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Determinants and Consequences of Foreign Indebtedness in Colombian Firms[1]

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ABSTRACT

During the nineties the performance of many emerging economies was linked to their access to foreign capital and its impact on the real exchange rate. Colombia was not an exception, as it experienced a sharp boom and bust cycle during the period. Although a number of studies have attempted to explain the underperformance of the Colombian economy since the mid-1990s, few attempts have been made at analyzing firm-level data. In this paper, we rely on information for a large sample of firms during 1995-2001 and examine the determinants of foreign indebtedness as well as the effects on firm performance of holding dollar debt amid changes in the real exchange rate (i.e. the "balance sheet effect"). Our results suggest that matching does seem to take place, to the extent that firms in more open sectors and exporting firms have higher shares of dollar debt. Size is the most robust determinant of dollar indebtedness, whereas there is somewhat weaker evidence that the degree of foreign ownership increases the likelihood of holding dollar debt. In addition, and in spite of the limited amount of dollar indebtedness of Colombian firms in general, our estimations suggest there is a negative balance sheet effect on firms' performance (i.e. on profitability). On the other hand, although we do find that firms that are not highly indebted in dollars and export part of their output tend to invest more than dollar-indebted, non-exporting firms, the interaction of dollar indebtedness with the real exchange rate is generally not significant in our investment regressions.

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1 Introduction

The traditional expansionary effect of a devaluation predicted by the Mundell-Fleming model has been recurrently subjected to criticism (i.e. Krugman and Taylor, 1978), and challenged on new grounds (Calvo, 1999, 2000, Calvo and Reinhart, 2000, Dornbusch, 2001). The basic argument in this new strand of literature is that firms and governments that borrow in foreign currency and produce an output that is not entirely tradable face a currency mismatch which, following a devaluation, can produce a balance sheet effect that offsets any enhancement in competitiveness. Largely motivated by the failure of traditional models of balance of payments crisis[2] to explain the financial turmoil in emerging markets during the late 1990's (most notably, the Asian crisis of 1997), a number of authors have appealed to this "open economy Bernanke-Gertler" argument (Krugman 1999a). According to this view, in a context of financial market imperfections and constraints where net worth affects investment levels (Bernanke and Gertler, 1989), substantial levels of foreign currency denominated liabilities imply the possibility of self-fulfilling crises: a loss of confidence by foreign investors and the capital flight that results leads to an exchange rate depreciation and to a balance sheet effect that depresses investment.

The actual implications and correct policy prescriptions in this setting have not been settled on theoretical grounds. On the one hand, some argue that a loose monetary policy after the crisis is not a remedy, as it reinforces the currency depreciation and its balance sheet effect (Krugman, 1999b). Aghion, *et al.* (2000, 2001) argue that the balance sheet effect of a devaluation might entail a decrease in economic activity which reduces money demand and weakens the currency even further. Thus, a currency crisis is a "bad" equilibrium, with low output and a weak exchange rate. They find that if credit supply does not react too strongly to changes in the interest rate, a tight monetary policy is the correct prescription to avoid a crisis. Nonetheless, if the rise in interest rates has a significant negative effect on future output that exerts downward pressure on the currency, it might be *impossible* to avoid a crisis.

On the other hand, in a series of papers Céspedes, Chang and Velasco support the Mundell-Fleming prediction and argue against dollarization. They point out that although a devaluation under "dollarization" of liabilities has a detrimental effect on net worth which constrains investment when firms face financial frictions, the offsetting effect of increased home output and returns to investment generally imply that the standard Mundell-Fleming expansionary effect of devaluations is still generated (Céspedes *et al.*, 2000)[3]. They find that fluctuations in domestic output and investment are larger and more persistent under fixed exchange rates. Also, under a fixed exchange rate, the impact of a real depreciation, albeit smaller, must be achieved through deflation, increasing the real wage and reducing employment if nominal wages are sticky. Nonetheless, balance sheet effects do matter in that they magnify the effects of foreign disturbances and might lead to a situation of *financial fragility* –where devaluations increase the country risk premium.

If balance sheets matter, a puzzling question is why do domestic agents choose to hold foreign denominated liabilities in the first place. Explanations of the so called "original sin"—the fact that developing countries cannot borrow in their own currencies or at long maturities—range

[2] "First generation" models emphasized the role of inflationary financing of budget deficits: fixed exchange rates collapsed as the government appealed to seignorage to cover its deficit. A speculative attack followed as foreign reserves fell below a given level. "Second generation" models relied instead on the conflict between a fixed exchange rate and an expansionary monetary policy.

[3] The overall impact of a devaluation might indeed be contractionary, but only if inherited dollar liabilities are (implausibly) large and international financial markets very imperfect (Céspedes *et al.*, 2002).

from models that point out moral hazard problems of fixed exchange rates and government policy (Burnside, *et al.* 1999, Schneider and Tornell, 2001) to those which consider the role of financial underdevelopment (Caballero and Krishnamurthy, 2000). In contrast to the theoretical discussion, empirical work on the determinants of liability dollarization and its "balance sheet effects" at the firm-level has been scarce and severely hindered by data availability. Exceptions include Bleakley and Cowan's (2002, BC in what follows) study on the balance sheet effect of devaluations for a sample of publicly traded Latin American firms. They report that the effect on performance of holding dollar debt during a devaluation is positive because the negative net worth effect is more than compensated by the effects of a devaluation on earnings. Furthermore, they suggest that this results from firms' matching the currency composition of their liabilities and earnings.

These conclusions are not supported by Aguiar (2002), who studies investment in post-crisis Mexican firms, finding an important (negative) "balance sheet effect" of devaluation on investment. Even though exporters outperform non-exporters in terms of profits and sales after a devaluation, their investment is constrained as a result of holding foreign currency denominated debt. Floating the currency also implies an increase in sales volatility, which further reduces investment. Aguiar finds only weak evidence in support of a model of hedging which predicts that the currency of debt should match the currency of revenue (i.e. that foreign currency debt payments should increase with the covariance of profits and the exchange rate).

An important issue for policy discussion that has received some attention empirically is the role of the exchange rate regime on exchange risk hedging. Arteta (2002) uses a database on deposit and credit dollarization in developing and transition economies to examine whether flexible exchange rate regimes encourage banks to match dollar-denominated liabilities with assets. His results indicate that, if anything, floating regimes tend to exacerbate currency mismatches. These results tend to favor the so-called "minority view" which emphasizes that the cost of insurance against exchange rate risk goes up with exchange rate volatility. According to Martínez and Werner (2002), the previous results are not supported by the case of Mexico. These authors point out that, while a pegged exchange rate might be an implicit guarantees that removes the need to hedge exchange rate risk, the "original sin hypothesis" actually implies a sort of natural tendency for liability dollarization that goes beyond the choice of exchange rate regime. Nonetheless, even if there is some sort of natural tendency towards *borrowing* in foreign currency, the exchange regime might bias the incentives of *lenders* towards firms under pegged regimes. A model that incorporates these elements is presented and tested, and results indicate that firms have taken exchange rate risk more seriously after flotation in 1994. Indeed, although firms are still exposed to exchange rate risk, during the fixed exchange rate regime the share of dollar debt was mainly determined by the size of the firm and unaffected by the composition of revenues, whereas during floating exports became the sole determinant of dollar indebtedness. Finally, Barajas and Morales (2003) find that determinants of liability dollarization go beyond the "usual suspects" (macro volatility and moral hazard) and include central bank intervention, borrower market power, and financial penetration.

All in all, the available empirical evidence on the balance sheet effects of devaluations is not conclusive. The final verdict has to come form the data and the particular conditions of firms in specific countries. In this paper we study the firm-level effects of monetary and exchange rate developments in Colombia during 1995-2001. Like many other emerging economies, Colombia experienced positive and increasing levels of capital inflows during the first half of the 1990s that allowed for a respectable performance in terms of GDP growth. Nonetheless, a curtailment of foreign financing after 1997 has coincided with Colombia's worst growth performance on record.

Ample foreign financing brought about an appreciation of the real exchange rate between 1990 and 1997, and a significant real depreciation was observed since. These exchange rate developments occurred in the context of a number of distinct regimes that included a standard crawling peg (until 1991), followed by an informal band in 1992 and 1993 that accompanied an active sterilization policy, and a formal band that was put in place in 1994 but had to be shifted a number of times and eventually abandoned in late 1999, when a floating regime was introduced.

At the time the band came under attack, many analysts and policy-makers argued that the lackluster performance of the economy beginning in the second half of 1997 was associated with an ill-conceived monetary and exchange rate policy that kept interest rates too high and the domestic currency too strong. Under this interpretation, floating the currency should have reverted the trend of the key components of aggregate demand. In particular, lower interest rates should foster investment and consumption and a weaker currency should boost exports. The stylized facts indicate that during the period of floating the recovery of private consumption and private investment has been far from satisfactory, while non-traditional exports[4] have performed reasonably well. Whether the recent relatively poor performance of the Colombian economy is associated with a protracted effect of having instrumented a tight monetary policy to defend the currency when it came under attack after 1997 and/or with the balance sheet effect associated with the depreciation following the floating of the currency is an empirical matter, better addressed at the level of the firm. In this paper, we rely on information for a large sample of firms during 1995-2001 and examine the impact of the exchange and interest rates on the performance of firms with varying degrees of foreign indebtedness, output tradeability, and imported inputs.

Since the limited time dimension of our database makes the causal interpretation of macroeconomic effects on firm performance problematic, we focus on the differential effect of exchange and interest rate movements on the performance of firms with different characteristics. In other words, our study does not allow us to pinpoint the overall expansionary or contractionary effect of devaluations in Colombia in the presence of balance sheet effects, but rather the existence (or lack thereof) of particular channels whereby the exchange rate affects firm performance. Moreover, much of the balance sheet effect of devaluations in Colombia at the macroeconomic level is likely to occur in the public sector, as the public deficit is largely financed with external debt and is mostly a producer of non-tradable goods.

Our results suggest that matching does seem to take place in our sample, to the extent that firms in more open sectors and exporting firms are engaged more often in foreign indebtedness and have higher shares of dollar debt. Nonetheless, firm size is the most robust and significant determinant of dollar indebtedness. Although the previous results and the limited amount of dollar denominated indebtedness in Colombia tilt the balance *against* finding any balance sheet effect of devaluations, we find evidence of a negative balance sheet effect on firms' performance as measured by profitability. Results for investment, on the other hand, are rather mixed.

The paper proceeds as follows. Section 2 briefly discusses BC's analytical framework for the effects of exchange rate devaluations on firm investment in the presence of dollar indebtedness. In section 3, we describe the data set that is used in section 4 to analyze the determinants and consequences of firm investment. Section 4.1 presents some regressions for the currency composition of debt, whereas section 4.2 focuses on firm performance as measured by profitability

[4] Those different from coffee, oil and coal.

and investment. Section 4.3 turns attention to "troubled" firms, and examines whether or not the prescence of high levels of foreign indebtedness prior to the devaluation period increased the probability of firms bankruptcy during the sharp devaluation starting in 1998. The fifth section concludes.

