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Balance sheet effects in Colombian non-financial firms

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October 2016

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Abstract[*]

After building up foreign currency-denominated (FC) liabilities over several years, the balance sheets of Colombian firms might be particularly vulnerable to a shift in external conditions. This paper undertakes four exercises in order to get a better understanding of these vulnerabilities. First, probit/logit estimations are used to identify the firm-level and macroeconomic determinants of FC borrowing by non-financial corporations. Second, the implications of the balance sheet vulnerability for real activity are investigated. Evidence is found of an FC balance sheet effect that transmits exchange rate fluctuations to firm-level investment, and show that that this effect is asymmetric, much greater for depreciations than for appreciations. Third, using logit/probit estimations, it is shown that not all firms use forward exchange derivatives solely to hedge their FC liabilities. This might be a consequence of exchange rate intervention by the monetary authority, protecting against extreme exchange rate misalignments. Finally, results are reported of a survey-based qualitative analysis on the hedging policies and activities of 12 large non-financial firms.

JEL classifications: E22, F31
Keywords: Colombia, Depreciation, Dollar debt, Balance sheet effects

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1. Introduction

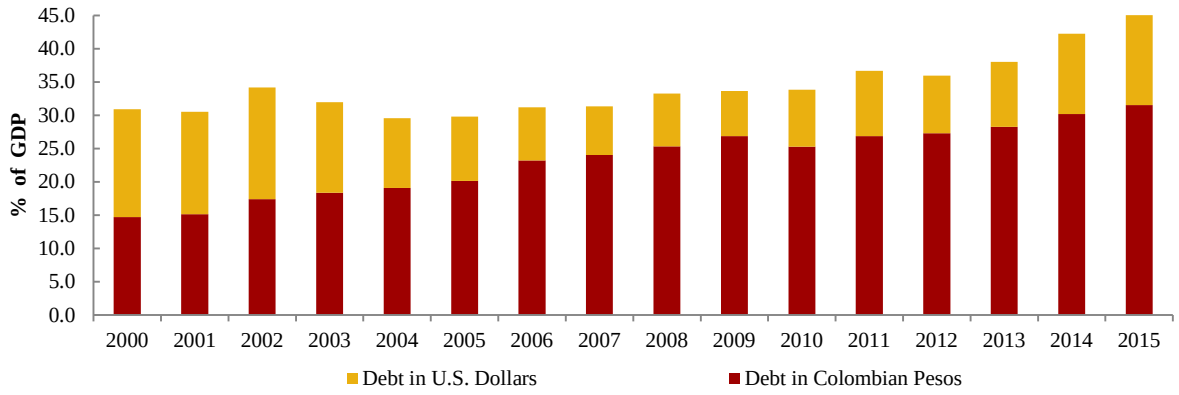
In recent years many emerging markets have benefitted from benign global conditions, including ample liquidity and, until mid-2014, very favorable terms of trade. Enactment of expansionary and often unconventional monetary policies, coupled with very low yields in mature markets, has facilitated access to foreign debt markets by emerging firms and the sovereign.

In Latin American countries bond issuance was facilitated by strong macroeconomic fundamentals and/or the upswing in commodity prices. According to Rodríguez, Kamil and Sutton (2015), gross bond issuance by non-financial corporates in LA-5 countries (Brazil, Chile, Colombia, Mexico and Peru) increased from US$15 billion in 2003 to US$77 billion in 2013 (totaling US$435 billion over the entire period). Issuance in these countries has increased rapidly since 2009, specifically in export sectors linked to commodities (such as mining, oil and gas), in response to abundant liquidity and strong investor appetite.

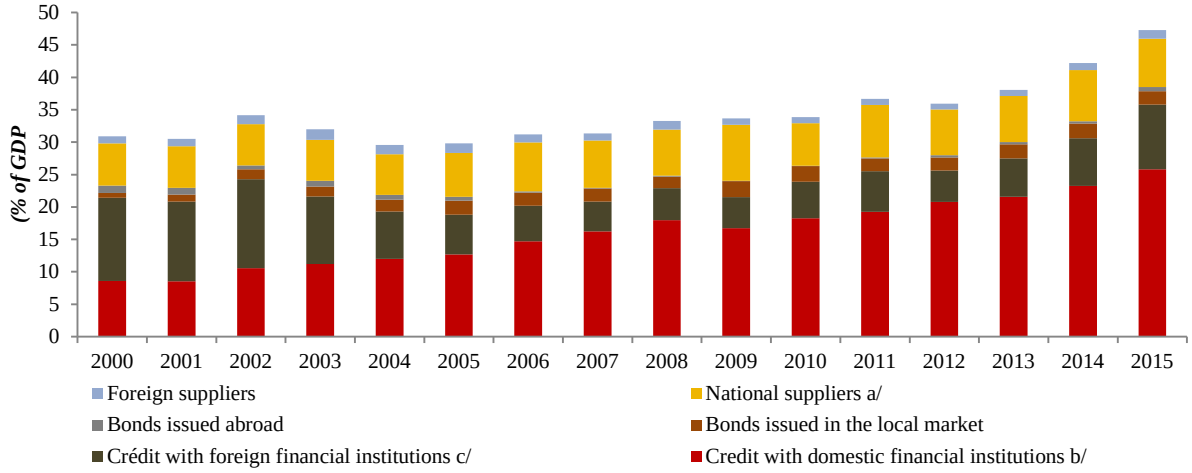
Colombia was no stranger to this phenomenon. Private sector debt increased from around 30 percent of GDP in 2000 to 45 percent of GDP in 2015 (Figure 1). Although more than half of total corporate debt is with domestic financial institutions and two thirds is peso-denominated, since 2009 the share of foreign-currency (FC) debt has increased markedly, from 20.2 percent to 33.3 percent (Panel A), and the share of credit with foreign financial institutions has gone from 14.1 percent to 21.1 percent (Panel B).

Figure 1. Private Corporate Debt by Instrument and Currency Denomination

Panel A. By currency



Panel B. By instrument



Source: Central Bank based on Superintendencia de Sociedades.
Note: Because of data limitations, 2015 suppliers' debt is assumed equal to that observed in 2014.

In spite of its well-known benefits, the sustained increase in foreign borrowing by non-financial firms is also a matter of concern, particularly in the post-2014 global scenario in which monetary conditions have tightened and are expected to tighten even further, and in which the collapse in the price of oil has provided Colombia with the sharpest decline ever in its terms of trade.[1] The current account deficit went from 3.2 percent of GDP in 2012 to 6.5 percent in 2015 and the peso depreciated by almost 53 percent against the US dollar during that period. The buildup of foreign currency debt in the context of a volatile and weakening currency is a potential vulnerability, particularly if firms do not match the currency composition of their liabilities with that of their assets, do not use financial derivatives to hedge their exposure to exchange rate risk, or do not benefit from a natural hedge in the form of FC revenues.

It is important to highlight that, like many other emerging economies, Colombia has experienced large swings in international capital flows since the early 1990s. These swings have generally been associated with similar swings in economic activity, working through two channels: exchange rate changes and bank credit. Regarding exchange rates, the resulting real appreciation during the upswing has contributed to the expansion in activity being biased toward

[1] Between June 2014 and December 2015 the price of Brent crude oil declined by more than 60 percent and the terms of trade by more than 40 percent. Even though oil represents only 7 percent of GDP, the macro-economy is highly sensitive to variations in the price of hydrocarbons. In 2014 oil exports accounted for 53 percent of total exports, while FDI in the hydrocarbons sector represented 30 percent of total FDI. Not to mention the fiscal dependence on oil: in 2014 taxes from oil companies and profits from Ecopetrol amounted to 20 percent of central government current revenue.

the non-tradable sector (Cano, 2010), while slowdowns in activity have been cushioned by a tradable sector benefitting from real depreciation. Regarding bank credit, pronounced cycles have largely coincided with swings in international capital flows (Barajas and Steiner, 2002). During the upswing, banks have found it easier to access foreign capital and also have encountered more rapid deposit growth, an indirect consequence of the surge in capital inflows. During the downswing, the opposite occurs. To the extent that certain businesses in the economy are "bank-dependent" in their financing possibilities, these bank credit cycles can serve to transmit and even amplify the effects of international capital cycles on the real economy.

What has received less attention in the empirical literature in Colombia has been the possible impact of these swings in capital flows on economic activity and on financial vulnerability, working through a balance sheet channel. Since the work of, among others, Krugman (1999) and Céspedes, Chang and Velasco (2002), it has been recognized that if currency mismatches are large enough, the traditional beneficial impact of depreciations might be overturned as firms with large currency mismatches experience distress as a result of a weaker local currency.

One strand of empirical work has focused on factors that contribute to the buildup of liabilities in foreign currency and on the firm-level balance sheet effects that ensue in the event of sizable depreciations. For 32 developed and developing countries, Calvo, Izquierdo and Mejía (2004) found that the interaction of large current account deficits and high dollarization may be a dangerous cocktail, as potential balance sheet effects become highly relevant in determining the probability of a Sudden Stop. For six Latin American countries, Kamil (2012) showed that fixed exchange rates may play a role in building up these vulnerabilities; after countries switch from pegged to floating exchange rates, firms reduced their foreign currency exposures.

In the case of Colombia, Echeverry et al. (2003) found that during 1995-2001 vulnerabilities were relatively limited, mainly because the buildup of FC liabilities was modest and mostly limited to "naturally hedged" firms, those with a sizable portion of revenues in foreign currency. It also showed that, amidst a real exchange rate depreciation, firms with foreign currency debt generally had lower profitability but no different investment than that of other firms. Recently, Restrepo, Cuervo and Montes (2014) found that firms in Colombia do not match the currency composition of their liabilities with those of their assets and income. Following Cowan, Hansen and Herrera (2005), they also found that, following a 10 percent

depreciation of the real exchange rate, investment fell by 3 percentage points more in firms with half of their debt denominated in dollars compared with firms that held no dollar debt.

As the recent upswing phase of the international capital cycle reaches its conclusion, it is relevant to assess to what extent vulnerabilities may have been built up over the past few years. The purpose of this paper is to identify econometrically the determinants of foreign borrowing by non-financial corporations and the effect of such borrowing on firm performance (i.e., profits and investment) in the presence of exchange rate fluctuations. We also want to understand what drives firms' decision to use forward exchange derivatives. The paper is divided into five sections, including this introduction. In the second section we describe the database. In the third section we motivate and undertake the econometric exercises. In the fourth section we report the results of a qualitative analysis of the hedging policies and activities of 12 large non-financial firms, while the last section draws conclusions.

