations	8543	8543	13941	13941	18804	18804
R^2	0.794	0.755	0.811	0.757	0.789	0.767
Product Digits	2	2	4	4	6	6
Level of Variation	Product × Origin	Product × Origin	Product × Origin	Product × Origin	Product × Origin	Product × Origin
Method	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted

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Balance

Variable	Observations		Average (SD)			
	Treated	Control	Treated	Control	Diff	P-Value ($\neq 0$)
$S^e_{0,0}$ (July 2021)	133	147	3876.6	3912.6	35.992	0.191
			(12.485)	(23.572)		
$S^e_{0,1}$ (July 2021)	133	147	3886.4	3899.1	12.711	0.679
			(22.165)	(21.261)		
$\pi^e_{0,0}$ (July 2021)	133	147	3.412	3.243	-0.169	0.693
			(0.310)	(0.296)		
$\pi^e_{0,1}$ (July 2021)	133	147	4.634	3.964	-0.670	0.106
			(0.327)	(0.246)		
All Exports	298	382	206,740	276,432	69,692	0.667
			(107,642)	(113,339)	(159,710)	
Exports to USD	298	382	56,239	80,971	24,731	0.534
			(17,348)	(32,384)	(39,742)	
Exports to Others	298	382	150,501	195,461	44,960	0.732
			(91,180)	(91,365)	(131,099)	
All Imports	298	382	526,482	406,159	-120,323	0.395
			(105,476)	(93,763)	(141,239)	

Dynamic Perception Effects: Exchange Rate Nowcasts

Pre-Treatment Perceptions on Future Perceptions

$$S^e_{i,t+h,t+h} = \beta_t + \beta^h_1 T_{i,t} + \beta^h_2 S^e_{i,t,t} + \beta^h_3 T_{i,t} \times S^e_{i,t,t} + \epsilon^h_{i,t}$$

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Distribution of Exports and Imports
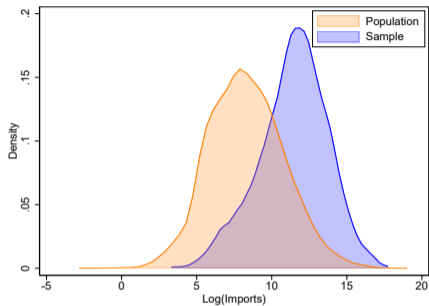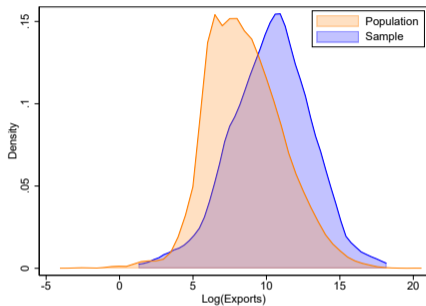
Distribution of Exports and Imports

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

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