2 Analytical framework for the firm-level analysis

Before turning to the empirical analysis, it is useful to consider the basic intuition behind BC's simple model of the impact of exchange rate movements for firm level investment and its variation across firms with different levels of dollarization of liabilities. BC's model can be extend easily in two directions, discussed by the authors but not incorporated in their model. As highlighted in the introduction, the basic argument behind this kind of models is that, in addition to the usual expansionary or "competitiveness" effect of devaluations, they consider the fact that for dollar-indebted firms devaluations might lead to a decrease in "net worth" due to a currency "mismatch" between liabilities and income. This deterioration in balance sheets makes firms appear as riskier investments. As a result, they face higher interest rates, which bring about a decline in investment.

BC's interesting framework fails to recognize other elements that might play a role in determining firms' investment during devaluations. First, firms might use imported inputs, challenging the fact that the "competitiveness" effect of a devaluation is necessarily positive. Second, firms pay an interest rate that depends not only on their own net worth, but also on macroeconomic elements. In particular, quitting the "dogged" defense of the currency, besides from leading to a devaluation, allows the domestic interest rate to decrease, fostering investment of firms indebted in pesos. Thus, in attempting to evaluate empirically the effect of a devaluation on firm investment across different levels of dollar indebtedness, it is important to take into account both the extent to which firms tend to import their inputs and the interaction of their degree of domestic indebtedness with domestic credit conditions.

Under the basic and extended BC frameworks, the effect on investment of a devaluation can be either increasing or decreasing in the degree of dollar indebtedness. In the case of the extended framework, the source of the ambiguity becomes more difficult to disentangle. For instance, in BC there is an unambiguously positive "competitiveness" effect of devaluations coupled with an ambiguous "net worth effect" (which depends on the extent of the increase in earnings as compared to the rise in the cost of external funds). However, the "competitiveness" effect might be negative if imported inputs are important. In the extended framework, in addition to BC's competitiveness and net-worth channels, there is a "macroeconomic channel" (the change in the interest rate) affecting firms' investment after devaluations. This channel might have a differential effect on firms with varying degrees of foreign and domestic debt levels, and moreover with varying degrees of debt maturity, since those firms most heavily indebted domestically in the short run are those that would (presumably) benefit the most from the decline in interest rates that usually accompanies the decision of allowing the depreciation of the currency.

3 Some stylized facts

BC's claim of no evidence of a large, negative net-worth effect on investment following devaluations in emerging markets is based on a sample of 2644 publicly traded firms in 5 countries, including Colombia. Their sample is not only heavily biased in favor of Brazil and Mexico (1479 and

577 firms, respectively), countries whose private sectors are not known to have highly dollarized liabilities. It is also biased in that publicly traded firms, the source of their sample, are generally the largest and most financially sophisticated ones. We use a more representative database, which covers an average of 8,246 firms from 1995 through 2001. These firms belong to 66 sectors (4-digit ISIC classification), and are under the supervision of the Superintendencia de Sociedades. Only commercial firms with assets of at least 20,000 legal minimum monthly wages[5] now *have* to report to the Superintendencia, but the sample also includes smaller firms. Due to procedural changes—the Superintendencia now differentiates between inspected (*inspeccionadas*) and supervised (*vigiladas*) firms—there was a non-negligible decrease in the number of firms in 2001. Until 2000 all firms had to report their financial statements. Starting in 2001 only (larger) *vigiladas* have to do so.

Firms entering after 1995 or leaving before 2001 because they ceased to operate will allow us to work with an unbalanced panel. We modified the data set in several ways. The following were excluded:

1) Firms that do not appear in the sample for at least four consecutive years. This results in dropping 6700 firms, which account for roughly 44% of the sample
2) 65 firms that have no change at all in their level of assets or liabilities in consecutive years.
3) 6 firms reporting unrealistically low levels of assets. In particular, firms whose assets do not exceed $100,000 Colombian pesos (US$35 at current exchange rates), which is nearly a third of the legal minimum monthly wage.
4) 868 firms displaying inconsistent accounting information, including:
    - firms having liabilities that exceed the value of their assets (812 firms)
    - negative operational income (4 firms)
    - short-term assets larger than total assets (7 firms)
    - firms reporting negative values for their total liabilities, any of its components, or on interests on their financial liabilities (24 firms)
    - firms in which components of liabilities exceed the total (foreign, domestic, trade and financial, 21 firms)
5) For estimation purposes, we also check the sensitivity of our results to the exclusion of outliers (firms for which our measures of investment lie in the upper or lower 3% of the sample). In a number of estimations, we are also obliged to drop firms for which we do not have (or are unable to impute) denomination of output and inputs in terms of currencies. 1064 firms (964 belonging to the retail sector) are dropped because of these criteria.

Table 1 includes the number of firms per year and sector that survived our filtering criteria (1 to 4). Our revised data set includes a large number of firms and covers a wide range of sectors. In what follows, we highlight several characteristics of these firms. Variables are defined in Appendix 1.

[5] The current minimum monthly wage is US$110. Hence, only firms with assets above US$2 million are subject to mandatory reporting.

Table 1. Firms per Sector (revised data set)

	1995	1996	1997	1998	1999	2000	2001
Agriculture	512	554	599	623	607	567	343
Mining	121	137	156	165	152	137	109
Manufacturing	1638	1735	1860	1915	1837	1749	1203
Electricity, gas and water	6	8	14	15	14	13	10
Construction	649	728	846	881	806	704	406
Commerce	1428	1534	1732	1842	1715	1621	1056
Transport and comunications	253	286	342	355	347	332	219
Services	1335	1466	1668	1771	1647	1538	873
TOTAL	5942	6448	7217	7567	7125	6661	4219

Source: Authors' calculations based on Superintendencia de Sociedades

Table 2 shows that, on average, total liabilities are close to 48% of total assets at the beginning of the period, and nearly 42% by the end. The decrease in total leverage occurs in the beginning of the period, from 1995 to 1998. The median value of leverage is close to the average. Apparently, firms have moved to more "conservative" indebtedness, although a few still have liabilities that are as large as their own assets, as indicated by the last column of the Table.

Table 2. Firm Leverage, descriptive statistics

Total Debt to Total Assets (%)

Year	Mean	Median	Std. Dev.	Min	Max
1995	47.79	50.61	26.08	0.00	100
1996	45.35	46.92	25.72	0.00	100
1997	44.54	45.72	26.27	0.00	100
1998	43.02	43.39	26.43	0.00	100
1999	42.28	41.77	26.36	0.00	100
2000	41.89	41.38	26.24	0.00	100
2001	42.13	42.27	26.33	0.00	100

Source: Authors' calculations based on Superintendencia de Sociedades

Table 3. Debt Maturity, Denomination and Financial vs. Trade-related Debt

Descriptive statistics for 2000 (%)

Variable	Mean	Median	Std. Dev.	Min	Max
Balance sheet information (Total liabilities)					
Short Term Debt/Total Debt	76.66	93.40	30.42	0.00	100.00
Trade Debt/Total Debt	19.70	9.07	24.16	0.00	100.00
Financial Debt/Total Debt	24.82	15.21	26.95	0.00	100.00
Other Liabilities/Total Debt	55.48	52.91	33.06	0.00	100.00
Annex information (Financial liabilities and liabilities with foreign suppliers)					
Dollar Debt/Total Debt	5.47	0.00	14.79	0.00	99.98
Short Term Dollar Debt/Dollar Debt	92.19	100.00	24.82	0.00	100.00
Short Term Domestic Debt/Domestic Debt	78.88	100.00	32.36	0.00	100.00
Foreign Trade Debt/Foreign Debt	85.55	100.00	33.11	0.00	100.00
Domestic Trade Debt/Domestic Debt	39.83	27.97	37.44	0.00	100.00

Source: Authors' calculations based on Superintendencia de Sociedades

The breakdown of liabilities by currency denomination, maturity, and financial vs. trade-related debt is presented in Table 3 for the year 2000[6]. Firms hold a large proportion of short-term debt (close to 75% on average and about 90% for the median firm; short term is less than one year). This is consistent with the available evidence on firms' financial opportunities in Colombia, where internal resources are often the source of funding for investment, whereas debt is a source of working capital. The share of "dollar" debt[7] is low on average (close to 5% of total debt) and most firms hold no foreign currency denominated liabilities (the median firm has no dollar debt). Nonetheless, a few hold a disproportionate share. The median firm holds its entire domestic and dollar debt in the form of short-term debt for all years. Also, the proportion of short-term debt is higher on average for dollar debt. This has to do with the fact that a very important component of foreign debt is actually trade debt—i.e. debt with foreign suppliers (85% on average, 100% for the median firm). If only financial dollar debt is considered (tables not shown), short-term dollar debt is actually close to 50% of total dollar debt on average. Taking types (dollar and domestic) of liabilities into account, trade-linked debt accounts for nearly 20% of total liabilities on average, with most firms being on the low side. Financial debt, in turn, is nearly 25% of total liabilities. Other liabilities (including bonds, liabilities with shareholders, among others) account for the remaining 55% of liabilities.

"Dollar indebtedness" appears to be relatively unimportant for this large sample of firms. Yet, how important is foreign indebtedness among those firms that do hold foreign currency liabilities? About 26% of the firms in our sample hold a positive amount of dollar debt (Table 4). Firms indebted abroad hold on average approximately 20% of their liabilities in dollars. The share of firms indebted abroad and (more surprisingly) their average indebtedness, does not change much, despite the recent devaluation. The only exception is 2001, the year in which our sample changes to include mostly firms that are *vigiladas*. In this year, the share of firms indebted abroad rises to nearly 33% of the entire sample. These (larger) firms hold dollar denominated debt more often.

[6] Yearly information is available upon request. Ratios vary little through time.

[7] Strictly speaking, "dollar" debt might actually be a combination of debt denominated in a basket of foreign currencies. It should be noted that all foreign currency denominated debt is with overseas creditors, as Colombian domestic financial institutions are not allowed to denominate loans in dollars.

Nonetheless, in 2001 average indebtedness in dollars falls from 20.4% to 17.5% of total debt. Thus, although larger firms that are *vigiladas* are more frequently indebted in dollars, they now hold a smaller share of their debt in dollars. The share of dollar debt for the median firm is always about a half of the share for the average firm; that is, most firms are either on the conservative side, or lack access to that financial market, with a few holding a disproportionate share of their debt in dollars. The previous figures correspond to total dollar debt, which is largely composed of trade-related debt. When only financial dollar debt is considered (tables not shown) the average share of dollar debt in the entire sample is much smaller, close to 2%. Also, the proportion of firms holding dollar debt that is not trade-related (i.e. financial) is significantly lower, 8-10% of the sample. Non-trade related dollar debt in firms holding this kind of debt is close to 25% of their total debt.

Turning to the revenue side, most firms do not export their output, although a few export their entire output (Table 5). The share of income generated abroad, while still low, has increased substantially through time, from 4.5% of total revenue to 7.1%. This effect occurred especially in the aftermath of the devaluation but, as the median firm illustrates, it was not widespread. A large proportion of firms in our sample lack information on imported inputs. Furthermore, reported figures on imported inputs are often unreliable. We rely on sectoral data on imported inputs for estimation purposes, using the most disaggregated information available on inputs purchased. Fr most sectors imported input shares do not change much through time, though there is a significant heterogeneity in terms of import orientation and its evolution by sector.