2. Firm-Level Database

We use balance sheet and income statements for non-financial firms for the 2005-2013 period, as provided by Superintendencia de Sociedades (SS) and Superintendencia Financiera (SF).[2] These standardized data sets cover firms with assets or annual revenue in excess of 30,000 times the monthly minimum wage.[3] The total number of observations is 215,016 with a yearly average of 23,890 firms, ranging between 19,744 and 27,091. As reported in Table 1, retail and manufacturing comprise the largest number of firms in the data base. For the currency composition of assets and liabilities, firm-level FDI and use of financial derivatives, we use data from Banco de la República (BdR). Import (CIF) and export data (FOB) come from DANE-DIAN. The definition and sources of all variables are reported in Annex A.[4]

Larger firms tend to have more exposure to exchange rate movements and are more likely to hold either a natural or a financial hedge. Therefore, they are of particular interest in this paper. We will also consider large firms which do not have foreign currency denominated debt,

[2] Even though SS information is available as of 1995, we consider only information since 2005 in order to ensure that we work with high-quality data. Other variables, including financial derivatives, are only available for this shorter period of time.

[3] In 2015 the monthly minimum wage was US$235. Hence, only firms with assets above US$7 million were subject to mandatory reporting.

[4] Two important differences between the data sources in this paper and those used in other recent papers on the same topic (including Restrepo, Cuervo and Montes 2014) are: i) we use information not only from SS, but also from SF, which includes firms listed on the stock exchange; and ii) we have considered one additional year (2013).

so as to understand both the determinants of holding foreign currency debt and the impact on profits and investment of exchange rate changes. In order to concentrate our analysis on this type of firms, we apply the following filters to the original database:

1. We remove firms where either of the following ratios are less than 0.01 or greater than 1.1: FC debt (bonds, credit from financial institutions and trade credit) to total debt, FC assets to total assets, exports to operational income.
2. Having applied the above filters, every year we rank all firms by asset size and we maintain only those above the 75th percentile.[5]
3. We then try to balance the panel as much as possible, removing those firms that do not appear in the database for at least 5 years.

After applying these filters, the database is reduced to a working sample of 38,523 observations with a yearly average of 4,280 firms, ranging between 3,479 and 4,847. Retail and manufacturing continue to be the sectors with the highest number of firms (Table 1). The descriptive statistics that follow are in reference to these average 4,280 firms, the database that will be used in the econometric exercises.[6]

Table 1. Firms by Sector, Yearly Average

	Original database	**Our sample**
Agriculture	1,553	319
Retail	13,866	2,116
Construction	2,386	389
Electricity, gas and water	78	17
Manufacturing	4,483	1,208
Oil & Mining	498	117
Transport and communication	906	114
Total	**23,770**	**4,280**

Source: Authors calculations based on SS, DIAN-DANE, SF and BdR.

[5] As our database is composed mostly of small firms that do not have foreign currency debt, foreign currency assets, exports or imports, we decided to work with the upper 25th percentile. This left us with a reasonably good number of heterogeneous firms.

[6] With the exception of the second econometric exercise in Section 3.1 where we only take into account firms holding FC debt.

In Panel A of Table 2 we report totals (in USD millions) for all firms in our sample for foreign currency debt, foreign currency assets, net forwards and net exports (exports minus imports of goods and services). Foreign currency assets are relatively small compared to debt and the net forward position—measured as the difference between long and short positions in currency forwards[7]—is negative for the sample period, implying that firms take mostly short positions, not hedging foreign currency debt; and net exports are highly positive for 2009 and 2013. In Panel B we report averages per firm as a percentage of total assets.[8] It is from Table 2 that we derive our main variable of interest for the econometric exercises in Section 3.2: balance sheet exposure (FC debt minus FC assets minus Net Forwards).

Table 2. FC Operations

Panel A. Balance-Sheet exposure in millions of USD

Year	# Firms	FC debt (1)	FC assets (2)	Net Fwds (3)	Balance-sheet exposure (4) = (1)-(2)-(3)	Net exports (5)
2005	3479	5410	681	-766	5496	-1018
2009	4847	9690	682	-601	9609	937
2013	4031	17328	2939	-1497	15886	7238

Panel B. Balance-Sheet exposure per firm (ratios to total assets, except for FC debt/total debt)

Year	# Firms	FC debt (1)	FC assets (2)	Net Fwds (3)	Balance-sheet exposure (4) = (1)-(2)-(3)	Net exports (5)	FC debt / Total debt
2005	3479	3.0%	0.6%	-0.6%	2.9%	-4.1%	5.5%
2009	4847	2.4%	0.4%	-0.3%	2.3%	-4.4%	4.3%
2013	4031	3.1%	0.6%	-0.5%	3.0%	-7.9%	5.5%

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.

[7] The forward contract is the net position of active contracts as of December 31 of each year for each firm. In general, the average duration of a COP/USD forward contract ranges between 1 and 3 months and is traded between non-financial firms and banks. Although forward contracts are not the only FC derivatives available, they account for 95 percent of the value of operations and for 99 percent of the number of derivatives operations.

[8] Net exports are positive when added across firms but negative for the average firm. This is due to the fact that one firm, Ecopetrol—the national oil company—is by far the largest exporter.

When we delve into the components of firms' FC debt, the largest share is FC loans (representing between 70 percent and 90 percent). It is worth noting that FC bonds [9] increased their share, despite there being only nine[10] issuers in our sample (Table 3; Panel A). Furthermore, when we scale by total assets, we can see that FC debt decreased in the first years of the sample from 3.0 percent to 2.4 percent, but increased after 2009, reaching in 2013 a level of 3.1 percent (Panel B).

Table 3. Composition of FC Debt, Selected Years[11]

Panel A. In US millions

Year	# Firms	# Bond issuers per year	Bonds (1)	Loans (2)	Financial debt (3)=(1)+(2)	Trade Credit (4)	FC debt (5)
2005	3479	4	717	4,359	5,076	335	5,410
2009	4847	4	1,482	7,612	9,094	596	9,690
2013	4031	3	4,939	12,224	17,163	165	17,328

Panel B. Average value per firm as a percentage of total assets

Year	# Firms	# Bond issuers	Bonds (1)	Loans (2)	Financial debt (3)= (1)+(2)	Trade credit (4)	FC debt (5)
2005	3479	4	0.0%	2.5%	2.5%	0.5%	3.0%
2009	4847	4	0.0%	1.8%	1.8%	0.6%	2.4%
2013	4031	3	0.0%	2.9%	2.9%	0.1%	3.1%

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.

Figure 2 reports some descriptive statistics (averages for 2005-2013) for our sample of firms. Total corporate liabilities increased from around 5 percent of total assets at the beginning of the sample to 6.2 percent in 2013; short-term debt declined from close to 80 percent of total liabilities in 2003 to 76 percent at 2013, while financial debt, defined as loans with local or foreign banks, was stable at 30 percent of total liabilities. Similarly, total FC debt (bonds, trade credit, and FC loans with local and foreign financial institutions) was relatively stable and averaged 5 percent of total liabilities. With respect to hedging instruments, net forwards as a

[9] All FC bonds were issued in foreign markets.
[10] There are a total of nine different firms that issued bonds throughout the period of study. Nevertheless, the maximum number of bond issuers in a given year was four.
[11] We do not include domestic credit indexed to the exchange rate, which has never been prominent in Colombia.

share of total liabilities was -0.4 percent—i.e., during our period of analysis, firms sold more dollars than they bought through forward contracts. Exports averaged 6 percent of total revenue and declined during the sample period. Finally, balance sheet exposure declined from 2.9 percent of total assets in 2005 to 1.8 percent in 2008, while after the post-crisis period it increased, reaching 3 percent in 2013.

Figure 2 also reports descriptive statistics for net exporting and net importing firms.[12] Exporting firms exhibit larger total liabilities to total assets in comparison to the whole sample (7.8 percent vs. 6.1 percent). They also hold larger proportions of short-term debt (78 percent vs. 76 percent), financial debt (34 percent vs. 29 percent), and FC debt (11.2 percent vs. 4.9 percent). With respect to exchange rate hedging instruments, we find that exporting firms have a long position, while the entire sample has a short position (5.1 percent vs. -0.4 percent). Finally, the balance sheet exposure as a ratio of total assets was slightly higher for exporting firms than for the whole sample (2.9 percent vs. 2.5 percent).

When compared with the entire sample, importing firms display smaller ratios of total liabilities to total assets (5.9 percent vs. 6.1 percent) and larger ratios of short-term to total debt (81 percent vs. 76 percent) and FC to total debt (5.7 percent vs. 4.9 percent), whereas the ratio of financial to total debt (29.8 percent vs. 29 percent) is very similar. Importing firms have a shorter position in exchange rate hedging instruments (-2.2 percent vs. -0.4 percent), a smaller exports to total revenue ratio (2.5 percent vs. 6 percent) and, importantly, a larger balance sheet exposure (3.7 percent vs. 2.5 percent).

[12] Exporting (importing) firms are those that have positive (negative) values for net exports of goods and services.

Figure 2. Descriptive Statistics

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.

In Table 4 we report descriptive statistics for the sub-sample comprised of firms that hold any amount of FC debt. These firms hold more debt (in any currency) in relation to total assets than the entire sample (8.9 percent vs. 6.2 percent) and more financial debt in relation to total liabilities (41.1 percent vs. 29.6 percent). Lastly, for this sub-sample the ratio of exports to total revenue is more than twice that of the entire sample.

Table 4. Descriptive Statistics for Firms Holding FC Debt

FC debtors		
Variable	Mean	Median
Total liabilities/Total assets	8.9	3.4
Short-term debt/Total liabilities	76.5	84.9
Financial debt/Total liabilities	41.1	43.1
Total FC debt/Total liabilities	16.0	8.8
Net FC forwards/Total liabilities	-1.9	0.0
Exports/Total revenue	13.2	0.6
Balance sheet exposure	9.3	4.5

Source: Authors calculations based on SS, DIAN-DANE, SF and BdR.

Table 5A focuses on a sub-sample of firms that held any type of FC forward at the end of each year. It is worth mentioning that manufacturing, agriculture and retail are the sectors most heavily represented in this group. Interestingly, it seems that for all sectors, except construction, a high percentage of firms using forwards—between 84 and 100 percent—are involved in international trade. The percentage of firms holding foreign debt, although also high, is substantially lower. In panel B holdings of financial derivatives are disaggregated further, between long and short forward positions. Most sectors have a larger short than long forward position. It is important to highlight that firms in agriculture exhibit the largest long forward positions (2.2 percent of total assets) and also the largest net forwards as a share of total debt (4.8 percent). With the exception of agriculture and transport and communications, firms have short net positions—i.e., they were net sellers of foreign currency.

