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Debt Composition and Balance Sheet Effects of Currency Depreciation: Empirical Evidence

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Abstract

This paper surveys recent empirical evidence on the determinants of the currency composition of debt, and on the impact of exchange rate fluctuations on economic activity and investment when currency mismatches are present. Microeconomic evidence suggests that Latin American firms tend to match the composition of their debt with the currency composition of their income stream. At a macro level as well as at a micro one, evidence suggests that liability dollarization can reduce or possibly reverse the typical Mundell-Fleming result of expansionary devaluations.

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1. Introduction

During the second half of the 1990s emerging market countries witnessed a series of financial crises that gave new strength to the debate on the effects of real exchange rate fluctuations on economic performance. The "Tequila" crisis of 1994-95 and the Asian meltdown of 1997 led many observers to suggest that the presence of debt denominated in foreign currency can reverse the expansionary impact of exchange rate depreciations common to the standard Mundell-Fleming framework.[1]

Krugman (1999a), Aghion, Bachetta and Banerjee (2001, 2003), and Céspedes, Chang and Velasco (2002) were among the first to utilize what is now known as the open economy Bernanke-Gertler-Gilchrist framework to show that, in the presence of foreign currency debt, currency depreciations may be contractionary.[2] Krugman (1999a, 1999b) argued that liability dollarization can help in explaining the Asian crisis as a situation in which "seemingly irrelevant events caused a self-fulfilling loss of confidence, and conventional macroeconomic remedies were not available." Along similar lines, Dornbusch (1998) suggests that emerging market countries are inherently financially fragile and vulnerable to sudden stops in capital flows because firms have both dollar debt and short-term debt in local currency (a situation that Eichengreen and Hausmann, 1999, later label "Original Sin"). While the former can lead to

[1] Moreover, analysts have suggested that liability dollarization itself can play a leading role in provoking a self-fulfilling crisis. Discussions can be found in Dornbusch (1998), Krugman (1999a, 1999b) and Calvo, Izquierdo and Talvi (2003). Calvo, Izquierdo and Mejia (2003) provide empirical evidence of the importance of liability dollarization as a predictor of sudden stops in capital flows for a sample of 32 emerging market countries. Previous work focused on industrialized countries suggested that depreciation could be contractionary through an imported input channel (see for instance, Campa and Goldberg (1999) and Nucci and Pozzolo (2001).

[2] In the standard closed economy Bernanke and Gertler (1989) model, a costly state verification set up makes the cost of capital depend (inversely) on the firm's net worth. See also Gertler, Gilchrist,and Natalucci (2003) and Faia and Monacelli (2002) for an application to the open economy.

contractionary depreciations, the latter limits the ability of central banks to increase interest rates to defend the currency.

Céspedes, Chang and Velasco (2002) show that the presence of liability dollarization (dollarization here stands for choosing debt denominated in any foreign currency) does not necessarily lead to contractionary depreciations. In particular, they show that depreciations can be contractionary only in the presence of very large levels of foreign currency debt and large imperfections in international capital markets.[3] So, according to Céspedes, Chang and Velasco, the answer to the question "Does liability dollarization lead to non-standard effects of monetary and exchange rate policy?" is "it all depends," or, as economists like to say, it is an empirical question.

Given that theoretical models do not yield unambiguous results ultimately the answer to the question of whether balance sheet effects may make currency depreciations contractionary (or the related question on which exchange rate regime should be adopted by emerging market countries) needs to be answered on empirical grounds. While some research has found that depreciations can be contractionary at an economy-wide level, the precise channels through which this occurs and their quantitative importance still need to be identified.[4] In particular, it is fundamental to assess whether there is any empirical evidence that supports the existence of a significant and sizeable balance sheet effect associated with the dollarization of liabilities at the firm level. If firms were perfectly hedged, currency depreciations should not have any relevant negative balance sheet consequences.

[3] In fact, Céspedes, Chang and Velasco (2002) find that the steady-state levels of debt and risk premia that are necessary to generate contractionary depreciations are unrealistically large.

[4] In an empirical study using a panel of macro data for developed and developing countries, Galindo, Panizza and Schiantarelli (2003) find that devaluations can have a contractionary impact in countries with heavy liability dollarization.

This is an extremely important question because the possible presence of negative balance sheet effects has important implication for economic policy, for the design of adequate regulatory frameworks to deal with dollarization risks, and for the debate on the optimal exchange rate regime. Some authors suggest that the presence of liability dollarization should not lead emerging market countries to the adoption of fixed exchange rate regimes (Chang and Velasco, 2000, Mishkin, 1998, Sachs and Larrain, 1999, and Gertler, Gilchrist, and Natalucci, 2003) and that emerging market countries should avoid the most damaging effects of large depreciation by adopting temporary capital controls (Krugman, 1999a). On the other side of the ring, advocates of super-fixed exchange rate systems (which included, among others, Calvo, 2000, Dornbusch, 2000, and Hausmann, 1999) have highlighted the risks of non-credible pegs and made the point that, as emerging market countries have a very limited ability to conduct counter-cyclical monetary policy, they should just give up the option and adopt a system that delivers maximum credibility. Yet other economists suggest that the optimal exchange rate is both country and time dependent (Frankel, 1999) or point out that the choice of the exchange rate regime is a false problem. What really matters are the institutional arrangements that make emerging market countries fundamentally different from high-income countries. So, the problem does not lie in the choice of the exchange regime but in the presence of weak institutions (Calvo and Mishkin, 2003).