Table 4. Dollar Debt as % of Total Debt

For firms holding dollar debt

	Observations				
Year	Number of firms	As percent of sample	Mean	Median	Std. Dev.
1995	1679	26.06	18.93	9.50	22.34
1996	1820	26.53	18.47	9.50	21.80
1997	1991	26.03	19.07	10.44	22.13
1998	2021	25.59	18.77	9.71	21.89
1999	1977	26.05	18.77	10.13	21.89
2000	1931	26.85	20.35	11.14	22.60
2001	1492	32.97	17.45	8.92	20.77

Source: Authors' calculations based on Superintendencia de Sociedades

Table 5. Composition of Output in Terms of Currencies

Ratio of exports to total revenue, in percent

Year	Mean	Median	Std. Dev.	Min	Max
1995	4.43	0.00	17.05	0.00	100.00
1996	4.52	0.00	17.25	0.00	100.00
1997	4.65	0.00	17.53	0.00	100.00
1998	4.79	0.00	17.35	0.00	100.00
1999	5.36	0.00	18.39	0.00	100.00
2000	5.83	0.00	18.88	0.00	100.00
2001	7.07	0.00	19.74	0.00	100.00

Source: Authors' calculations based on Superintendencia de Sociedades

When examined by sector, exports are important for firms in agriculture, manufacturing, and mining, although most firms do not export at all, regardless of which sector they are in. On the other hand, several sectors seem to be affected by the cost of inputs channel (Figure 1). Foreign debt is also important for a number of sectors. In particular, the electricity, gas and water sector (made up of a few and large firms) is highly indebted in dollars. This sector is also a net importer. Transportation and Commerce are in a similar situation (Figure 2).

Our main dependent variable, the rate of investment in fixed capital, is defined as net purchases of property, plant and equipment as percent of total assets. Fixed capital investment decreased sharply from 1996 to 1997 and slightly thereafter reaching its lowest level in 1999; a mild recovery is observed since. Overall, the rate of fixed capital investment falls from about 3.02% of assets in 1996 to 1.16% in 2000. Most firms are in the low side, with investment falling for the median firm from a rate of 0.95% to 0.16% of total assets during the same period.

Figure 1. Share of Imports, by sector
Purchases of goods and raw materials from abroad as percent of total purchase of goods and raw material, all years

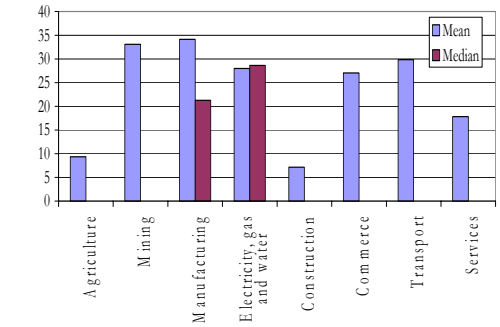
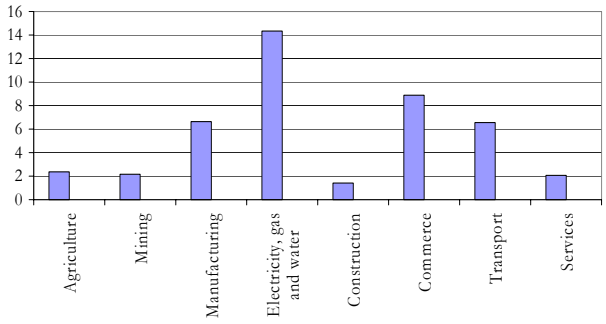


Figure 2. Share of Foreign debt, by sector
Total foreign debt as percent of total debt, all year median is zero for all sectors



Source: Authors' calculations based on Superintendencia de Sociedades

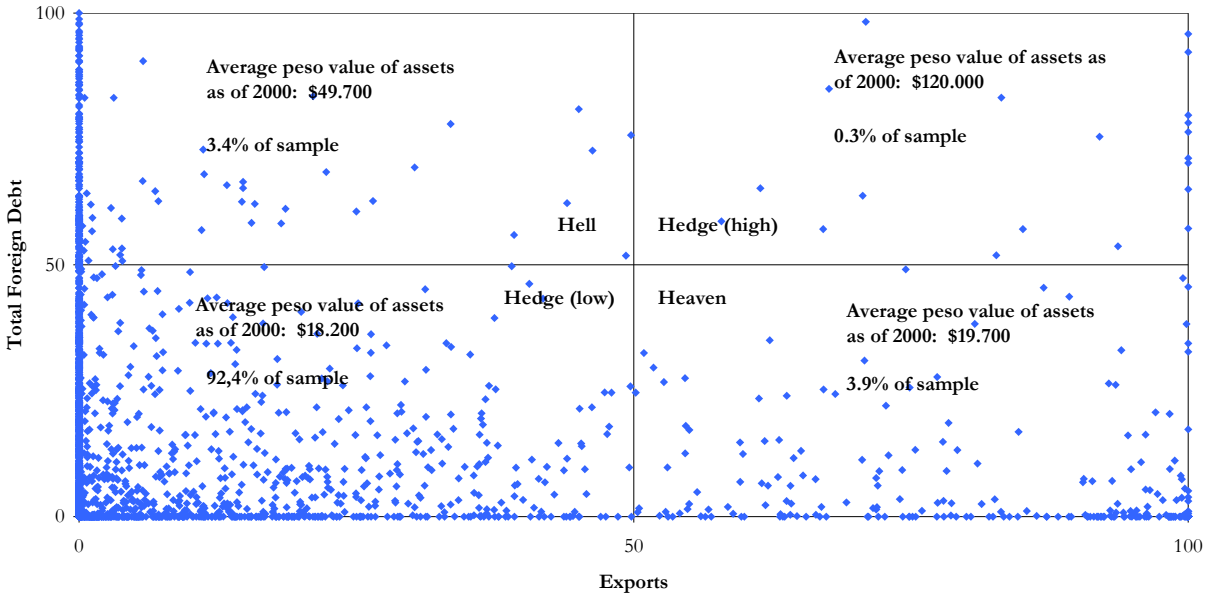
We now turn to a description of the main correlates of firms' characteristics. We identify each firm as belonging to one of four zones: *hell, heaven, and hedge (high and low)*. Firms are in hell when their output is denominated in domestic currency, yet have a large share of foreign denominated liabilities. These are the firms that potentially face the strongest balance sheet effect during real exchange rate devaluations. In the opposite extreme, firms in heaven sell a large proportion of their output in dollars, yet have a low share of dollar debt[8]. Firms that are highly indebted in dollars but nonetheless have a tradable output are hedged. Finally, firms with low levels of exports and dollar indebtedness are also "hedged"[9]. The distribution of firms and the average value of assets for firms in each zone is presented for 2000 only, as it varies little through time. As shown in Figure 3 an overwhelming majority of the firms in our sample belong to the "hedge (low)" zone (92.4%). Firms in Heaven follow in importance (3.9%), whereas just a few firms (0.3%) are in hedge (high). Finally, firms in Hell account for 3.4% of total firms. In terms of size, firms in Heaven and Hedge (low) are the smallest, whereas those in Hell are relatively large and those in Hedge (high) are the largest. It seems

[8] Obviously, firms in Heaven are actually in Hell as a result of a real exchange rate appreciation.
[9] In the Figure, this is labeled "hedge (low)". The definition of hedging considered here is quite limited in scope, as it has to do with the extent of mismatch between the currency composition of output and liabilities. In our data set we are unable to observe whether firms use derivatives or forwards to hedge their foreign indebtedness.

that only large firms have foreign debt, and that larger does not necessarily mean more export oriented. On average, firms in hell did actually invest less during our sample period.

Since a large share of foreign debt in our sample is trade-related, it is important to check whether or not this distribution of firms changes when only financial dollar debt is taken into account. The overall picture is quite similar to the one presented above, with the only important change referring to a decrease in the share of firms in the hell area. This is not surprising as non-trade related dollar debt is far less important than trade-related dollar debt.

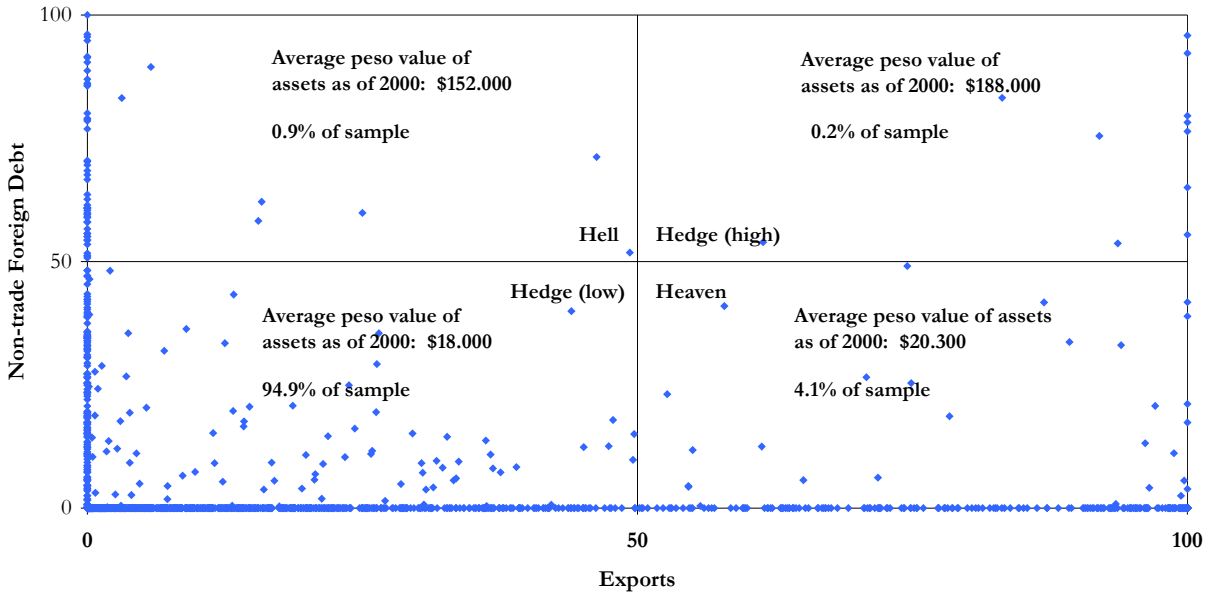
Figure 3. Share of Foreign Debt vs. Exports, 2000



Source: Authors' calculations based on Superintendencia de Sociedades

Note: Ratio of Foreign Debt to Total Debt and of Operational Income Generated Abroad to Total Operational Income, in percent
Average value of assets for firms in each zone in 2000 Colombian pesos (in thousands)

Figure 4. Share of Non-Trade Foreign Debt vs. Exports, 2000



Source: Authors' calculations based on Superintendencia de Sociedades
Note: Ratio of Foreign Debt to Total Debt and of Operational Income Generated Abroad to Total Operational Income, in percent
Average value of assets for firms in each zone in 2000 Colombian pesos (in thousands)

Interestingly, when examined by zone (Figures 5 and 6) fixed capital investment is higher for firms in hell than for firms in heaven—it is actually increasing for firms in heaven over part of the devaluation period. In section 4.2 we examine whether this result holds once we control for additional relevant characteristics.