Table 5. Descriptive Statistics for Firms Holding Financial Derivatives

Panel A. Firm-level variables, descriptive statistics (average 2005–2013)

Firms descriptive statistics by industry

	% of firms with Fwds	% of firms with Fwds and international trade	% of firms with Fwds and FC debt
Agriculture	11.5	10.0	6.7
Retail	9.6	8.1	6.7
Construction	3.1	2.2	2.5
Electricity, gas and water	7.7	7.7	3.9
Manufacturing	16.9	16.7	13.7
Oil & Mining	3.9	3.5	3.0
Transport and communications	5.9	5.1	4.1

Panel B. Long, short and net forwards positions (as a ratio of total assets; average 2005-2013)

Firms descriptive statistics by industry

	Net Fwds/Total assets		Long Fwds/Total assets		Short Fwds/Total assets	
	Mean	Median	Mean	Median	Mean	Median
Agriculture	2.0	0.0	2.2	0.0	0.2	0.0
Retail	-0.7	0.0	0.3	0.0	1.0	0.0
Construction	-0.1	0.0	0.0	0.0	0.1	0.0
Electricity, gas and water	-0.2	0.0	0.0	0.0	0.2	0.0
Manufacturing	-0.5	0.0	0.6	0.0	1.1	0.0
Oil & Mining	0.0	0.0	0.2	0.0	0.2	0.0
Transport and communications	0.4	0.0	0.6	0.0	0.2	0.0

Source: Authors calculations based on SS, DIAN-DANE, SF and BdR.

3. The Drivers and Consequences of FC Debt

In this section we address three questions: i) which factors drive non-financial firms' decision to issue FC debt, and how much do they issue? ii) What is the impact on firm performance (i.e., profits and investment) of holding FC debt in the presence of exchange rate fluctuations? and iii) what are the determinants of the use of exchange rate derivatives (forwards) by firms?

3.1 Determinants of Issuance of FC Debt

In order to assess the importance of the different factors that might affect a firm's decision to issue foreign currency denominated debt, we follow Echeverry et al. (2003), as follows:

$$FC_{i,t} = \propto_i + \beta_1 A_{i,t} + \beta_2 L_{i,t} + \beta_3 Z_{i,t} + \beta_4 FO_{i,t} + \beta_5 G_{i,t} + \beta_6 I_{i,t} + \beta_7 S_{i,t} + \beta_8 IP_{i,t} + \rho_1 s_t + \rho_2 c_t + e_{i,t} \quad (1)$$

FC is a dummy variable equal to 1 for the year in which the firm acquired (any amount of) FC debt, 0 otherwise. The firm-level explanatory variables are: *A*, the logarithm of total assets; *L*, leverage, the ratio of total liabilities to total assets; *Z*, exports in relation to total sales; *FO*, a dummy variable equal to 1 if 50 percent or more of the firm's equity is owned by foreigners; *G*, the rate of growth of sales; *I*, FC assets held abroad;[13] *S*, the ratio of short-term debt to total debt; and *IP*, imports as a ratio of total operational expenses. We have included two macroeconomic variables: *s*, the difference between the domestic interbank rate of interest, the overnight Libor, and the premium on exchange rate forward contracts; and *c*, domestic credit to the private sector as a percentage of GDP. We also estimate a slightly different specification in which macroeconomic variables are replaced with time effects.

We run three different versions of (1), all of them as a logit regression.[14] In the first, the dependent variable includes all three types of FC liabilities (bonds, bank loans, and trade credit). In the second, it only includes financial debt (bonds and bank loans). The third only includes trade credit. Results are very similar for the three exercises.

As can be seen in Table 6, most variables have the expected sign and are significant at the 10 percent confidence level. The probability of issuing any kind of FC debt increases with size, leverage, and the ratio of exports to total sales. The significance of exports to total sales provides evidence of "natural hedging." The probability of issuing any kind of FC debt declines with the rate of growth of sales, an indication that the ability of the firm to self-finance its investment needs increases with sales, as in Rajan and Zingales (1998). Firms that rely more on short-term debt, that are importers, or that are foreign-owned, are more likely to issue FC debt. With regard to macroeconomic variables, the probability of issuing any kind of FC debt increases when the domestic interest rate increases relative to the foreign interest rate or when the forward premium goes up, the latter presumably because a weaker exchange rate is to be expected. Total and financial FC debt does not appear to substitute for domestic bank credit; issuance is actually more likely when aggregate credit to the private sector is on the upswing, thus issuance is pro-cyclical with respect to domestic credit conditions. Trade credit behaves somewhat differently, as it decreases when domestic credit conditions tighten.

[13] FC-denominated assets held within the country is not known.

[14] When a probit model is used for the Total FC Debt and Financial FC debt estimations, results are robust to the econometric methodology. However, there are no firm-level determinants when the FC trade credit version takes the form of a probit model. See Annex B.

Table 6. Determinants of the Decision to Issue FC Debt
(Marginal effects after logit)

VARIABLES	(1) Logit Total FC Debt	(2) Logit Financial FC Debt	(3) Logit FC Trade Credit	(4) Logit Total FC Debt	(5) Logit Financial FC Debt	(6) Logit FC Trade Credit
A, Assets	0.0512***	0.0338***	0.000120***	0.0518***	0.0341***	0.000101***
	(0.00452)	(0.00296)	(2.66e-05)	(0.00453)	(0.00297)	(2.35e-05)
I, Assets held abroad	-0.00959	-0.0123	0.000399	-0.0128	-0.0133	0.000387
	(0.0537)	(0.0318)	(0.000574)	(0.0571)	(0.0342)	(0.000511)
L, Leverage	0.289***	0.175***	0.000763***	0.291***	0.177***	0.000649***
	(0.0389)	(0.0241)	(0.000210)	(0.0389)	(0.0242)	(0.000186)
S, Short term debt	0.0585***	0.0393***	0.000132*	0.0564***	0.0389***	7.76e-05
	(0.0119)	(0.00757)	(7.87e-05)	(0.0119)	(0.00758)	(6.79e-05)
Z, Exports	0.293***	0.173***	0.000597***	0.288***	0.170***	0.000459***
	(0.0318)	(0.0192)	(0.000146)	(0.0314)	(0.0191)	(0.000122)
IP, Imports	0.102**	0.0356*	0.000181	0.0974**	0.0343*	0.000128
	(0.0479)	(0.0200)	(0.000172)	(0.0458)	(0.0196)	(0.000129)
G, Sales growth	-0.00535***	-0.00250**	-4.39e-05**	-0.00488**	-0.00207*	-4.75e-05**
	(0.00206)	(0.00127)	(2.02e-05)	(0.00202)	(0.00124)	(1.98e-05)
FO, Foreign ownership	0.0416***	0.00516	0.000524***	0.0482***	0.00854**	0.000460***
	(0.00915)	(0.00411)	(0.000132)	(0.00942)	(0.00425)	(0.000119)
s, Spread				0.0353**	0.0152*	0.000468***
				(0.0143)	(0.00857)	(0.000122)
c, Credit to private sector				0.0998***	0.119***	-0.00117***
				(0.0244)	(0.0163)	(0.000271)
RE	YES	YES	YES	YES	YES	YES
Time Effects	YES	YES	YES	NO	NO	NO
Number of Observations	34,064	34,064	34,064	34,064	34,064	34,064
Number of firms	5,012	5,012	5,012	5,012	5,012	5,012

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.
Note: Robust standard error in parenthesis.***p<0.01, **p<0.05, *p<0.1

Having specified regression (1) to determine the decision of whether or not to issue FC debt, we now limit the sample to issuing firms in order to understand the determinants of the firms' share of FC debt issued.

$$FCS_{i,t} = X_{i,t}B + a_i + \rho_1 s_t + \rho_2 c_t$$
$$+ s_t\left[\beta_1 A_{i,t} + \beta_2 Z_{i,t} + \beta_3 FO_{i,t} + \beta_4 IP_{i,t}\right]$$
$$+ c_t\left[\delta_1 A_{i,t} + \delta_2 Z_{i,t} + \delta_3 FO_{i,t} + \delta_4 IP_{i,t}\right] + e_{i,t} \quad (2)$$

where X=[A, L, Z, FO, G, I, S, IP]

In this specification, *FCS* is FC debt denominated as a ratio of total assets. The firm-level and macroeconomic explanatory variables are as in (1) above. In addition, the macro variables

are interacted with assets, with exports (as a proportion of sales), with the foreign ownership dummy variable and with imports (as a percentage of operational expenses). As in the previous exercise, we run different versions of (2), using three definitions of FC debt as the dependent variable. We run equation (2) as a fixed effects panel regression. We also include a specification using time effects in place of the macroeconomic variables.

As Table 7 shows, all coefficients of firm-level, non-interacted and interacted macroeconomic variables are significant at the 10 percent confidence level. In general terms, all types of FC debt behave as expected. The shares of total and financial FC debt increase with size, leverage, short-term debt and exports to total sales—yet again evidence of natural hedging—and decreases with the ratio of imports to total expenses. They are both pro-cyclical with respect to domestic bank credit. In contrast, the share of trade credit exhibits a negative sign for size and exports to total sales ratio, a positive sign for imports to total expenses ratio, is counter-cyclical with respect to domestic bank credit, and is not significant with respect to other explanatory variables. Some effects are common across all three types of FC debt: shares of FC debt all decrease with sales growth—giving support to the idea of investment self-financing by the firm—and increase if the firm is owned by foreigners.

With respect to the interaction with macroeconomic variables, the larger the exports to total revenue ratio, the more sensitive the use of trade credit to the interest rate differential and forward premium. Firms with higher export ratios are also less likely to show countercyclical use of trade credit with respect to domestic bank credit. Also, for larger or foreign-owned firms, use of financial FC debt is less pro-cyclical, presumably because swings in domestic bank credit have a smaller effect on their access to financing. Firms with larger imports to total expenses ratio tend to be more sensitive to interest rate and forward premium movements, their use of FC financial debt is more pro-cyclical and their use of trade credit is less pro-cyclical with respect to swings in domestic bank credit.