Figure 5. Fixed capital investment, by zone
Medians, zones defined using total dollar debt

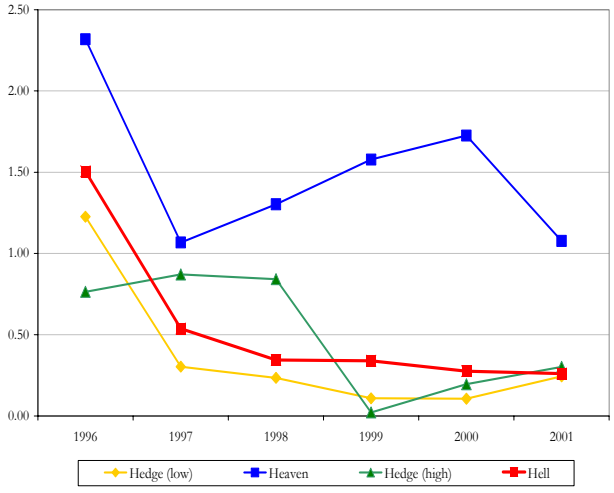
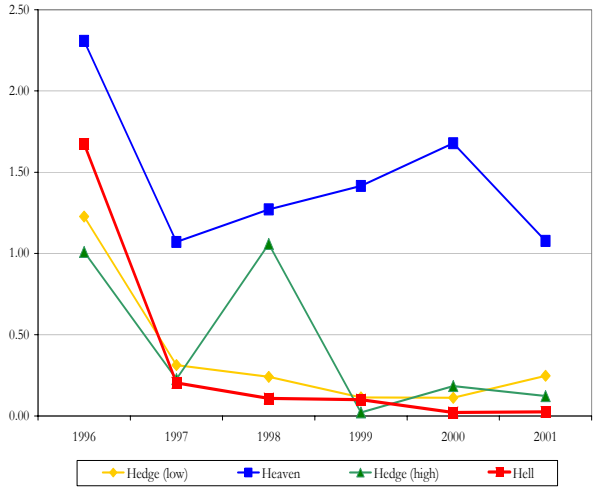


Figure 6. Fixed capital investment, by zone
Medians, zones defined using non-trade dollar debt



Source: Authors' calculations based on Superintendencia de Sociedades

Table 6. Economy-wide importance of the sample

	Investment in sample as % of		Exports in sample as % of		Non traditional exports in sample as % of *		Operational Income as % of
year	Private investment	GDP	Exports	GDP	Non-traditional exports	GDP	GDP
1995	29.17	3.69	34.58	4.77	73.25	3.79	65.09
1996	26.58	3.32	34.41	4.50	76.88	3.74	64.44
1997	18.68	2.10	42.70	5.59	87.26	4.35	62.61
1998	20.37	2.24	43.95	5.61	81.60	4.57	62.66
1999	22.04	1.70	42.20	6.11	84.49	5.28	65.27
2000	14.45	1.34	36.15	6.53	68.97	5.20	69.76
2001	13.81	1.38	35.18	5.69	61.36	4.97	67.55
All years	**18.26**	**2.04**	**38.30**	**4.96**	**73.80**	**4.69**	**65.72**

Source: Authors' calculations based on Superintendencia de Sociedades and DANE
* Excluding firms in coffee, coal and oil sectors.

The limited time dimension of our database does not allow us to pinpoint the overall expansionary or contractionary effect of devaluations, but rather the existence (or lack thereof) of particular channels whereby shifts in the exchange rate could have contractionary effects. This is aided by the fact that our sample of firms is sufficiently representative of the economy as a whole (Table 6). Total investment (net purchases of plant and equipment) reported by firms in our sample amounts to almost a third of total (national accounts) private investment in Colombia for 1995. Although this share falls throughout the period, the amount of investment undertaken by our firms remains significant. Indeed, it represents almost one fifth of the investment undertaken by the private sector throughout the whole period and to 2% of total domestic production. Our sample of firms are also representative in terms of exports: total operational income generated abroad reported by our firms amount to nearly 40% of total exports in Colombia and 5% of GDP. Our sample is especially representative of non-traditional exports; once we exclude firms in the coffee, coal, and oil sectors, exports amount to 74% of total non-traditional exports (4.69% of GDP) in all years. Not surprisingly, the overall importance of our sample also shows in operational income figures, which were on average 65.72% of total domestic production in the period.

4 Estimation and results

4.1 Currency composition of debt

In BC it is argued that the key determinant of the overall sign that real exchange rate devaluation has on firm investment is the correlation between the currency composition of debt and the exchange rate sensitivity of profits at the firm level. Moreover, they argue that their finding that firms holding dollar debt actually invest more than firms holding peso debt in the period following a devaluation is due to the fact that firms match the currency composition of debt with the elasticity of their income to the real exchange rate. Under this interpretation, dollarization of liabilities should be higher in firms that could be expected to benefit from a devaluation. Lending support to this hypothesis, BC report the results of a set of simple regressions where the ratio of dollar debt to total liabilities is a (positive) function of several proxies for the sensitivity of profits to the real exchange rate. In what follows we examine whether this result holds in our data.

In Table 7 we consider a set of alternative specifications for the determinants of non-trade related dollar debt[10]. In particular, we are interested in knowing whether larger firms have more access to external credit. Also, the tradeability of firms' output and inputs is presumably an important component of firms' foreign indebtedness to the extent that firms are interested in "matching" their income streams with their liabilities. Obviously, perhaps the most important determinant of the extent of dollar indebtedness is the interest rate differential that each firm faces when considering different financing options. Since we are working with low frequency data, it is difficult to find a reliable measure of such differential. Finally, a number of authors have found that firms with international operations are more likely to hold foreign debt. In our data set the information on whether a firm is a parent or subsidiary is unreliable, so we include the share of foreign ownership in each firm.

The results presented in Table 7 show that foreign debt is positively correlated with firms´ size (i.e. the log of the value of its assets). In the first column, a simple random effects panel data estimation reveals that firms with foreign ownership have a (marginally significant) higher share of dollar debt to total debt, and the time dummies indicate a negative trend in the share of financial dollar debt for our sample of firms. In this equation, belonging to an open sector (agriculture, mining or manufacturing) is not a significant determinant of indebtedness in dollars.

[10] We also run regressions for the share of total dollar debt, to check the sensitivity of the results. There are only two significant changes. First, and not surprisingly, there is a positive correlation between imports and the total share of dollar debt. Second, the somewhat negative time trend that we report below for financial dollar debt does not hold for total dollar debt.

Table 7. Determinants of Debt Denomination

Share of Non-trade Dollar Debt

Dependent Variable: Non-trade Foreign Debt to Total Debt						
	Random effects GLS	**Tobit**	**Probit**	**Fixed Effects**	**Tobit**	**Probit**
Independent variables						
Openness Dummy	-0.0069 0.173	9.072*** 1.267	0.4170*** 0.0634			
Exports				0.00856** 0.0035	0.132*** 0.0207	0.0071*** 0.0012
Imports				-0.115 0.0893	0.4204 0.4368	0.0168 0.0272
Log (Assets)	0.996*** 0.0477	14.221*** 0.4592	0.628*** 0.02355	0.873*** 0.099	12.31*** 0.528	0.5665** 0.026
Foreign participation	0.003** 0.0012	0.0281** 0.0112	0.00117** 0.0006	0.0023 0.00178	0.0385*** 0.014	0.00176** 0.0007
1996	0.174* 0.103	2.386** 1.054	0.1544** 0.0513	0.1755 0.1323	2.267* 1.18	0.154** 0.060
1997	-0.022 0.101	-0.724 1.055	0.020 0.0513	-0.0862 0.13	-2.152* 1.196	-0.0620 0.0610
1998	-0.0698 0.1004	-2.043** 1.063	-0.054 0.052	-0.1356 0.130	-3.10** 1.2	-0.1158*** 0.061
1999	-0.241** 0.1027	-4.839*** 1.120	-0.194*** 0.0543	-0.4224 0.135	-5.93*** 1.273	-0.221*** 0.0646
2000	-0.515*** 0.104	-8.147*** 1.151	-0.327*** 0.0554	-0.758*** 0.138	-9.898*** 1.31	-0.399** 0.0663
2001	-0.890*** 0.1192	-9.076*** 1.226	-0.3528*** 0.059	-1.061*** 0.156	-10.296*** 1.383	-0.408*** 0.0699
Constant	-12.838*** 0.709	-284.32*** 7.62	-12.567*** 0.382	-10.952*** 1.48	-245.13*** 8.54	-11.285*** 0.4234
No of observations	45179	45179	45179	27681	27681	27681
No of firms	7567	7567	7567	4567	4567	4567
Wald or F Test	578.08 [0.000]***			20.97 [0.000]***		
R-square	0.0347			0.0497		
Likelihood Ratio test		1204.98 [0.000]	2409.91 [0.000]		818.1 [0.000]	1319.31 [0.000]
Pseudo R-square		0.03	0.08		0.03	0.07

Notes:
Asymptotic standard errors below coefficients
p-values for regressions statistics in lower panel appear in [ ]
*, significant at the 90% level, ** at the 95%, *** at the 99%

This simple regression is nonetheless problematic since conventional estimators are biased and inconsistent in the context of limited dependent variables[11]. Thus, we estimate a Tobit model in the second column. Also, besides form the extent of dollar indebtedness, we are interested in the determinants of whether or not to acquire debt in dollars at all. Thus, a Probit model for the likelihood of holding dollar debt is presented in column 3. Results for size, foreign participation, and

[11] In particular, since the dependent variable is truncated, the appropriate distribution of the error term must take this issue into account. Maximum likelihood procedures, whereby a log-likelihood function having a component for those observations that are "uncensored" and those that are "censored" is maximized, can be applied in this context to obtain consistent estimators.

the time dummies are qualitatively unchanged. More importantly, there is a positive and significant coefficient attached to the openness dummy in the Tobit and Probit estimations[12]. These results suggest that there is evidence of matching of liabilities and income streams, to the extent that firms in more open sectors[13] tend to have foreign debt more often as well as larger shares of dollar debt. The downward trend could also be an indication of this attempt to hedge against currency risk, as the latter part of the period is the one of highest currency depreciation.

In the three final columns, we drop the openness dummy and consider instead firms´ exports and imports as additional dependent variables. Initially, we run a simple regression where we control for firm specific effects and obtain a positive effect of exports and size. As before, this regression can be criticized on the grounds that the dependent variable lies between zero and one. Our Tobit and Probit[14] regressions show that exports, size *and* foreign participation are a significant and positive determinant of the existence and extent of foreign indebtedness.[15] The time dummies show again a downward trend.

In sum, our results suggest that matching does seem to take place to the extent that firms in more open sectors and exporting firms are engaged more often in foreign indebtedness and have higher shares of dollar debt. In this regard, it is also interesting that financial dollar debt has a downward trend during the devaluation period and that imports do no exert a significant effect on financial dollar debt. Finally, size is the most robust and significant determinant of dollar indebtedness, whereas there is somewhat weaker evidence that the degree of foreign ownership increases dollar debt[16].