Table 7. Determinants of the Share of FC Debt Issued

VARIABLES	(1) Total FC debt	(2) Financial FC debt	(3) Trade Credit	(4) Total FC debt	(5) Financial FC debt	(6) Trade Credit	(7) Total FC debt	(8) Financial FC debt	(9) Trade credit
A, Assets	0.0120***	0.0145***	-0.00126	0.0120***	0.0142***	-0.000991	0.0150**	0.0229***	-0.00628***
	(0.00352)	(0.00375)	(0.00131)	(0.00337)	(0.00395)	(0.00102)	(0.00605)	(0.00541)	(0.00172)
I, Assets held abroad	0.0762	0.0718	0.000827	0.0755	0.0722	-0.000214	0.0769	0.0723	0.00114
	(0.0568)	(0.0577)	(0.00247)	(0.0582)	(0.0488)	(0.00189)	(0.0555)	(0.0580)	(0.00217)
L, Leverage	0.153***	0.151***	-9.63e-06	0.153***	0.151***	-9.87e-05	0.152***	0.152***	-0.00221
	(0.0203)	(0.0185)	(0.00414)	(0.0181)	(0.0175)	(0.00446)	(0.0203)	(0.0217)	(0.00428)
S, Short term debt	0.0215***	0.0215***	-0.00118	0.0214***	0.0222***	-0.00190	0.0213***	0.0226***	-0.00245
	(0.00642)	(0.00505)	(0.00287)	(0.00600)	(0.00518)	(0.00288)	(0.00662)	(0.00675)	(0.00290)
Z, Exports	0.0357***	0.0389***	-0.00390*	0.0365***	0.0411***	-0.00517*	0.0577	0.0826*	-0.0269***
	(0.0115)	(0.0110)	(0.00219)	(0.0109)	(0.0101)	(0.00266)	(0.0468)	(0.0445)	(0.00772)
IP, Imports	-0.0103	-0.00890*	-0.00137	-0.00977	-0.00797	-0.00177	0.0951***	0.0110	0.0827***
	(0.00628)	(0.00469)	(0.00241)	(0.00858)	(0.00594)	(0.00378)	(0.0246)	(0.0234)	(0.0175)
G, Sales growth	-0.00266**	-0.00198*	-0.000717	-0.00256**	-0.00163	-0.000951*	-0.00256**	-0.00167	-0.000912**
	(0.00126)	(0.00115)	(0.000581)	(0.00118)	(0.00113)	(0.000538)	(0.00128)	(0.00123)	(0.000431)
FO, Foreign ownership	0.00545*	0.00594**	-0.00106	0.00491	0.00611*	-0.00174	0.00694	-0.0174	0.0241***
	(0.00315)	(0.00288)	(0.00111)	(0.00340)	(0.00321)	(0.00134)	(0.0174)	(0.0155)	(0.00682)
s, Spread				0.00733	-0.00260	0.00987***	-0.0192	-0.0289	0.0105
				(0.00607)	(0.00615)	(0.00284)	(0.0346)	(0.0330)	(0.00832)
c, Credit to the private sector				0.0254***	0.0419***	-0.0190***	0.0775***	0.108***	-0.0270***
				(0.00965)	(0.0109)	(0.00339)	(0.0294)	(0.0316)	(0.00883)
Spread*assets							0.00144	0.00316	-0.00189
							(0.00579)	(0.00522)	(0.00148)
Spread*exports							0.0309	0.0487	-0.0174**
							(0.0480)	(0.0515)	(0.00861)
Spread*imports							0.0976***	0.0447*	0.0523***
							(0.0272)	(0.0252)	(0.0188)
Spread*foreign ownership							-0.0209	-0.0254	0.00496
							(0.0171)	(0.0177)	(0.00868)
Credit to the private sector*assets							-0.00609	-0.0132**	0.00597***
							(0.00458)	(0.00514)	(0.00159)
Credit to the private sector*exports							0.0173	0.00413	0.0174*
							(0.0519)	(0.0609)	(0.00936)
Credit to the private sector*imports							-0.0150	0.0626**	-0.0758***
							(0.0318)	(0.0257)	(0.0163)
Credit to the private sector*foreign ownership							-0.0455**	-0.000572	-0.0445***
							(0.0210)	(0.0177)	(0.00879)
Constant	-0.0464**	-0.0656***	0.0127	-0.0535***	-0.0927***	0.0342***	-0.0968***	-0.147***	0.0431***
	(0.0223)	(0.0207)	(0.00852)	(0.0171)	(0.0207)	(0.00642)	(0.0361)	(0.0336)	(0.0103)
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	NO	NO	NO	NO	NO	NO
Number of Observations	16,450	16,450	16,450	16,450	16,450	16,450	16,450	16,450	16,450
Number of firms	2,325	2,325	2,325	2,325	2,325	2,325	2,325	2,325	2,325
R-squared	0.039	0.052	0.016	0.038	0.051	0.015	0.042	0.054	0.042

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.

Note: Standard errors estimated by bootstrapping in parentheses.*** p<0.01, ** p<0.05, * p<0.1

3.2 Profits and the Currency Composition of Debt

We estimate the effect of FC exposure on firm profits in the presence of changes in the real exchange rate. In particular, we estimate a fixed-effects model where the dependent variable is net profits as a proportion of total assets at $t-1$. Recall that our critical value FC exposure is defined as the difference between FC debt, FC assets and net forward position. We estimated two versions of equation (3); results are reported in Table 8.

$$PR_{it} = \beta_1 x_{it} + \vartheta_i + \varepsilon_{it} \qquad i = 1, \dots, N \quad t = 1, \dots, 9 \quad (3)$$

PR_{it}: Firm net profits as a share of total assets.

ϑ_i: Fixed effects

ε_{it}: i.i.d error term with variance σ_ϵ^2

Specification 1

x_{it}: our two key variables of interest are the interaction between FC debt in *t-1* and the log of the real exchange rate and the interaction between FC assets in *t-1* and the log of the real exchange rate. We also include as controls lagged total financial liabilities; net exports and net forwards interacted with the real exchange rate; the foreign-owned dummy FO; I, investments owned abroad; and G, the rate of growth of sales.

Specification 2

x_{it}: here we interact FC balance-sheet exposure with the log of the real exchange rate. We include the same control variables as in Specification 1.

In specification 1, where we disaggregate the components of FC exposure, we see that only net exports transmit exchange rate fluctuations to firm profits; as expected, profits increase following a depreciation. In specification 2 we see that FC balance-sheet exposure does not transmit exchange rate fluctuations to profits, but net exports do. To some extent, this is to be expected, as most of the impact of exchange rate fluctuations for firms with sizable balance sheet exposures would tend to be on capital gains or losses rather than on revenue or expenses. Also of note is the fact that net profits increase with a smaller FC balance sheet exposure (and FC debt in particular), with higher net exports, with FC assets or ownership of investments abroad, and with more rapid sales growth.

Table 8. Net Profits and the Currency Composition of Debt

VARIABLES	(1)	(2)
FC debt*loge	-0.0508	
	(0.0723)	
FC assets*loge	0.547	
	(0.409)	
Balance-sheet exposure*loge		-0.0831
		(0.0584)
Balance-sheet exposure		-0.0267***
		(0.00951)
Net exports*loge	0.0351***	0.0321***
	(0.0108)	(0.0102)
Net Forwards*loge	-0.0144	
	(0.0970)	
FC debt	-0.0424***	
	(0.0132)	
Total liabilities	0.00141	0.00127
	(0.00516)	(0.00502)
FC assets	0.209**	
	(0.0818)	
Net exports	0.00276	0.00227
	(0.00191)	(0.00203)
Net Forwards	-0.00109	
	(0.0143)	
Sales growth	0.0172***	0.0174***
	(0.00133)	(0.00133)
Ownership abroad	0.118***	0.114***
	(0.0336)	(0.0332)
Foreign	-0.00160	-0.00131
	(0.00283)	(0.00283)
Constant	0.0315***	0.0324***
	(0.00286)	(0.00290)
Observations	33,321	33,321
R-squared	0.522	0.521

Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.
Note: The dependent variable is profits in millions of COP adjusted by CPI. All variables (except dummies) are scaled by firms' previous period total assets. The real exchange rate is the nominal COP/USD exchange rate divided by the domestic CPI. Net forward position corresponds to nominal values of long and short positions with local banks. Accounting information was obtained from SS and SF. Macroeconomic variables were obtained from various sources. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

3.3 Investment and the Currency Composition of Debt

Here we explore whether FC indebtedness increases the sensitivity of firm-level investment to exchange rate fluctuations. Taking advantage of the similarity of the data, we begin this section by replicating the estimation of Restrepo, Cuervo and Montes (2014),[15] the results of which are reported in Annex C. We ran 11 static panel data models in order to elucidate the firm´s investment behavior as a result of holding FC debt and facing exchange rate fluctuations. We begin with a very basic specification in which only FC-denominated debt is interacted with the real exchange rate. In specifications (2) – (4) we progressively introduce new controls such as net exports, a dummy variable that indicates if the firm belongs to a tradable sector, cash flow, net forward position and lagged capital stock. Then, in specifications (5) – (11) we introduce the interaction between the real exchange rate and FC assets, a dummy variable for whether the firm is engaged in the production of a tradable good, its balance sheet exposure, and net exports.

Our results are similar to those reported in Restrepo, Cuervo and Montes (2014). Regardless of the controls introduced, the results indicate that, following a depreciation (appreciation), firms holding FC debt will reduce (increase) investment more rapidly than firms that do not hold FC debt. On the other hand, neither holding FC assets, net forwards, nor being a net exporter seems to have an offsetting effect; the interaction with the real exchange rate is not statistically significant in any of the specifications. Similarly, investment by firms in tradable sectors is no more sensitive to exchange rate fluctuations.

These findings suggest that the balance sheet exposure matters for investment: the greater the exposure, the stronger the cutback in investment following a real depreciation. In particular, ceteris paribus, a 10 percent depreciation of the real exchange rate would imply a 2 percent reduction in the rate of investment in fixed assets of those firms with half of their debt denominated in foreign currency when compared with those that do not have any foreign currency debt. This result compares with the 3 percent estimated in Restrepo, Cuervo and Montes (2014).

The main shortcoming of Restrepo, Cuervo and Montes (2014) is that investment is estimated using a static panel regression. In what follows we adopt a more appropriate dynamic panel estimation method (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and

[15] A very important difference between their work and ours is that their sample was composed of only FC indebted firms and not the full sample as we do. For comparison reasons, in the estimations presented in Annex C we did exactly the same procedures and data cleaning (which means we only left FC indebted firms also).

Bond, 1998) for which our database is well suited since: i) we have few periods and many individual firms; ii) a linear functional relationship is reasonable; iii) the dependent variable is dynamic, a function of its past realizations; iv) independent variables are not strictly exogenous; v) we need to account for firm-level fixed effects; and vi) there is likely to be heteroskedasticity and autocorrelation within individuals but not across them.. The model we estimate is the following:

$$INV_{it} = \sum_{j=1}^{1} \alpha_j INV_{i,t-j} + x'_{it}\beta_1 + w_{it}\beta_2 + \vartheta_i + \varepsilon_{it} \qquad i = 1, \ldots, N \quad t = 1, \ldots, 9 \quad (4)$$

We include yearly dummy variables (y_t) and firm-specific fixed effects (ϑ_i). Yearly dummies capture aggregate shocks common to all firms, including changes in the exchange rate. Firm-specific fixed effects capture differences among firms in their optimal capital stock, which we presume does not change over our sample period.

INV_{it}: Fixed investment by firm i in period t

x'_t: Year dummies (exogenous)

ϑ_i: Panel effects (which might be correlated with the co-variables)

ε_{it}: i.i.d error term with variance σ_ϵ^2.

We estimate five specifications of (4) for our sample of firms during 2005-2013. All five specifications use 2-stage GMM, reporting GMM standard errors (Table 9). Endogenous and predetermined variables are optional, with restrictions regarding the number of instruments used. The dependent variable appears with one lag and this establishes the limit to the lags for the instruments.[16] Annex D reports the Arellano-Bond test of no autocorrelation of first differences in the error term and the Sargan test for over-identification of restrictions. Both tests confirm the validity of our specification—i.e., that there is zero autocorrelation of the first difference of the error term and over-identification of restrictions are valid.

We begin with a very basic specification and progressively include additional relevant predetermined and endogenous variables. In specifications (1) – (4) we include interactions of the change in the real exchange rate with one or more individual components of a firm's balance sheets exposure—FC debt, FC assets, and net forwards—and in specifications (3) and (4) we also include the interaction with net exports. Both FC debt and FC assets transmit exchange rate fluctuations to investment as expected; having greater FC debt causes investment to decline

[16] Option endogenous is used to indicate that the variables appear as contemporary regressors.

(increase) following a depreciation (appreciation), while the opposite is true for FC assets. Thus, for a given level of FC debt, having FC assets can reduce the sensitivity of firm-level investment to exchange rate fluctuations. Similarly, having larger net exports—a natural hedge— is associated with a higher level of investment when a depreciation occurs, also dampening the curtailment in investment for a firm holding FC debt.

These effects are summarized in specification (5), where we include the FC balance-sheet exposure variable as defined earlier (section 3.2) as well as net exports. As expected, the coefficient of the interaction between the change in the real exchange rate and FC balance sheet exposure is negative and significant, indicating that a real exchange depreciation (appreciation) would have a stronger contractionary (expansionary) effect on investment for firms exhibiting larger FC balance sheet exposure.

Table 9. Fixed Capital Investment and Foreign Currency Exposure

VARIABLES	(1)	(2)	(3)	(4)	(5)
Lagged investment	0.00650***	0.00699***	0.00489***	0.00472***	0.00480***
	(0.00222)	(0.00220)	(0.000940)	(0.000911)	(0.000975)
Lagged FC debt*loge	-0.0367*	-0.0345*	-0.0179	-0.0195	
	(0.0212)	(0.0204)	(0.0204)	(0.0188)	
Lagged FC assets*loge		0.105***	0.100***	0.100***	
		(0.0386)	(0.0379)	(0.0389)	
Lagged Net exports*loge			0.00575	0.00641	0.00813*
			(0.00497)	(0.00477)	(0.00486)
Lagged Net Fwds*loge				0.000842	
				(0.0184)	
Lagged balance-sheet exposure*loge					-0.0282**
					(0.0133)
FC debt	-0.0235	-0.0221	-0.0248***	-0.0263***	
	(0.0155)	(0.0138)	(0.00908)	(0.00819)	
FC assets		-0.0328**	-0.0326*	-0.0344**	
		(0.0166)	(0.0171)	(0.0170)	
Balance-sheet exposure					-0.0132*
					(0.00705)

Table 9., continued

	(1)	(2)	(3)	(4)	(5)
VARIABLES					
Net exports			0.00135	0.00222**	0.00132
			(0.00109)	(0.00108)	(0.00103)
Total liabilities	0.0266*	0.0228*	0.0264***	0.0244***	0.0225***
	(0.0140)	(0.0126)	(0.00662)	(0.00589)	(0.00639)
Net Fwds				-0.00984	
				(0.0101)	
Cash flow	0.0821***	0.0615***	0.0434***	0.0425***	0.0378***
	(0.0227)	(0.0148)	(0.0118)	(0.0113)	(0.0139)
Constant	0.000771	0.00427	-0.00951***	-0.00826**	-0.00858**
	(0.00784)	(0.00726)	(0.00367)	(0.00331)	(0.00369)
Observations	28,351	28,351	28,351	28,351	28,351
Number of firms	5,012	5,012	5,012	5,012	5,012

Source: Authors' calculations based on SS, SF, DIAN-DANE and BdR.
Note: The dependent variable is the change in the stock of fixed capital in millions of COP adjusted by the CPI. All variables (except dummies) are scaled by previous period total assets. The real exchange rate is the nominal COP/USD exchange rate divided by domestic CPI. Net forward position corresponds to the difference in nominal values of long and short positions with local banks. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

We estimate two specifications, where all independent variables are for 2008. In the first one we include total liabilities, FC debt, FC assets, net exports, net forwards and cash flow as controls.[17] In the second specification we include FC balance sheet exposure, net exports and cash flow. Results in Table 10 show that all coefficients were significant at a 1 percent level of confidence, and that firms invested more in 2009 in comparison to the 2005-2008 period if they had larger FC assets, net exports, or cash flow, and invested less if they had larger liabilities or FC debt. This provides evidence that investment reacts much more strongly to depreciations than to appreciations. With a real depreciation of about 3 percent between the average for 2005-2008 and 2009, the event study's results imply that firms with a ratio of FC debt to total assets of 0.5 would invest 3 percent less than firms with zero FC debt to total assets, a much larger effect than that estimated earlier using a sample period dominated by real appreciations.[18] Similarly, firms with FC assets equivalent to 0.5 of their total assets would increase investment by 3 percent

[17] All defined as in (3).
[18] Translating this estimated effect to the 40 percent real depreciation used to illustrate the full sample effect, one obtains that firms with an FC debt-asset ratio of 0.5 would reduce investment by 40 percent, much larger than the 0.56 percent decline estimated in the full simple. Although the methodologies are not strictly comparable, it should be relatively clear that the sensitivity of investment is substantially greater during the depreciation episode.

relative to firms without FC assets. Finally, firms with 0.5 of net exports to assets ratio would increase their investment by 6 percent in comparison with firms with no net exports.

Table 10. Balance Sheet Effect on Investment during a Depreciation Period

VARIABLES	(1)	(2)
FC debt in 2008	-0.0626***	
	(0.0172)	
FC assets in 2008	0.626***	
	(0.164)	
Net exports in 2008	0.128***	0.125***
	(0.00458)	(0.00445)
Net Fwds in 2008	-0.00269	
	(0.0323)	
Balance-sheet exposure in 2008		-0.0118
		(0.0103)
Total liabilities in 2008	-0.0524***	-0.0582***
	(0.00441)	(0.00391)
Cash flow in 2008	0.286***	0.293***
	(0.00564)	(0.00509)
Constant	-2.071	-0.550
	(3.570)	(3.559)
Observations	4,244	4,244
R-squared	0.931	0.931

Source: Authors' calculations based on SS, SF, DIAN-DANE and BdR.
Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

To understand further the behavior of investment during the 2009 depreciation episode, we ran a quantile regression[19] where the dependent variable is investment in fixed capital and the key explanatory variable is the balance sheet exposure.[20] As Table 11 shows, balance sheet exposure has a negative and significant effect on investment from the seventh to the ninth decile of investment. As expected, the effect of balance sheet exposure on investment is not linear across firms. While a firm in the seventh decile with a 0.5 balance sheet exposure to total assets ratio would decrease its investment by 0.9 percent in comparison to a firm without balance sheet exposure, a firm in the ninth decile would decrease its investment by 5 percent. The larger the firm, the greater the reduction in investment caused by the balance sheet exposure.

[19] Standard linear regression techniques summarize the average relationship between a set of regressors and the outcome variable based on the conditional mean function. Quantile regression allows us to describe the relationship at different points of the conditional distribution of the outcome variable.
[20] Other control variables are: net exports, total liabilities and cash flow, all as defined in equation (1).

Table 11. Quantile Regression: The effect of Balance Sheet Exposure on Investment by Deciles of Investment, 2009

VARIABLES	
First decile of investment	0.01204
	(0.01516)
Second decile of investment	0.00821
	(0.00507)
Third decile of investment	0.00338
	(0.00380)
Fourth decile of investment	0.00099
	(0.00195)
Fifth decile of investment	-0.00032
	(0.00284)
Sixth decile of investment	-0.00569
	(0.00572)
Seventh decile of investment	-0.01797*
	(0.00999)
Eight decile of investment	-0.03914*
	(0.02060)
Ninth decile of investment	-0.09846**
	(0 .04084)
Firm level controls	YES
Observations	4,627

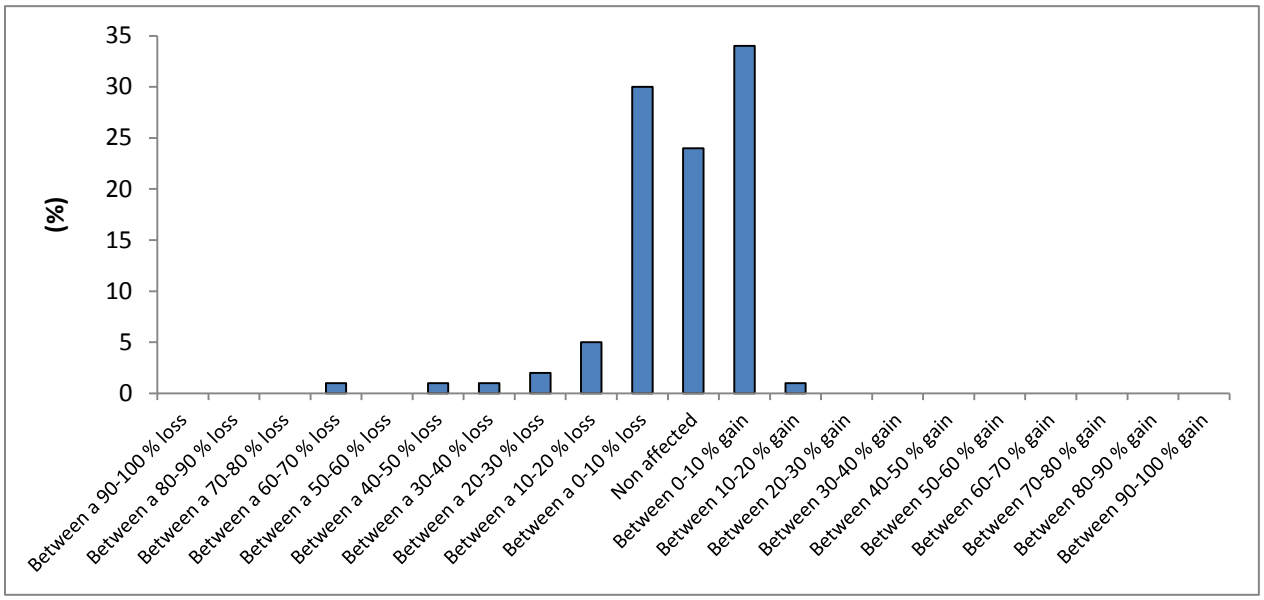
Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.
Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

To delve deeper into the balance-sheet effect of a nominal depreciation, we used 2013 balance-sheet data (the latest available) and simulated the change in a firm's net worth following a 60 percent nominal depreciation of the exchange rate, a change similar to the one actually observed between December 2013 and September 2015. The exercise consists of taking total net worth in 2013 and increasing FC liabilities and assets by 60 percent to see the effect on net worth, holding all other balance sheet items constant. If the firm has more FC liabilities than assets, its simulated net worth will be smaller than observed (and vice versa).

$$Net\ Worth = \left(\frac{\partial NW}{NW}\right)^{p} = \frac{1.6\left(FCAssets - FCLiab\right)}{NW_{2013}} \qquad (4)$$

Results are reported in Figure 3, which reads as follows: *ceteris paribus*, 30 percent of firms would have a net worth loss of between 0 and 10 percent after a 60 percent depreciation of the nominal exchange, whereas 24 percent of firms would not be affected. The main result is that although most firms see either no effect or only a small effect on their net worth (positive for some, negative for others), for the few firms that observe a significant change, such a change is always a *deterioration* of their net worth.