4.2 Firm performance

We begin our econometric analysis of firm performancce by presenting some regressions for firm investment as a function of "zone dummies" describing the position of the firm in terms of the hell, heaven and hedge areas of Figure 4[17]. In the first three columns of Table 8 the "Zone dummy" is assigned a value of -1 for firms in heaven, 0 for firms in hedge (whether it be because they export a lot and have a large share of foreign debt or because they have small values for this two variables), and 1 for firms in heaven. A negative coefficient for this dummy would indicate that, controlling for sectoral GDP growth and lagged leverage, firms in heaven tend to perform better than hedged firms, which in turn perform better than those in hell. Indeed, this is the result we get in the first column, yet the coefficient is not significant. Sectoral GDP growth has a (expected) positive effect on firm performance. Lagged leverage does not have a significant effect. The sign of this coefficient is undetermined a priori, as a high level of leverage could increase financial constraints and debt

[12] A drawback from the previous estimations is that in our sample there is a substantial number of firms holding no dollar debt. Thus, in regressions, inference is drawn from the difference between a very small share of firms as compared to the majority of firms holding no dollar debt. Nonetheless, there is no simple way to deal with this.

[13] Besides from these regressions, we also performed regressions where the degree of sectoral openness, defined as the ratio of sectoral exports plus imports to total sectoral production, is considered instead of the openness dummy. Results also indicate that openness, size and the extent of foreign participation are significant determinants of the existence and extent of dollar indebtedness.

[14] Logistic regressions were also performed and results were very similar.

[15] For all estimations we report (and fail to accept) Likelihood Ratio and Wald tests for the joint lack of significance of the regressors.

[16] Indeed, besides from showing up with lower significance levels, the coefficient attached to this variable turns out not to be significant when outliers (in terms of investment) are dropped from the estimations in unreported results.

[17] Regressions for areas defined as in Figure 3—i.e. in term of total dollar debt as opposed to financial dollar debt—as well as eliminating outliers in terms of investment were also performed. Results were actually stronger to the ones we present below.

payments could reduce the amount of internal funds available for investment, yet a positive coefficient might arise from the fact that only firms that have access to credit are able to invest..

We also repeat the estimations in the second and third column for the period before and after 1999 respectively (with 1999 onwards being the period of sharpest real depreciation). Interestingly, we obtain a large and significant negative coefficient for the latter period[18]. Furthermore, the regression significantly improves its overall fit after 1999, indicating that the zone classification was a better predictor of performance in the strong depreciation period. Sectoral GDP growth has the expected significant positive effect in this sub-period and, quite interestingly, lagged leverage changes sign across sub-periods. Apparently, in the latter period the financial constraint effect dominated the overall sign attached to this variable as it had a negative and significant effect on firm investment.

In the last three columns of Table 8, we repeat our estimations for the sample of firms in the hell and heaven zones. Our new Hell-Heaven dummy takes a value of 1 for firms in hell. Although in this case controls are usually not significant, we still obtain a negative effect for the whole period and after the strong devaluation period (with the point estimate being larger after 1999) on performance for being in hell.

We interpret these results as suggesting the presence of a negative balance sheet effect for firms that produce non-tradables and are highly indebted abroad. Of course, we could control for a number of additional characteristics and employ more adequate estimation methods to analyze this result more carefully (as we do below), but this is nonetheless provocative evidence in favor of the balance sheet effect of devaluations. Furthermore, as stated in footnote 17, these results are actually stronger once we drop outliers in terms of investment. Thus, they not only *not* driven by outliers; they are actually more important for "average" firms.

[18] Once standard deviations are added, the difference in the magnitude of the estimates in the two periods is nonetheless not significant since the effect is measured quite imprecisely before 1999. We also performed regressions in which we interacted the dummy variable with year specific dummies for the period following the 1999 depreciation. We always obtained negative coefficients, albeit not significant at conventional confidence intervals, suggesting weak evidence of a stronger balance sheet effects after 1999.

Table 8. Zone-Performance Regressions

Share of non-trade Dollar Debt

Dependent variable: Fixed Capital Investment						
Independent variables	**whole sample**	**before 1999**	**from 1999**	**whole sample**	**before 1999**	**from 1999**
Zone Dummy	-0.77	-0.6766	-2.08***			
	1.584	2.4636	0.5697			
Hell Dummy				-1.484**	0.473	-3.66***
				0.7871	1.58	1.489
Sectoral GDP	0.0635*	0.0852	0.0106***	0.087**	0.1932*	0.015
	0.0376	0.0943	0.011	0.052	0.12	0.041
Leverage (-1)	0.0169	0.0457**	-0.0319***	0.0089	-0.022	-0.0014
	0.0144	0.02	0.00528	0.014	0.026	0.0218
Constante	0.43	-0.462	1.998***	3.182***	3.68**	3.823***
	0.777	1.081	0.271	0.792	1.6	1.23
Observations	37612	19607	18005	1803	898	905
Firms	7567	7217	7125	660	463	475
R-square	0.002	0.004	0.04	0.004	0.001	0.012
Wald	4.43 [0.218]	5.49 [0.1391]	50.75 [0.000]***	6.79 [0.07] *	3.76 [0.289]	6.54 [0.088] *

Notes:
Standard errors below coefficients
Random effects GLS regressions

Since the previous results suggest the presence of a balance sheet effect for our sample of firms, they tend to contradict BC's finding of a *positive* effect on investment of holding dollar debt during devaluations. Nonetheless, to confirm that this difference stems from differences in the data employed rather than from the specification considered, we perform alternative versions of BC's regressions for our sample. We estimate[19] the following investment equation:

$$(1) \qquad I_{it} = \bar{\beta}_1 + \mu_i + \beta_2\left(D^*_{i,t-1} \times \Delta e_{BSt}\right) + \beta_6 D^*_{i,t-1} + \vec{\beta}_{10}\mathrm{X}_{i,t} + \varepsilon_{i,t}$$

where, I_{it} is the *rate* of fixed capital investment at time *t* for firm *i*, with investment in property, plant and equipment normalized by total assets. The main effect that we want to capture is the interaction between the inflation-adjusted devaluation of the bilateral exchange rate (with the U.S., e_{BSt}), and dollar debt at the beginning of *t*, $D^*_{i,t-1} \times \Delta e_{BSt}$. Two alternative definitions of $D^*_{i,t-1}$ are considered: the ratio of lagged dollar debt to total assets and to total debt for firm *i*. Since foreign debt is presumably denominated in dollars, to capture the "balance sheet effect" we define exchange rate, e_{BSt} as the nominal bilateral exchange rate with the U.S. adjusted by domestic inflation. By interacting the (log) percentage change in this real exchange rate index with the share of foreign debt, we capture the differential effect that real exchange rate devaluation has on investment for

[19] Estimations undertaken using DPD for OX developed by Manuel Arellano, Stephen Bond and Jurgen A. Doornik.

firms with varying degrees of foreign debt exposure20. The specifications consider firm fixed effects. In (1) we define $\beta_{1i} = \overline{\beta} + \mu_{it}$ as the intercept for the ith firm with $\overline{\beta}$ as the mean intercept and μ_i the difference from this mean for the ith firm. An additional set of regressors including firms' leverage and sectoral GDP growth are summarized by X_{it}.

Alternative specifications of such regressions are reported in Table 9. In columns 1 and 2, dollar debt is normalized by total assets, whereas the two final columns include dollar debt to total debt. The first point that should be highlighted is that the direct and independent effect of the real exchange rate depreciation is consistently negative. Likewise, the interaction of the bilateral exchange rate devaluation with dollar debt is consistently negative and significant. This result stands in stark contrast with the one reported by BC for their sample of Latin American corporations. Our results suggest that holding dollar debt during devaluations is detrimental for investment. Moreover, in this set of estimations holding dollar debt makes matters worse. In columns 2 and 4 we directly control for the share of exports and imported inputs and their interaction with real exchange rate devaluation. Although lagged imports have a negative effect on fixed capital investment, none of the additional variables are significant and, more importantly, results for real exchange rate devaluation and its interaction with debt remain unchanged[21]. Regarding other controls, investment depends positively, and in a significant manner, on sectoral output growth, whereas firm's leverage does not have a significant effect[22].

[20] We performed estimations for end of period and average percentage change of e_{BSt}. To ease reading, we shall present results with the latter measure, noting which results change when end of period depreciation is considered instead.

[21] There might be a chance for measurement error in the export and import variables if firms do not export/import directly but rather through an intermediary. As explained above, imported inputs data is imputed from sectoral data but we do rely on balance sheet data on exports for our baseline estimations. When sectoral data for exports is included results are unchanged.

[22] Whereas dollar debt is interacted with the bilateral real exchange rate (BRER) devaluation, when devaluation enters independently it is measured by the effective (multilateral) real exchange rate (RER) devaluation. When the BRER depreciation is included instead, the resulting direct effect is still negative and much larger, yet in this case the interaction term ceases to enter significantly. Thus, the depreciation of the BRER has a detrimental effect on investment, irrespective of the denomination of debt.

Table 9. Fixed Capital Investment Regressions (BC)

Total Dollar Debt

Dependent variable: Fixed Capital Investment				
	(1)	(2)	(3)	(4)
DIRECT EFFECTS	dollar debt to total assets		dollar debt to total debt	
Δ Log (real exchange rate)	-0.0590216***	-0.0463386***	-0.0585038***	-0.0459509***
	(0.006381)	(0.008793)	(0.006426)	(0.008814)
INTERACTIONS				
Δ Log (end of period bilateral US "real exchange rate") x Dollar Debt	-0.0877725**	-0.086709**	-0.0506702**	-0.050536**
	(0.03905)	(0.03931)	(0.0209)	(0.02102)
Lagged Exports x Devaluation		0.000327988		0.00032903
		(0.0003513)		(0.0003509)
Lagged Imports x Devaluation		-0.000357374		-0.000351108
		(0.000265)		(0.000265)
CONTROLS				
Lagged "Dollar" Debt	-0.00887189	-0.00893557	-0.00330865	-0.00384471
	(0.01057)	(0.01061)	(0.004958)	(0.004946)
Lagged Exports		0.00145488		0.00151932
		(0.004338)		(0.004334)
Lagged Imports		-0.0122769***		-0.0123029***
		(0.00252)		(0.002521)
Leverage	0.00564034	0.00508707	0.00554653	0.00500553
	(0.003896)	(0.003889)	(0.00385)	(0.003844)
Sectorial Output Growth	0.0115091**	0.0171221***	0.0115748**	0.0171592***
	(0.005228)	(0.005524)	(0.00523)	(0.005524)
R^2	0.01547785	0.01806729	0.01547785	0.01806729
Observations	15900	15900	15900	15900
Wald Test (joint)	182.3 [0.000] **	207.0 [0.000] **	181.8 [0.000] **	205.8 [0.000] **

Notes
Estimates using within estimator, robust standard errors in parenthesis
p- values fo regression statistics appear in [ ]
***, significant at the 90% level, **at the 95%, *** at the 99%**

The previous results consider total dollar debt and this is largely composed of trade-related debt (which is probably not the type of debt usually considered in the balance sheet effect literature as it is directly linked to importing decisions). In Table 10 we present the basic BC estimations considering non-trade related dollar debt. In this case, the interaction term capturing the balance sheet effect is statistically equals to zero. The real exchange rate devaluation still has a negative effect and the only significant control is sectoral GDP growth with a positive effect.

In short, the results from Tables 9 and 10, which replicate in our own sample of firms the estimation undertaken by BC for a sample of Latin American corporations, indicate that there is a clear evidence of a negative effect of devaluations and that foreign indebtedness (if anything) makes matters worse.

Table 10. Fixed Capital Investment Regressions (BC)

Non-Trade Dollar Debt

Dependent variable: Fixed Capital Investment		
Independent variables		
INTERACTIONS		
Bilateral US "RER" devaluation x Dollar Debt (-1)	0.0411	0.011
	-0.066	(0.033)
DIRECT EFFECTS		
RER Devaluation	-0.062***	-0.0617***
	(0.0064)	(0.0064)
CONTROLS		
"Dollar" Debt (-1)	-0.0034	-0.0023
	(0.012)	(0.0052)
Leverage (-1)	0.0059	0.006
	(0.0039)	(0.0039)
Sectorial Output Growth	0.0112**	0.0114**
	(0.0052)	(0.005)
Observations	15900	15900
Firms	3188	3188
Wald (joint)	175.4 [0.000] **	175.5 [0.000] **
R^2	0.0150739	0.01510363

Notes: See Table 9

Although these estimations are a useful starting point, there are a number of limitations in the approach. In the first place, the only robust result refers to devaluation having a significant negative effect on firm investment[23]. Nonetheless, the interpretation of this direct coefficient is unclear. Actually, putting too much emphasis on any coefficient attached to macro variables is problematic because these variables, which are common to all firms and only vary across time, are likely to be correlated with a set of omitted macro variables that could be captured in a year-specific component of the error term. Thus, the coefficient attached to macroeconomic variables may be inconsistent. For instance, the strong negative coefficient of the direct devaluation term could actually proxy for a loss in consumer confidence in the period. In general, the short time-dimension of our panel makes causal interpretation of macroeconomic coefficients very problematic.

On more technical grounds, a major drawback of the estimations reported thus far is that, although the within estimator eliminates the inconsistency arising from the fact that firm-specific effects might be correlated with the set of independent variables, it does not account for the fact that most right hand side variables might be endogenous. Also, one might be interested in allowing the investment regressions to have a dynamic structure.

A Generalized Method of Moments (GMM) estimator based on the use of lagged observations of the dependent and explanatory variables allows us to deal with both of these

[23] This result is not only robust under BC's specification, but under a number of additional specifications in which additional macro and firm-level variables (such as the interest rate, the maturity of indebtedness, the tradability of output and the import component of inputs) were considered, as well as in a number of regressions were different estimation methods were employed.

problems (Arellano and Bover, 1995). To address the problem of possible omitted variable bias induced by firm specific effects, the regression equation is differenced. Also, to address the problem of joint endogeneity, suitably lagged values of the original (i.e. measured in levels) independent variables, including the lagged value of the dependent variable, are used as instruments for the right hand side variables (i.e. the differenced values of the original regressors) of the transformed equation. The validity of the moment conditions implicit in this "GMM difference estimator" are tested statistically. First, we present results for a Sargan test of over identifying restrictions that checks the overall validity of these moment conditions. Failure to reject this test indicates validity of the moment conditions. Under the maintained assumption that the error term of the original dynamic levels equation is serially uncorrelated, the transformed error term for the difference equation is expected to have serial correlation of first order, but no serial correlation of second order. Thus we report AR(1) and AR(2) tests on the lack of serial correlation for the transformed error term[24]. These test statistics are asymptotically normal under the null of no serial correlation.

A drawback of the first differenced GMM estimator is that the instruments available for the transformed regression equation are weak when the individual series have near unit root properties. Indeed, if the series are highly persistent, their differences are nearly innovations and there are no good instruments for near white noise series. Thus, the GMM difference estimator can be subject to finite sample biases. This potential bias can be reduced using the "GMM system estimator" proposed by Arellano and Bover (1995). This estimator combines the regression expressed in first differences with the original equation expressed in levels. As before, suitably lagged values of the dependent variables in levels are used as instruments for the differenced equation, whereas the equation in levels is instrumented with lagged differences of the explanatory variables. Both the Sargan and serial correlation tests are examined in this case. A Difference Sargan Test is also useful in this context, since the set of moment conditions specified under the simple difference estimator is a subset of the one considered in the system estimator[25]. The difference between the Sargan statistic obtained under the system estimator and the one obtained under the difference estimator is asymptotically distributed χ^2 with degrees of freedom given by the difference between the number of degrees of freedom of the system estimator and that of the difference estimator. Failure to reject the null hypothesis of the validity of additional restrictions gives support to the system estimator.

Taking the former considerations into account, we estimate alternative specifications in which we drop the non-interacted macro variables and include year specific effects to capture the overall macroeconomic environment affecting our sample of firms[26]. We concentrate our attention on the role of firm specific variables and, perhaps more importantly, their interaction with

[24] One may allow for the error term of the original levels equation to follow an autoregressive process of finite order, as long as there are enough time series to estimate the parameters. For example, if the original error term is MA(1), the differenced error term is MA(2) and only lags of the dependent variables dated *t-2* are available as instruments for the differenced equation. See Bond [2002] for an intuitive review on this and other issues concerning GMM estimators for dynamic panel data models. Unless otherwise stated, we stick to the assumption of no serial correlation in the residuals and use instruments dates *t-2* and earlier.

[25] The Difference Sargan Test is also useful in determining the lags available for instrumenting right hand side variables. Indeed, when right hand side variables are *endogenous*—correlated with present and past variables of the regression disturbance—lags dated *t-2* and onwards are available as valid instruments. If these variables are *predetermined*—correlated with past variables of the regression disturbance— then lags dated *t-1* also become available and if the variable is *strictly exogenous* then current values (dated *t*) are also available as valid instruments. In all specifications below, firm-specific characteristics are lagged one period, so we usually assumed that these variables are predetermined. Nonetheless, when more than one specification was valid according to Sargan tests, we relied on the Difference Sargan Test to choose the preferred specification.

[26] We also experimented by interacting firm-specific variables (like dollar debt, share of exports, and share of imports) with year dummies to examine whether the coefficients were different during the period in which the currency depreciates. These interactions never turned to be significant under any of the specifications.

macroeconomic variables. Obviously, we include the interaction between dollar debt at the beginning of *t* and alternative measures for the role of the real exchange rate[27]. Since the investment response to higher exchange rate levels might vary for firms with different degrees of output and input tradeability, we include interactions of exchange rate terms with lagged exports and with lagged imports. Also, as noted in Section 2, we might see firms investing more after a devaluation not because individually they benefit from a "competitiveness effect" but because collectively this allowed for a looser monetary policy. Likewise, we could see them investing less not because of a balance sheet effect of dollar indebtedness but because they face higher interest rates under a dogged defense of the currency. Since this would most likely affect firms that are highly indebted domestically in the short run, we include interest rate terms interacted with different measures of short term indebtedness.

Although we will present results for only one measure of bilateral real exchange rate, dollar debt, short-term debt, and exports, results do not change when alternative definitions are included[28]. Results for the modified specifications and for 4 types of estimation techniques are presented in Tables 11 to 14. We estimate some static fixed effects specifications, using orthogonal deviations in addition to the standard within estimator to test the robustness of our results. Regarding GMM estimations, Sargan Tests, as well as AR(1) and AR(2) tests performed satisfactorily for the GMM Difference regressions. Also, the additional moment restrictions implied by the GMM System estimator, valid under a mean stationary assumption for the set of variables to be instrumented, were not rejected according to the Sargan and Difference Sargan Tests in our specifications, and the AR(1) and AR(2) statistics show again satisfactory results. Thus, we present both the GMM Difference and System estimations[29].

It should also be noted that although we run regressions instrumenting for all the firm-specific explanatory variables, we report only a small subset of the estimations undertaken–-i.e. those in which we only instrument for the intuitively "most endogenous" variables, the level of foreign debt, leverage, and the maturity composition of debt. Also, although we run regressions using all available lags as instruments, we only report those in which three lags were used–-thereby minimizing the possibility of an "over fitting bias." A final point regarding econometrics is that, in this context, estimating the dynamic specifications with the fixed effects and OLS estimators is potentially useful, since the former is usually biased downwards and the latter upwards. For all reported estimations, we run OLS and fixed effects regressions to check that our GMM estimators, presumably consistent, lied between the two[30]. The difference in the estimators were often large, suggesting the presence of significant firm-specific effects.

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[27] We interacted firm level variables both with the *changes* in macro variables and with their *levels*. The latter approach could be motivated by an *accelerationist* approach (see Bond et. al., 1997) whereby the desired level of capital depends, for instance, on the level of the exchange and interest rates so that the ratio of investment to total assets (a proxy for the rate of growth of capital) depends on the devaluations rate and the rate of change of the interest rate. On the other hand, interaction with levels captures to what extent does investment as a proportion of assets change as a result of shifts in, say, the real exchange rate.

[28] The exchange rate devaluation refers to average devaluation of the bilateral real exchange rate, short term debt is the share of short term domestic debt, and exports are obtained at the level of the firm. In the case of exports and imports interactions a multilateral real exchange rate is considered instead. Regressions were run for end of period depreciation, the overall share of short term indebtedness and for sectoral data on exports. Results were mostly unchanged.

[29] Two step estimates with robust standard errors are presented. Second-step standard errors were computed using Windmeijer's (2000) finite-sample correction.

[30] Estimations are available upon request.

Table 11 presents a set of estimations for the case in which dollar debt is defined to include only non-trade related debt and firm level variables are interacted with measures for the *changes* in the macro variables (i.e. dollar debt, exports, and imports are interacted with the real exchange rate *devaluation*, whereas the degree of short term indebtedness is interacted with the (log) percentage change of the real interest lending rate). The most salient feature of these regressions is that we fail to find any significant heterogeneity in terms of the response of firms to exchange and interest rate movements depending on their particular level of dollar indebtedness, export orientation, imported inputs, and maturity profile. Actually, the terms included in our fixed effects regressions (besides from the time specific effects) are not jointly significant. In the case of the dynamic GMM regressions, there is clear evidence of persistence in the level of investment undertaken by firms, but key interactions are once again not significant. Only under the GMM System regression we find a significant effect of firm level characteristics on investment, namely, a positive effect of short term debt, total leverage, and share of imports. In this case, sectoral GDP growth also exerts a significant positive effect on the level of investment.

When macro variables are interacted in levels as in Table 12, we are able to capture somewhat more heterogeneity. In particular, the interaction of the real exchange rate index with exports is positive and significant in every but the GMM difference specification. On the other hand, although the interactive balance sheet term of dollar debt and the real exchange rate is negative, it is not significant. Under one of the fixed effects specification, the interaction of the real interest rate and short term debt enters significantly and with the expected negative sign. Regarding non-interacted firm level variables, the only important change refers to the level of exports having a negative effect on investment under the fixed effect and system GMM regressions. As before, time effects are significant, and there is evidence of persistence in investment rates.