Figure 3. Impact of Exchange Rate Changes on Net Worth: A Simulation
(Percentage of Net worth loss/gain to a depreciation of the nominal exchange rate of 60 percent)



Source: Authors' calculations based on SS, DIAN-DANE, SF and BdR.

3.4 Determinants of the Use of Exchange Rate Derivatives

With regard to the use of FC derivatives, one surprising stylized fact emerges from the descriptive statistics: firms tend to have short positions, regardless of whether they are indebted in FC or not. In addition, the results from Section 3.3 show that forward exchange derivatives on their own do not have an effect on investment or on profits in a context of exchange rate fluctuations. A tentative conclusion that arises is that firms are not using this kind of derivatives

to hedge themselves but rather to speculate. To test this hypothesis we propose the following equation for the determinants of the use of forward exchange derivatives (*FED*):

$$FED_{i,t} = \propto_i + \beta_1 A_{i,t} + \beta_2 L_{i,t} + \beta_3 Z_{i,t} + \beta_4 FO_{i,t} + \beta_5 G_{i,t} + \beta_6 I_{i,t} + \beta_7 S_{i,t} + \beta_8 IP_{i,t} + \beta_9 FCS_{i,t} + \rho_1 s_t + \rho_2 f_t + \rho_4 NER_t + e_{i,t} \quad (6)$$

All firm-level variables are defined as in (1). To test whether FC derivatives are used to hedge FC debt servicing obligations, we include an additional term not included in (1): *FCS* for the share of FC debt on liabilities. We also include three macro variables: the interest rate differential (the difference between the interbank rate and the overnight Libor), the forward premium, and *NER*, the annual average of the nominal exchange rate. We use three different definitions for *FED*. The first *FED* is a dummy variable that takes the value of 1 if the firm had any position in forward exchange derivatives, 0 otherwise. In the second definition *FED* takes a value of 1 only if the firm has a long position, 0 otherwise. In the third definition *FED* takes a value of 1 only if the firm has a short position and 0 otherwise. For each definition, we run an alternative specification in which we excluded the macro variables and included time effects.

All firm-level variables are significant at least at the 10 percent level of confidence (Table 12)[21]. Size of the firm is a positive determinant of participation in forward markets, which could be related to scale economies in the FC forward market. FCS, the size of FC liabilities, is associated with a higher probability of using FC forwards and of having a short, consistent with a hedging motive. On the other hand, FCS is also associated with a higher probability of having *long* FC forward positions, not consistent with hedging. Consistent with previous results, exports are positively related to taking FED long positions and negatively related to taking short positions, suggesting that export-oriented firms use derivatives as a substitute to natural hedging. Firms with a higher share of imports to total expenses are expected to have a higher probability of being in a short FED position, and a lower probability of being in a long FED position. As expected, import-oriented firms are more likely to be in a short position, evidence that forward exchange derivatives are being used for hedging reasons. Another interesting result is that foreign owned firms tend to be long on FC while domestic firms tend to be short. This could be reflecting alternative strategies by multinational companies to hedge exchange rate risk across markets and Colombian subsidiaries in domestic markets. Finally, the probability of having a short position increases with leverage and short term debt and decreases with the growth of sales.

[21]Results are robust when run as a probit model. See Annex E.

We try to shed light on these results with the help of the qualitative exercise discussed in detail in the following section. More than a half of the firms surveyed do not financially hedge to any extent their balance sheet exposure,[22] and less than a quarter hedge more than 25 percent of their balance sheet exposure.[23] This might be related to the relatively high natural match they report to have between their operating revenue, costs and financial debt. Nevertheless, most firms are still active in the FC derivatives markets, as more than a half of surveyed firms have used futures or forward contracts in order to manage FC risk. In conclusion, although firms are active in the FC derivatives markets, only a small proportion of firms use FC derivatives to hedge their FC liabilities, and those that do only hedge a small portion of their exposures.

Regarding macroeconomic variables, they all are significant at a 1 percent confidence level. The higher the forward premium, the smaller the probability of taking any kind of position in the FC derivatives market, meaning that if a large depreciation is expected, firms decrease the probability of selling or buying FC. The interest rate differential has a negative effect on the probability of acquiring a short position in the FC derivative market and has no effect on the long position. Notably, the more depreciated the NER is, the lower the probability in engaging in any type of FC derivative. This could be related to the fact that, even under inflation targeting, there is empirical and anecdotal[24] evidence that the Central Bank of Colombia is involved in some degree of exchange rate targeting, especially in the face of large external shocks. For example, Barajas et al. (2014) find empirical evidence that intervention seems to be explained to a great extent by concerns with regards to levels of exchange rate misalignments rather than concerns with exchange rate volatility. Notably, these authors highlight that this intervention is more aggressive when the central bank perceives the currency to be strong than when it perceives it to be weak. Hence, the coverage decision of firms has been affected by the way in which the Banco de la República tries to moderate the exchange rate level when there is a large level of depreciation or appreciation.

[22] When we asked the reasons why they did not engage in FC risk management, firms answered: i) their exposure to FC risk was low, ii) they could manage it more effectively by other means, iii) accounting treatment complexity, and iv) costs of establishing and maintaining a risk management program exceed the expected benefits.

[23] The concept in the surveys that is the closest to our balance sheet exposure definition is the "translation exposure", and it refers to the risk that the firm's assets, equity, liabilities or income change in value due to fluctuations in exchange rates. This exposure, thus, refers to the risk that the financial figures reflected in the accounting statements will change their value as a result of the translation of foreign accounts into the domestic currency.

[24] For example, the minutes of the Banco de la República Board of Director's meeting on the last months of 2015 highlight that the exchange rate levels is one of the main consideration for the monetary policy decision.

To sum up, we have found qualitative and quantitative support for the fact evidence that Colombian non-financial firms engage in the use of FC derivatives with both hedging and with speculative purposes. In addition, there is evidence that the monetary authority has been active in the FC market trying to smooth exchange fluctuations to some extent. Therefore, firms, have not had the urgency of using the FC derivatives market for hedging reasons, and instead they opted for hedging in a very limited manner or engaging in FC speculation.

Table 12. Determinants for the Use of Forward Exchange Derivatives by Firms
(Marginal Effects after logit)

VARIABLES	(1) Logit Long or short positions	(2) Logit Long or short positions	(3) Logit Long position	(4) Logit Long position	(5) Logit Short position	(6) Logit Short position
A, Assets	0.00780***	0.00797***	0.000465***	0.000489***	0.00544***	0.00558***
	(0.000760)	(0.000765)	(9.38e-05)	(9.67e-05)	(0.000552)	(0.000558)
I, Assets owned abroad	-0.0217	-0.0222	-0.00110	-0.00119	-0.0163	-0.0167
	(0.0166)	(0.0171)	(0.000889)	(0.000940)	(0.0112)	(0.0115)
L, Leverage	0.0197***	0.0201***	4.91e-05	5.94e-05	0.0192***	0.0195***
	(0.00536)	(0.00542)	(0.000390)	(0.000411)	(0.00403)	(0.00411)
FCS, FC debt	0.0621***	0.0633***	0.00139***	0.00150***	0.0474***	0.0484***
	(0.00589)	(0.00595)	(0.000388)	(0.000408)	(0.00464)	(0.00471)
S, Short term debt	0.0196***	0.0193***	9.82e-05	7.23e-05	0.0179***	0.0178***
	(0.00287)	(0.00289)	(0.000182)	(0.000191)	(0.00234)	(0.00236)
Z, Exports	0.0262***	0.0253***	0.00355***	0.00373***	-0.00512**	-0.00624**
	(0.00372)	(0.00373)	(0.000739)	(0.000761)	(0.00260)	(0.00267)
IP, Imports	0.0152***	0.0145***	-4.79e-05	-9.32e-05	0.0137***	0.0132***
	(0.00505)	(0.00494)	(0.000155)	(0.000166)	(0.00423)	(0.00416)
G, Sales growth	-0.00194***	-0.00226***	-3.12e-05	-4.95e-05	-0.00138***	-0.00161***
	(0.000603)	(0.000639)	(4.88e-05)	(5.58e-05)	(0.000454)	(0.000484)
FO, Foreign ownership	-0.00211*	-0.00196	0.000258*	0.000250*	-0.00307***	-0.00296***
	(0.00120)	(0.00120)	(0.000135)	(0.000137)	(0.000850)	(0.000863)
s, Interest rate differential		-0.128***		-0.00179		-0.0849***
		(0.0229)		(0.00204)		(0.0170)
f, Forward Premium		-0.0242***		-0.00182***		-0.0110***
		(0.00453)		(0.000550)		(0.00324)
NER, Exchange rate		-2.12e-05***		-1.36e-06***		-1.05e-05***
		(2.97e-06)		(3.46e-07)		(2.09e-06)
FE	YES	YES	YES	YES	YES	YES
Time effects	YES	NO	YES	NO	YES	NO
Observations	34,064	34,064	34,064	34,064	34,064	34,064
Number of nit	5,012	5,012	5,012	5,012	5,012	5,012

Source: Authors calculations based on SS, DIAN-DANE, SF and BdR.
Note: Standard error in parenthesis. ***p<0.01, **p<0.05, *p<0.1

4. Questionnaire to CFOs on Hedging Activities

We undertook a two-stage survey on hedging policies and activities of 12 non-financial firms, all of which were large, spanned a variety of sectors and included some firms known to have no foreign currency liabilities. In particular, we used the following criteria in selecting the 12 firms (Table 13):

- ✓ Firms listed in the Superintendencia de Sociedades (SS) or Superintendencia Financiera (SF) and that are among the 30 largest firms in these databases (measured by assets)
- ✓ Firms listed in the Dealogic database, which covers the universe of bond issuers
- ✓ If not issuers, firms that play a central role in their respective industry and satisfy the first condition mentioned above

Table 13. Selected Non-financial Firms

COMPANY NAME	INDUSTRY	SECTOR	ISSUER	HEADQUARTERS
Almacenes Éxito SA	Retail	Traded	Yes	Envigado
Avianca Holdings SA	Transport	NonTraded	Yes	Bogotá
Colombia Telecomunicaciones SA	Telecom	NonTraded	No	Bogotá
Danone Alquería SA	Food_bev	NonTraded	No	Cajica
Ecopetrol SA	Mining	Commodities	Yes	Bogotá
Empresa de Energia de Bogota SA	Utilities	NonTraded	Yes	Bogota
ISAGEN	Energy	NonTraded	Yes	Medellín
Grupo Argos SA	Utilities	Traded	Yes	Medellín
Grupo Nutresa SA	Food_bev	Traded	Yes	Medelllín
Interconexion Electrica SA ESP	Utilities	NonTraded	Yes	Medellín
Organización Terpel SA	Utilities	Traded	Yes	Bogotá
Promigas SA ESP	Utilities	NonTraded	Yes	Barranquilla

The questionnaire is divided into two parts: one was sent in advance of the interview, with questions that require more time and may be answered by a less senior person. The second part of the questionnaire—focused on policy and strategy—was used for the interview with the

CFO. All 12 firms completed the first part of the questionnaire. We then interviewed nine of the twelve CFOs.