Since a small share of firms hold non trade related dollar debt, in Tables 13 and 14 we repeat the regressions of Tables 11 and 12 considering the total dollar debt and its interaction with real exchange rate terms as dependent variables. When macroeconomic variables enter the interactions in changes (Table 13) results hardly change, whereas in the case of level interactions (Table 14) the most significant change refers to the balance sheet interaction term between dollar debt and the exchange rate having a negative and significant effects.

Table 11. Fixed Capital Investment Regressions

RER devaluation interactions, non-trade dollar debt

Dependent variable: Fixed Capital Investment				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step***	**GMM Difference 2 step***
Dependent Variable (-1)			0.053502***	0.0595772***
			(0.01083)	(0.01058)
INTERACTIONS				
Bilateral US "RER" devaluation x Dollar Debt (-1)	0.0599122	0.0551037	0.0394215	0.0295692
	(0.0666)	(0.06661)	(0.0601)	(0.06721)
Share of Exports (-1) x RER devaluation	0.000354403	0.000316228	0.000270528	0.000248216
	(0.0003543)	(0.0003543)	(0.0004216)	(0.0004034)
Share of Imports (-1) x RER devaluation	-0.000224202	-0.000244386	-0.00067575	-0.000795185
	(0.0002676)	(0.0002585)	(0.00093)	(0.001105)
Real interest lending rate % change x Short Term Domestic Debt (-1)	-0.017154	-0.0226013	0.0240819	-0.00258244
	(0.01873)	(0.01858)	(0.0259)	(0.0262)
CONTROLS				
Short Term Domestic Debt (-1)	0.00180248	0.00176761	0.00351608	0.00433332**
	(0.001427)	(0.001429)	(0.003172)	(0.001914)
Leverage (-1)	-0.000416352	-0.000412172	0.0381845	0.0491533***
	(0.003835)	(0.003843)	(0.02884)	(0.017)
Dollar Debt (-1)	-0.00163133	-0.00192167	-0.0110864	-0.0164009
	(0.01265)	(0.01265)	(0.0175)	(0.01779)
Exports (-1)	0.00384874	0.00391591	-0.00059051	0.00408227
	(0.004449)	(0.004437)	(0.008164)	(0.004776)
Imports (-1)	-0.00340769	-0.00310793	0.000945745	0.0264567*
	(0.003201)	(0.0032)	(0.0124)	(0.015)
Sectorial Output Growth	-0.0012415	-0.000121977	0.0283447	0.0567363**
	(0.008701)	(0.008588)	(0.02429)	(0.02442)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	12.43 [0.257]	12.92 [0.228]	43.79 [0.000] **	83.21 [0.000] **
Wald Test (time)	206.6 [0.000] **	207.4 [0.000] **	92.99 [0.000] **	120.4 [0.000] **
Sargan Test			47.49 [0.535]	72.31 [0.369]
Difference Sargan Test				24.82 [0.208]
AR(1)			-10.05 [0.000] **	-10.06 [0.000] **
AR(2)			0.9133 [0.361]	1.067 [0.286]

Notes: Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Table 12. Fixed Capital Investment Regressions

RER level interactions, non-trade dollar debt

Dependent variable: Fixed Capital Investment				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step***	**GMM System 2 step***
Dependent Variable (-1)			0.0523789***	0.058666***
			(0.0108)	(0.01031)
INTERACTIONS				
Bilateral US "RER" x Dollar Debt (-1)	-0.00101053	-0.000939282	-0.000825999	-0.000149967
	(0.0007627)	(0.0007606)	(0.0007182)	(0.0007319)
Share of Exports (-1) x RER	0.000396796**	0.000388392**	0.000359156	0.000547929**
	(0.000198)	(0.0001976)	(0.0003388)	(0.0002592)
Share of Imports (-1) x RER	-0.00037182	-0.000367705	-0.000494522	-0.00108082
	(0.0002838)	(0.0002371)	(0.001058)	(0.001072)
Real interest lending rate x Short Term Domestic Debt (-1)	-0.000349247	-0.000433053*	0.00000101348	0.0000292491
	(0.0002391)	(0.0002439)	(0.0003743)	(0.0003511)
CONTROLS				
Short Term Domestic Debt (-1)	0.0404265	0.0496728*	0.00323491	0.0074255
	(0.02662)	(0.02714)	(0.04178)	(0.03916)
Leverage (-1)	-0.000513609	-0.000524875	0.0478343	0.0486141***
	(0.003821)	(0.003824)	(0.03034)	(0.0164)
Dollar Debt (-1)	0.0583365	0.0538135	0.038609	-0.00981506
	(0.05105)	(0.05092)	(0.05049)	(0.05112)
Exports (-1)	-0.0371652*	-0.036298	-0.0329123	-0.0540121*
	(0.0225)	(0.02247)	(0.03207)	(0.02848)
Imports (-1)	0.0344353	0.0345167	0.0547159	0.141954
	(0.02892)	(0.0245)	(0.109)	(0.1127)
Sectorial Output Growth	-0.00149374	0.0000370776	0.0197732	0.05973***
	(0.008512)	(0.008422 -)	(0.02041)	(0.02152)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	20.74 [0.023] *	22.22 [0.014] *	43.65 [0.000] **	89.62 [0.000] **
Wald Test (time)	183.8 [0.000] **	184.8 [0.000] **	88.20 [0.000] **	115.5 [0.000] **
Sargan Test			45.05 [0.634]	70.36 [0.432]
Difference Sargan Test				25.31 [0.190]
AR(1)			-10.07 [0.000] **	-10.01 [0.000] **
AR(2)			0.8632 [0.388]	1.078 [0.281]

Notes:
Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Table 13. Fixed Capital Investment Regressions

RER devaluation interactions, total dollar debt

Dependent variable: Fixed Capital Investment				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step***	**GMM Difference 2 step***
Dependent Variable (-1)			0.0523064***	0.0553523***
			(0.01102)	(0.01053)
INTERACTIONS				
Bilateral US "RER" devaluation x Dollar Debt (-1)	0.0614696	0.0566169	0.0451111	0.0605907
	(0.0457)	(0.04567)	(0.05654)	(0.05928)
Share of Exports (-1) x RER devaluation	0.000340307	0.00030287	0.00025194	0.00010777
	(0.0003545)	(0.0003544)	(0.0004249)	(0.0004062)
Share of Imports (-1) x RER devaluation	-0.000240743	-0.000260234	-0.000691665	-0.000307248
	(0.0002677)	(0.0002587)	(0.0009335)	(0.001087)
Real interest lending rate % change x Short Term Domestic Debt (-1)	-0.0164595	-0.0218592	0.0331093	0.0054487
	(0.01872)	(0.01859)	(0.02588)	(0.02638)
CONTROLS				
Short Term Domestic Debt (-1)	0.00177118	0.00173695	0.00376401	0.00339489*
	(0.001426)	(0.001429)	(0.003223)	(0.00192)
Leverage (-1)	-0.000868109	-0.000850977	0.0359274	0.0654191***
	(0.003842)	(0.003849)	(0.03207)	(0.0164)
Dollar Debt (-1)	0.00848216	0.00796909	-0.0155155	-0.0149879
	(0.01039)	(0.01039)	(0.02182)	(0.01844)
Exports (-1)	0.00390748	0.00397015	0.000334874	0.00547964
	(0.004445)	(0.004433)	(0.008247)	(0.004779)
Imports (-1)	-0.00325286	-0.00298825	-0.0025057	0.0174753
	(0.003205)	(0.0032)	(0.01225)	(0.01411)
Sectorial Output Growth	-0.0011823	0.0000745201	0.0234355	0.0526719**
	(0.008701)	(0.008587)	(0.02414)	(0.02467)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	12.54 [0.251]	12.97 [0.225]	44.68 [0.000] **	87.08 [0.000] **
Wald Test (time)	207.5 [0.000] **	208.3 [0.000] **	91.22 [0.000] **	122.4 [0.000] **
Sargan Test			48.40 [0.497]	70.11 [0.440]
Sargan Difference Test				21.71 [0.356]
AR(1)			-10.06 [0.000] **	-10.07 [0.000] **
AR(2)			0.8685 [0.385]	0.8575 [0.391]

Notes:
Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Table 14. Fixed Capital Investment Regressions

RER level interactions, total dollar debt

Dependent variable: Fixed Capital Investment				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step**	**GMM System 2 step**
Dependent Variable (-1)			0.0506968***	0.054832***
			(0.01095)	(0.01027)
INTERACTIONS				
Bilateral US "RER" x Dollar Debt (-1)	-0.000964838*	-0.000900479*	-0.000959505*	-0.000693349
	(0.000534)	(0.000533)	(0.00056)	(0.0005365)
Share of Exports (-1) x RER	0.00039373**	0.000385229*	0.000428142	0.000512323**
	(0.0001977)	(0.0001973)	(0.0003414)	(0.0002545)
Share of Imports (-1) x RER	-0.00037366	-0.000375812	-0.000667808	-0.00092777
	(0.0002837)	(0.0002374)	(0.001024)	(0.001027)
Real interest lending rate x Short Term Domestic Debt (-1)	-0.00036189	-0.000442403*	0.00000284048	0.0000595301
	(0.0002393)	(0.0002441)	(0.0003677 -)	(0.0003462)
CONTROLS				
Short Term Domestic Debt (-1)	0.0417945	0.0506775*	0.0034296	-0.00318957
	(0.02664)	(0.02716)	(0.04095)	(0.03861)
Leverage (-1)	-0.000920012	-0.000923009	0.0498972	0.0630387***
	(0.003828)	(0.003831)	(0.03498)	(0.01569)
Dollar Debt (-1)	0.0644469*	0.0602553*	0.0392485	0.0187463
	(0.03638)	(0.03633)	(0.04522)	(0.03897)
Exports (-1)	-0.0367998	-0.0359251	-0.0384374	-0.0491694*
	(0.02247)	(0.02244)	(0.03216)	(0.02787)
Imports (-1)	0.0347476	0.0354264	0.0711522	0.119956
	(0.02891)	(0.02453)	(0.1055)	(0.1076)
Sectorial Output Growth	-0.00145962	0.00000217467	0.0121894	0.0524441**
	(0.008504)	(0.008416-0)	(0.02007)	(0.02159)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	21.24 [0.019] *	22.45 [0.013] *	45.96 [0.000] **	94.20 [0.000] **
Wald Test (time)	179.4 [0.000] **	180.8 [0.000] **	85.94 [0.000] **	118.3 [0.000] **
Sargan Test			44.25 [0.666]	67.24 [0.537]
Sargan Difference Test				22.9 [0.289]
AR(1)			-10.08 [0.000] **	-10.03 [0.000] **
AR(2)			0.8154 [0.415]	0.9120 [0.362]

Notes:
Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Table 15. Profits Regressions

RER level interactions, non-trade dollar debt

Dependent variable: Profits				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step***	**GMM System 2 step***
Dependent Variable (-1)			-0.295544	0.0262638
			(0.27)	(0.399)
INTERACTIONS				
Bilateral US "RER" x Dollar Debt (-1)	-0.0188625**	-0.0169787**	-0.00843483*	-0.00604187*
	(0.031)	(0.028)	(0.089)	(0.06)
Share of Exports (-1) x RER	-0.00280278	-0.00224577	0.00346564	0.00560315**
	(0.407)	(0.511)	(0.191)	(0.012)
Share of Imports (-1) x RER	0.00364273*	0.0233152	-0.00726833	-0.0268092***
	(0.051)	(0.157)	(0.355)	(0.008)
Real interest lending rate x Short Term Domestic Debt (-1)	-0.0015174	-0.00464446**	0.00277901	0.0000403485
	(0.468)	(0.02)	(0.287)	(0.983)
CONTROLS				
Short Term Domestic Debt (-1)	0.268482	0.613559**	-0.34093	0.00247722
	(0.185)	(0.027)	(0.242)	(0.991)
Leverage (-1)	0.172224	0.156111	0.351469	0.296041**
	(0.278)	(0.335)	(0.451)	(0.04)
Dollar Debt (-1)	1.2092**	1.08787**	0.419611	0.288606
	(0.032)	(0.029)	(0.33)	(0.227)
Exports (-1)	0.418229	0.358826	-0.378174	-0.616729**
	(0.379)	(0.452)	(0.217)	(0.011)
Imports (-1)	-0.452395**	-2.37544	0.742191	3.10639***
	(0.029)	(0.147)	(0.398)	(0.008)
Sectorial Output Growth	-0.21644	-0.30548	0.0756018	0.390098
	(0.319)	(0.295)	(0.569)	(0.121)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	28.50 [0.001] **	32.60 [0.000] **	14.06 [0.230]	16.05 [0.139]
Wald Test (time)	8.228 [0.144]	6.301 [0.278]	7.135 [0.211]	9.933 [0.128]
Sargan Test			54.5 [0.273]	79.43 [0.183]
Sargan Difference Test				24.93 [0.204]
AR(1)			-0.9876 [0.323]	-1.377 [0.168]
AR(2)			0.2931 [0.769]	0.8119 [0.417]

Notes:
Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Table 16. Profits Regressions

RER level interactions, total dollar debt

Dependent variable: Profits				
Independent Variables	**Fixed Effects Within**	**Fixed Effects Orthogonal**	**GMM Difference 2 step***	**GMM System 2 step***
Dependent Variable (-1)			-0.30316	0.0262853
			(0.261)	(0.03052)
INTERACTIONS				
Bilateral US "RER" x Dollar Debt (-1)	-0.0190567**	-0.0171145**	-0.00566066	-0.00516707*
	(0.007999)	(0.006846)	(0.00372)	(0.003034)
Share of Exports (-1) x RER	-0.00289572	-0.00233797	0.00312912	0.00545837**
	(0.003384)	(0.003412)	(0.002335)	(0.002108)
Share of Imports (-1) x RER	0.0035938*	0.0231135	-0.00486003	-0.0248797***
	(0.001851)	(0.0164)	(0.006839)	(0.008738)
Real interest lending rate x Short Term Domestic Debt (-1)	-0.00183356	-0.00486446**	0.00279022	0.00000172229
	(0.002031)	(0.00203)	(0.002357)	(0.002089 0)
CONTROLS				
Short Term Domestic Debt (-1)	0.303465	0.637929**	-0.339202	0.00526011
	(0.2023)	(0.2843)	(0.2682)	(0.232)
Leverage (-1)	0.171302	0.155471	0.334657	0.310899*
	(0.1602)	(0.1633)	(0.3132)	(0.1611)
Dollar Debt (-1)	1.23057**	1.10223**	0.0314837	0.04889
	(0.517)	(0.4408)	(0.3784)	(0.2924)
Exports (-1)	0.428571	0.369015	-0.336792	-0.60002**
	(0.4758)	(0.4771)	(0.2741)	(0.2347)
Imports (-1)	-0.444554**	-2.35315	0.498146	2.91438***
	(0.2051)	(1.631)	(0.7961)	(1.011)
Sectorial Output Growth	-0.217292	-0.306375	0.140247	0.444849
	(0.2172)	(0.2916)	(0.1763)	(0.2935)
TIME EFFECTS	YES	YES	YES	YES
Observations	15900	15900	15900	15900
Firms	3188	3188	3188	3188
Wald Test (joint)	34.13 [0.000] **	37.31 [0.000] **	12.68 [0.315]	17.42 [0.096]
Wald Test (time)	9.291 [0.098]	7.096 [0.214]	6.493 [0.261]	10.39 [0.109]
Sargan Test			60.7 [0.122]	79.62 [0.179]
Sargan Difference Test				18.92 [0.527]
AR(1)			-0.9896 [0.322]	-1.380 [0.167]
AR(2)			0.2866 [0.774]	0.8169 [0.414]

Notes:
Robust standard errors in parenthesis
***Two step results using robust standard error, Windmeijer's finite sample correction**
p-values for regression statistics appear in [ ]
*** significant at the 90% level; ** at the 95%; *** at the 99%**

Finally, in Tables 15 and 16 we change our definition of our dependent variable and consider the behavior of profits (as % of total assets). Right hand side variables are the same as those considered in previous estimations, and the macro variables in the interactions enter in levels[31]. Interestingly,

[31] Indeed, it is not straightforward to motivate, as in the case of investment, regressions that consider the rate of devaluation and the rate of change of the interest rate as right hand side variables resulting form an accelerationist approach. Rather, one would like to uncover the role of exchange rate shifts on the level of profits.

both when we include non trade dollar debt (Table 15) or total dollar debt (Table 16), we obtain a significant negative effect of its interaction with the exchange rate. This result is somewhat puzzling since if (as we have assumed) net worth affects investment levels, decreased profits should imply lower investment. In these regressions there is also some evidence that exporting firms tend to have larger increases in their profits in times of devaluations, whereas the impact of having a higher share of imported inputs is unrobust. A noteworthy result is that, unlike investment, there appears to be no persistence in firm profitability. Regarding the role of additional firm level variables, results are not robust to alternative specifications. For instance, whereas the fixed effects regressions indicate that dollar indebted firms tend to have higher profits on average, once we control for endogeneity this impact is not significant.

In sum, this section suggests that, while there is evidence of a negative balance sheet effect on firms' performance as measured by profitability, results for investment are rather mixed. On the one hand, we find that firms that are not highly indebted in dollars and export part of their output tended to outperform dollar-indebted, non-exporting firms. Nonetheless, the interaction of dollar indebtedness with the exchange rate terms is generally not significant in the investment regressions. Another noteworthy result from our estimations is the fact that the real interest rate interaction, arguably an important determinant of firm investment, is rarely significantly negative[32].

4.3 Troubled firms

TO BE PROVIDED

5 Conclusions

The recent behavior of the Colombian economy has been characterized by increased macroeconomic volatility. After a period of significant currency appreciation associated with important capital inflows, the exchange rate experienced a strong real depreciation in response to capital flight. While among policy makers the favorable view of exchange rate devaluation for firm investment has prevailed, there is a recent and increasing concern in the literature for the possible detrimental effects of devaluations in the presence of foreign indebtedness. Foreign denominated currency, it is argued, leads to a negative balance sheet effect that constraint firms' investment.

This paper is an attempt to contribute to this debate on empirical grounds. We examine the determinants of investment for a large sample of Colombian firms in the period 1995-2001. Our results suggest that matching does seem to take place in our sample of firms, to the extent that firms in more open sectors and exporting firms are engaged more often in foreign indebtedness and have higher shares of dollar debt. Nonetheless, firm size is the most robust and significant determinant of dollar indebtedness. Although the previous results and the limited amount of dollar denominated indebtedness in Colombia tilt the balance *against* finding any negative balance sheet effect of devaluations, we find evidence of a negative balance sheet effect on firms' performance as measured by profitability. Results for investment, on the other hand, are rather mixed. Although we find that firms that are not highly indebted in dollars and export part of their output tended to outperform

[32] This finding is consistent with previous studies on the determinants of investment at the macro level. For instance, Ocampo *et. al.* (1988) survey the evidence on the determinants of investment in Colombia and conclude that, with a few exceptions, there is no significant impact of the real interest rate on investment. These results are confirmed by Fainboim (1990) who finds that the price of capital and tax policy are important determinants of investment, whereas the real interest rate is relevant only for a few sectors.

dollar-indebted, non-exporting firms, the interaction of dollar indebtedness with the exchange rate terms is generally not significant in the investment regressions.

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Appendix 1. Variable definition

In this appendix, we list the main variables used in the analysis. As explained in Section 3, some firm-level data was combined with aggregate macroeconomic or sectoral data in constructing relevant variables. In particular, import input shares were imputed to each firm by mapping each firm's sector with the most disaggregated sector available in National Accounts Data. Sectoral imported input shares were computed in turn as the ratio of imported intermediate purchases by each sector to total intermediate purchases, both domestic and imported. Such data is available from the economy-wide input-output matrix, with 60 sectors being the thinner disaggregation available. Also, in constructing the rate of inventory investment, the real change in inventories was computed by deflating the original firm level data by the most disaggregated data available on sectoral producer price indices (PPI). In those cases were there was no satisfactory disaggregation of the PPI to match the firm's sector, the total national PPI was used. Further details on variables' construction are available form the authors upon request.

Debt Variables

1. Total Debt=Total liabilities. Balance sheet.
2. Short-term Debt=Total liabilities due in less than one year. Balance sheet.
3. Foreign or "Dollar" Debt= Liabilities with foreign banks, corporations and foreign suppliers (long and short-term). Balance sheet annex, no. 9.
4. Short-term Foreign Debt=Short-term liabilities with foreign banks, corporations and foreign suppliers. Balance sheet annex, no. 9.
5. Foreign Financial Debt= Liabilities with foreign banks and corporations (long and short-term). Balance sheet annex, no. 9.
6. Foreign Trade Debt= Liabilities with foreign suppliers. Balance sheet annex, no. 9.
7. Domestic Debt= Liabilities with domestic banks, corporations and national suppliers (long and short-term). Balance sheet annex, no. 9.
8. Short-term Domestic Debt=Current liabilities with domestic banks, corporations and suppliers. Balance sheet annex, no. 9.
9. Domestic Financial Debt= Liabilities with domestic banks and corporations (long and short-term). Balance sheet annex, no. 9.
10. Domestic Trade Debt= Liabilities with national suppliers. Balance sheet annex, no. 9.
11. Leverage=Total liabilities as a share of total assets in the balance sheet.

Investment Variables

1. Investment in fixed capital= Net purchase of properties, plant and equipment. Income statement. For estimation, this variable is expressed as % of total assets.

Other Relevant Variables

1. Total assets. Balance sheet.
2. Exports= Operational income generated abroad. Balance sheet annex, no. 15.
3. Imports= Purchases of goods not produced by the firm and of raw materials abroad. Balance sheet annex, no. 15.
4. Net Exports= Total exports minus total imports. Balance sheet.
5. Interest expense: accrued interest on financial liabilities. Balance sheet annex, no.6.

Macroeconomic Variables

1. Real exchange rate index and bilateral exchange rate. Source: Banco de la República.
2. Real interest rate. Source: Superintendencia Bancaria.
3. Sectoral output and sectoral output growth. Source: DANE.