Results of the in-advance questions suggest that foreign currency hedging is only common for "transactional exposure,"[25] and is generally made in small amounts. Although nine of 12 companies stated that they typically hedge to manage transactional exposure, seven answered that the proportion typically hedged for this type of exposure was under 25 percent. With regard to "translation exposure"[26] which is close to our definition of "balance sheet exposure," only five firms hedge to manage this type of risk, while only 1 firm hedging for economic/competitive exposure.[27]

Interest rate risk is very common among these 12 firms. In fact, only one company ample indicated that it does not hold any debt at floating interest rates. Furthermore, eight of 12 companies reported that floating interest rate debt represented more than 50 percent of total debt. Regarding capital structure and debt policy, in 10 of 12 firms total debt represents more than 50 percent of total assets. In terms of liquidity policy, with only two exceptions, firms' currency holdings in cash and marketable securities represent less than 25 percent of assets.

Concerning the interview with the CFO, there exist heterogeneous results among the strategy and policy revealed by each of them. Results confirm that FC exposure is common for all these companies; all have operations (revenues, expenditures, assets or debt) denominated in FC. Three-fourths of CFOs acknowledged that during the last two years the firm had acquired bank loans or issued bonded debt in foreign currency abroad, mainly as a result of lower interest rates in foreign currency, more abundant funding and longer maturity terms. Acquiring bank loans or issuing bonded debt in foreign currency with domestic institutions is much less common—only four of nine indicating that they have considered this type of operation. Additionally, companies that have preferred to issue bonds in FC rather than acquiring bank loans in FC acknowledged that the main reasons for this decision were lower funding costs, longer maturity and more funding availability.

[25] Refers to the risks faced by the firm stemming from changes in exchange rates after the firm has contracted financial obligations. This exposure thus refers to risks to the company's future cash flows.
[26] Refers to the risk that the firm's assets, equity, liabilities or income change in value due to fluctuations in exchange rates. This exposure thus refers to the risk that the financial figures reflected in the accounting statements will change their value as a result of the translation of foreign accounts into the domestic currency.
[27] For example, a weakening foreign currency benefiting foreign competitors.

Six of nine CFOs acknowledged that their companies engaged in FC Risk Management activities, essentially concentrated in short terms currency derivatives, forwards contracts and debt in foreign currency. The CFOs that did not engage in these activities mentioned that this was due to insufficient exposure to FC risk or to accounting complexity. Moreover, with only 3 exceptions, CFOs consider that there is a relatively high or complete match among the currencies in which the company's different operations are denominated.

Regarding interest rate exposure and hedging, five of 9 CFOs reported that their company engaged in interest rate risk management activities, particularly using derivatives as forwards or options. In addition, only three of 9 firms stated that it was very usual (either frequently or always) that their markets view of interest rates forced them to actively take positions in interest rate derivatives or to alter the timing or size of hedging.

In terms of control and reporting, seven of 9 CFOs disclosed that they consider risk management during their strategic planning, and basically all of them assert that their planning process explicitly considers risks and measure them. Additionally, six of 9 CFOs note that they frequently (quarterly or monthly) report risk management activities to the Board of Directors, and that this practice is decided by the Board itself. Along this same line, six CFOs reckon that they calculate "value-at-risk" for some or its entire derivatives portfolio.

Furthermore, six of 9 CFOs stated that their firm had a target capital structure, which responded to leverage and EBITDA, and was guided by concerns regarding ratings by credit rating agencies. In terms of liquidity, the sample observed that the currency of their cash holdings was largely determined by depreciation expectations and by the currency denomination of expenses. Additionally, they stated that if FC debt were less available locally, most of them would react by increasing debt in foreign jurisdictions. On the other hand, if funds were less available in international markets, the common answer would be to increase debt in domestic currency. Finally, seven of 9 CFOs estimated that a further peso depreciation could have a slightly negative effect on the financial results of the company.

To sum up, in spite of significant heterogeneity among companies, results lead us to conclude that most of them have considerable FC and interest rate exposure. However, with only a few exceptions, financial hedging policies have not been undertaken. Most CFOs consider that their firms are "naturally hedged"—because they hold assets in FC, export significant amounts, or sell domestically with prices indexed to the exchange rate.

5. Conclusion

As in many emerging economies, Colombia has in recent years experienced a period of surging capital inflows, in which international bond issuance and other borrowing by domestic non-financial corporations has become increasingly important. With global monetary conditions now beginning to tighten and expected to tighten further, compounded with the collapse Colombia's terms of trade, the accumulated foreign borrowing by non-financial firms is a matter of concern. In this paper we have first identified the determinants of foreign borrowing, then estimated to what extent the resulting FC balance sheet mismatches have affected firm performance (i.e., investment and profits), in the context of exchange rate fluctuations.

We provide evidence that larger, more leveraged, foreign-owned firms are more likely to acquire FC debt, as well those engaging in international trade—either imports or exports—and those who have a higher share of short-term debt. In addition, firms tend to borrow more in FC when the interest rate differential or the forward premium is higher. Finally, we find that overall FC borrowing behaves procyclically with respect to domestic bank credit, they do not appear to be substitutes.

We found evidence of a balance sheet effect transmitting exchange rate fluctuations to real activity. Firms with a larger FC balance-sheet mismatch reduce (increase) their investment by more following a depreciation (appreciation). On the other hand, net exports serve as a natural hedge, dampening the above effects of balance sheet exposure on investment.

Although statistically significant, the magnitude of the balance sheet effect estimated over the entire 2005-13 sample period was relatively small, thus suggesting that there might be asymmetry in the sensitivity to depreciations vs appreciations. This was confirmed by our event study, in which we isolated the 2009 episode, the one year in which a substantial real depreciation had occurred. This exercise showed an estimated effect that was several times greater than that for the full period, which had been characterized by an almost continuous appreciation.

We also investigated the factors behind non-financial firms' decision to participate in the FC forward market. Certainly those with FC debt were more likely to do so, but in both short and long FC positions, thus suggesting that these instruments are not being used solely for hedging purposes. Furthermore, while exporting firms tended to substitute their natural hedge with the financial hedge provided by FC forwards, importers were shown to hold FC forward positions

that were consistent with hedging. This behavior could be related to exchange rate intervention by the Colombian monetary authority, even under an inflation targeting regime rate targeting behavior. There is evidence that intervention is particularly acute during periods of prolonged appreciation. Under these circumstances, firms might feel protected against extreme exchange rate misalignments and therefore engage in FED markets mainly for speculative purposes.

Finally, the survey-based qualitative analysis regarding hedging policies and activities allow us to conclude that, in spite of significant heterogeneity among the different large companies surveyed, most of them have considerable foreign currency activities and positions and do participate in FC derivatives markets. However, with few exceptions and in a limited manner, these companies have not been using these instruments to hedge their FC balance sheet.

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Annex A. Data Availability and Variables Definition

Variable	Description
Firm level variables	
Total Assets	Logarithm of real value of assets. Source: Superintendencia de Sociedades and Super. Financiera.
Imports	CIF value of goods imported plus imports of services. We convert the dollar value of exports into pesos using the average exchange rate of the corresponding year. Source: DANE-DIAN.
Exports	FOB value of exports of goods & services. For estimation it is normalized by total sales. We convert the dollar value into pesos using the average exchange rate for the year. Source: DANE-DIAN.
Sales	Source: SS and SF.
Foreign participation in Ownership	Share of company owned by foreign investors. Source: SS and SF.
Cash flow	A revenue or expense stream that changes a cash account over a given period. Source: SS and SF.
Total Profit/losses	Total income (operational+non-operational) net of total expenses and taxes. Source: SS and SF.
Total debt or leverage	Total liabilities (excluding net worth) as reported in balance sheets. Source: SS and SF.
Short- Term Debt	Debt that has to be repaid within 1 year. Source: SS and SF.
Total "dollar" debt	Debt (including bonds) acquired by firms with foreign and domestic banks or corporations. Source: BdR.
Tradable	Takes the value 1 if the firm belongs to any of the following sectors: agriculture, mining or industry. Zero otherwise.
Financial debt	Source: SS and SF.
Long forward COP/USD	Value of the active long cop/usd forwards at December 31 of the corresponding year at firm level. Source: BdR.
Short forward COP/USD	Value of the active short cop/usd forwards at December 31 of the corresponding year at firm level. Source: BdR.
Investment in fixed capital	Capital in t minus capital in t-1. Capital is the addition of physical properties as equipment, edification, ongoing constructions, and other assets. Source: SS and SF.
Foreign Direct Investment	Annual net flow of FDI at firm level. Source: BdR.
Portfolio Investment	Annual net flow of portfolio investment. Source: BdR.
Colombian Direct Investment Abroad	Annual net flow of direct investment abroad at firm level. Source: BdR.
Macroeconomic variables	
Real GDP growth	Annual percentage change of real GDP. Source: DANE
Inflation	Annual percentage change in Consumer Price index. Source: DANE
Average Exchange Rate	Average of the exchange rate for the respective year. Source: BdR.
Exchange Rate End of Period	Exchange rate as of December 31 of each year. Source: BdR.
Exchange Rate Forward[28]	Average forward rate of the COP / USD traded forwards during the period t + 1 which are due in December of each year. Source: BdR.
Exchange rate forward premium	Forward Exchange Rate over Exchange Rate End of period. Source: BdR.
Private Credit	Total credit granted to the private sector as a percentage of GDP. Source: BdR and DANE.

[28] Information regarding the position of currency derivatives firms is harder to build. Only recently regulators and investors have begun to demand more systematic information on these financial transactions. As in Restrepo *et al* (2014), information was used from operations of foreign currency derivatives of banks established in Colombia. We took only the forwards COP/USD, which represent about 85% of the total notional amount of derivatives traded in Colombia.

Annex B. Determinants of Firm Issuance of Debt in Foreign Currency (Marginal effects after probit)

	Probit	Probit	Probit	Probit	Probit	Probit
VARIABLES	Total FC Debt	Financial FC Debt	FC Trade Credit	Total FC Debt	Financial FC Debt	FC Trade Credit
Assets	0.0590***	0.0378***	3.82e-07	0.0596***	0.0381***	1.64e-06*
	(0.00650)	(0.00429)	(2.55e-07)	(0.00649)	(0.00429)	(9.48e-07)
Assets owned abroad	-0.00908	-0.0126	1.37e-06	-0.0120	-0.0134	6.06e-06
	(0.0602)	(0.0365)	(2.10e-06)	(0.0634)	(0.0387)	(8.60e-06)
Leverage	0.301***	0.184***	2.52e-06	0.305***	0.188***	1.03e-05*
	(0.0472)	(0.0299)	(1.73e-06)	(0.0471)	(0.0301)	(6.25e-06)
Short term debt	0.0644***	0.0419***	4.45e-07	0.0626***	0.0417***	1.33e-06
	(0.0141)	(0.00894)	(3.75e-07)	(0.0140)	(0.00896)	(1.22e-06)
Exports	0.312***	0.187***	1.94e-06	0.308***	0.185***	7.48e-06*
	(0.0407)	(0.0256)	(1.33e-06)	(0.0401)	(0.0254)	(4.49e-06)
Imports	0.0354	0.0178	3.71e-07	0.0350	0.0177	1.49e-06
	(0.0278)	(0.0136)	(3.84e-07)	(0.0274)	(0.0136)	(1.44e-06)
Sales growth	-0.00563**	-0.00269*	-1.36e-07	-0.00509**	-0.00220	-7.29e-07
	(0.00227)	(0.00139)	(1.08e-07)	(0.00223)	(0.00136)	(4.87e-07)
Foreign ownership	0.0488***	0.00646	4.01e-06	0.0557***	0.0101**	1.62e-05*
	(0.0111)	(0.00468)	(2.76e-06)	(0.0114)	(0.00488)	(9.74e-06)
Spread				0.0429***	0.0168*	7.47e-06*
				(0.0158)	(0.00952)	(4.32e-06)
Credit to private sector				0.101***	0.124***	-1.96e-05*
				(0.0270)	(0.0198)	(1.12e-05)
RE	YES	YES	YES	YES	YES	YES
Time Effects	YES	YES	YES	NO	NO	NO
Number of Observations	34,064	34,064	34,064	34,064	34,064	34,064
Number of firms	5,012	5,012	5,012	5,012	5,012	5,012

Source: Authors calculations based on SS, DIAN-DANE, SF and Banco de la República.
Note: Standard Error in parenthesis ***p<0.01, **p<0.05, *p<0.1

Annex C. Static Panel Regressions of Exposure in Foreign Currency over Investment

Dependent variable : investment in fixed capital

	(1)	(2)	(3)	(4)	(5)	(6)
Interactions						
FC debt x	-0.427	-0.456	-0.425	-0.455	-0.430	-0.428
(log e)	[0.0722]***	[0.0723]***	[0.072]***	[0.072]***	[0.072]***	[0.0723]***
Balance-sheet exposure x						
(log e)						
Principal effects						
FC debt	-0.238	-0.235	-0.238	-0.235	-0.238	-0.238
	[0.0103]***	[0.01]***	[0.01]***	[0.0103]***	[0.0103]***	[0.0103]***
Balance-sheet exposure						
Total debt	0.330	0.329	0.330	0.329	0.330	0.330
	[0.0027]***	[0.0027]***	[0.0027]***	[0.0027]***	[0.002]***	[0.002]***
Controls						
Net exports		-0.007		-0.007		
		[0.0017]***		[0.0017]***		
Net exports x		0.007		0.006		
(log e)		[0.011]		[0.011]		
I(tradable) x			0.014	0.010		0.015
(log e)			[0.026]	[0.026]		[0.026]
FC assets					-0.122	-0.123
					[0.057]**	[0.0574]**
FC assets x					-0.335	-0.353
(log e)					[0.4089]	[0.41]
Cash flow						
Net Fwds						
Net Fwds x						
(log e)						
Stock of lagged capital x						
(log e)						
Stock of lagged capital						
Regression information						
Num. Observations	20,649	20,649	20,649	20,649	20,649	20,649
	0.4775	0.4785	0.4774	0.4785	0.4776	0.4776
Estimator	OLS/FE	OLS/FE	OLS/FE	OLS/FE	OLS/FE	OLS/FE
Fixed year effect	Yes	Yes	Yes	Yes	Yes	Yes
Cluster year	Yes	Yes	Yes	Yes	Yes	Yes

	Dependent variable : investment in fixed capital				
	(7)	**(8)**	**(9)**	**(10)**	**(11)**
Interactions					
FC debt x	-0.411	-0.424	-0.454		
(Δlog e)	[0.071]***	[0.071]***	[0.0719]***		
Balance-sheet exposure x				-0.356	-0.276
(Δlog e)				[0.0605]***	[0.0565]***
Principal effects					
FC debt	-0.212	-0.212	-0.210		
	[0.01]***	[0.0103]*	[0.0103]***		
Balance-sheet exposure				-0.136	-0.127
				[0.0082]***	[0.007]***
Total debt	0.311	0.311	0.311	0.300	0.301
	[0.002]***	[0.0029]***	[0.002]***	[0.0027]***	[0.0026]***
Controls					
Net exports			-0.007	-0.010	-0.009
			[0.0017]***	[0.001]***	[0.0259]***
Net exports x			0.004	-0.004	-0.001
(Δlog e)			[0.011]	[0.0112]	[0.0104]
I(tradable) x	0.012	0.013	0.010	0.005	0.007
(Δlog e)	[0.025]	[0.0257]	[0.0258]	[0.0259]	[0.0248]
FC assets	-0.185	-0.184	-0.181		
	[0.056]***	[0.0568]***	[0.0568]***		
FC assets x	-0.571	-0.554	-0.559		
(Δlog e)	[0.4055]	[0.4054]	[0.4051]		
Cash flow	0.219	0.219	0.217	0.226	0.214
	[0.0116]***	[0.0116]***	[0.0116]***	[0.0116]***	[0.0108]***
Net Fwds		0.031	0.034		
		[0.0145]**	[0.0149]**		
Net Fwds x		-0.006	-0.020		
(Δlog e)		[0.125]	[0.1316]		
Stock of lagged capital x					-0.456
(Δlog e)					[0.0741]***
Stock of lagged capital					-0.774
					[0.017]***
Regression information					
Num. Observations	20,649	20,649	20,649	20,649	20,649
	0.49	0.4903	0.4913	0.4859	0.5532
Estimator	OLS/FE	OLS/FE	OLS/FE	OLS/FE	OLS/FE
Fixed year effect	Yes	Yes	Yes	Yes	Yes
Cluster year	Yes	Yes	Yes	Yes	Yes

Annex D. Arellano-Bond and Sargan Tests

Table D.1. Arellano-Bond Test for Zero Autocorrelation of the First Difference of the Error Term

Specification 1

Order	z	Prob > z
1	-10.268	0.0000
2	-.5694	0.5691

H0: no autocorrelation

Specification 2

Order	z	Prob > z
1	-10.267	0.0000
2	-.58104	0.5612

H0: no autocorrelation

Specification 3

Order	z	Prob > z
1	-10.255	0.0000
2	-.58933	0.5556

H0: no autocorrelation

The null hypothesis that $Cov(\Delta\varepsilon_{it}, \Delta\varepsilon_{i,t-k}) = 0$ for $k = 1,2$ is rejected at the 0.05 level if $p < 0.05$. If ε_{it} is serially uncorrelated, we would expect to reject at order 1 but not at higher orders. We reject at order 1 because $p = 0.0000$. At order 2, $\Delta\varepsilon_{it}$ and $\Delta\varepsilon_{i,t-2}$ are not serially correlated because $p > 0.1$.

Table D.2. Sargan Test for Over-identification of Restrictions

In Specification 1 we used 149 instruments to estimate 23 parameters. There are, therefore, 126 over-identified restrictions. In Specification 2 we used 70 instruments to estimate 13 parameters. There are, therefore, 57 over-identified restrictions. In Specification 3 we used 97 instruments to estimate 16 parameters. There are, therefore, 87 over-identified restrictions. STATA's *estat sargan* command implements this test, which cannot run if the model has been estimated with robust standard errors since errors ε_{it} have to be *i.i.d.* It is therefore required to run the test without the option of error term robustness.

Specification 1:

```
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(127)     =  167.9948
        Prob > chi2   =    0.0087
```

Specification 2:

```
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(57)      =  84.36371
        Prob > chi2   =    0.0107
```

Specification 3:

```
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(81)      =  126.7526
        Prob > chi2   =    0.0009
```

We accept the null hypothesis of over-identification of restrictions at the 5% confidence level.

Annex E. Determinants of Firms' Use of Forward Exchange Derivatives (Marginal effects after probit)

VARIABLES	Probit Long or short positions	Probit Long or short positions	Probit Long position	Probit Long position	Probit Short position	Probit Short position
Assets	0.00732***	0.00750***	0.000116***	0.000126***	0.00451***	0.00466***
	(0.000913)	(0.000923)	(4.26e-05)	(4.52e-05)	(0.000643)	(0.000653)
Assets owned abroad	-0.0185	-0.0194	-0.000249	-0.000280	-0.0128	-0.0133
	(0.0136)	(0.0140)	(0.000240)	(0.000262)	(0.00838)	(0.00870)
Leverage	0.0185***	0.0191***	3.93e-05	4.54e-05	0.0149***	0.0154***
	(0.00515)	(0.00525)	(0.000101)	(0.000109)	(0.00358)	(0.00367)
FC debt	0.0596***	0.0609***	0.000379**	0.000419**	0.0403***	0.0414***
	(0.00740)	(0.00750)	(0.000159)	(0.000172)	(0.00592)	(0.00589)
Short term debt	0.0184***	0.0183***	3.72e-05	3.41e-05	0.0144***	0.0145***
	(0.00303)	(0.00304)	(4.87e-05)	(5.21e-05)	(0.00241)	(0.00241)
Exports	0.0247***	0.0241***	0.000931***	0.00101***	-0.00367*	-0.00452**
	(0.00403)	(0.00402)	(0.000352)	(0.000374)	(0.00215)	(0.00220)
Imports	0.00951**	0.00934**	-1.02e-05	-2.05e-05	0.00700*	0.00698**
	(0.00437)	(0.00429)	(3.98e-05)	(4.45e-05)	(0.00365)	(0.00352)
Sales growth	-0.00171***	-0.00198***	-7.60e-06	-1.15e-05	-0.00106***	-0.00124***
	(0.000558)	(0.000593)	(1.21e-05)	(1.41e-05)	(0.000369)	(0.000397)
Foreign Ownership	-0.00168	-0.00160	7.36e-05	7.29e-05	-0.00225***	-0.00222***
	(0.00109)	(0.00111)	(4.62e-05)	(4.68e-05)	(0.000691)	(0.000711)
Interest rate differential		-0.118***		-0.000283		-0.0699***
		(0.0234)		(0.000545)		(0.0159)
Forward Premium		-0.0228***		-0.000485**		-0.00957***
		(0.00464)		(0.000210)		(0.00287)
Exchange rate		-1.92e-05***		-3.40e-07**		-8.67e-06***
		(3.09e-06)		(1.33e-07)		(1.89e-06)
RE	YES	YES	YES	YES	YES	YES
Time Effects	YES	NO	YES	NO	YES	NO
Observations	34,064	34,064	34,064	34,064	34,064	34,064
Number of nit	5,012	5,012	5,012	5,012	5,012	5,012

Source: Authors calculations based on SS, DIAN-DANE, SF and BdR.
Note: Standard error in parenthesis. ***p<0.01, **p<0.05, *p<0.1