This paper is organized as follows. Section 2 uses cross-country aggregate data to present some evidence of the presence of a link between liability dollarization and contractionary depreciations. Section 3 surveys the literature that aims at uncovering balance sheet effects by using firm-level data, paying particular attention to six recent studies that focus on the largest Latin American economies. Section 4 concludes.

2. The Macro Evidence

As discussed in the introduction, theoretical models do not provide clear-cut answers to the question of whether currency depreciations are expansionary. The presence of a balance sheet effect can reverse the conventional Mundell-Fleming finding in which a depreciation of the currency should lead to economic expansion. Until recently, however, empirical studies on the possible presence and magnitude of balance sheet effects were extremely limited, and very often strong statements on the desirability of a given exchange rate regime were made on the basis of some stylized facts or, even worse, on the basis of "one observation econometrics."[5]

A useful starting point is to consider the bivariate correlation between the GDP per capita growth rate and the log change in the real exchange rate. Table 1 contains the results for an unbalanced panel of 62 countries over the 1993-2000 period. It shows that for the full sample there is a negative correlation between depreciation and growth. The correlation is statistically significant and large; a 10-percent depreciation is associated with a drop in growth of 1.2 percentage points. To look at the effect of liability dollarization, we split the sample into two groups, depending upon their ability to borrow abroad in their own currency.[6] We use the index of "original sin" built by Eichengreen Hausmann and Panizza (2003), and we include in the first group those countries for which the share of total non-official external debt in foreign currency

[5] In the mid 1990s, the relative resilience of Argentina during the Tequila crisis was used as an example of the superiority of a super-fixed exchange rate regime. In the last few years, however, Argentina has instead been used as an example of the costs of a super-fixed exchange rate regime.

[6] We use this index because if a country cannot borrow abroad in its own currency when it accumulates a net debt it will have an aggregate currency mismatch on its balance sheet (see Eichengreen, Hausmann, and Panizza, 2003).

exceeds the 75 percent cutoff adopted by Hausmann and Panizza (2003).[7] In the second group, we include the remaining countries. Column 2 shows that in countries that borrow abroad in their own currency there is no correlation between growth and real depreciation. However, the correlation is very strong, negative, and significant in countries that do not borrow abroad in their own currency.

As the ability to borrow abroad in own currency is somewhat positively correlated with the level of development (even though the correlation is not very strong; see Eichengreen, Hausmann and Panizza, 2003), we further split our sample into developing and industrial countries. The negative correlation between depreciation and growth holds in each of the two sub-samples, although it is stronger and more significant for industrial countries. As before, we find no correlation between depreciation and growth for industrial countries with low external debt in foreign currency. The correlation is, instead, positive and significant for developing countries with low external debt in foreign currency (however, the sample is very small). When we focus on countries that borrow heavily abroad in foreign currency, the correlation is negative and significant both for industrial and developing countries, although it is larger in absolute value and more significant for developing countries.

While the results of Table 1 are suggestive of the possibility that an adverse balance sheet effect may more than counterbalance the positive competitiveness effect of a depreciation, they

[7] This is the index of Original Sin developed by Eichengreen, Hausmann, and Panizza (2003). The index is defined as follows: $OSIN_i = \max\left(1 - \frac{\text{Securities in currency } i}{\text{Securities issued by country } i}, 0\right)$. Eichengreen, Hausmann, and Panizza include all securities issued in a given currency regardless of the nationality of the issuer because bonds issued by non-residents can be used by residents to swap their foreign currency obligations. This opportunity to hedge would not be captured by an index that only includes debt issued by residents. Clearly, $\frac{\text{Securities in currency } i}{\text{Securities issued by country } i}$ can be greater than one. However, Eichengreen, Hausmann, and Panizza bound *OSIN* at zero because countries cannot hedge more debt than they have.

are just simple correlations that do not control for a host of other factors that are likely to influence growth and could be correlated with depreciation and the presence of foreign currency debt. In fact, they yield the rather counterintuitive result that depreciations are never expansionary. To the best of our knowledge there are only two studies (Céspedes, 2003, and Galindo, Panizza, and Schiantarelli, 2003) that use macroeconomic data to investigate whether the presence of dollar debt affects the relationship between economic activity and exchange rate depreciation. Both papers find that the presence of dollar debt reduces (up to the point of possibly making it negative) the expansionary effect of currency depreciations. Galindo, Panizza, and Schiantarelli (2003) augment a standard growth specification with a variable measuring exchange rate depreciation, a variable measuring foreign currency debt and the interaction of the two variables. The estimated models are variants of the following equation:

$$Growth_{i,t} = \alpha \Delta RER_{i,t} + \beta DDEBT_{i,t} + \delta \Delta RER_{i,t} * DDEBT_{i,t} + X_{i,t}\lambda' + \mu_i + \varepsilon_{i,t} \qquad (1)$$

where ΔRER measures exchange rate depreciation (a positive value corresponds to a depreciation, a negative value to an appreciation), DDEBT the share of foreign currency debt, X is a set of standard controls (the basic data are from Levy-Yeyati and Sturzenegger, 2001), μ is a country fixed effect, and ε the error term.[8] There is no clear prediction for β, but one would expect α to be positive (due to a standard Mundell-Fleming argument) and δ to be negative

[8] To measure the share of foreign currency debt, we use the index of original sin (measuring the currency composition of international debt) assembled by Eichengreen, Hausmann and Panizza (2002). The dependent variable is the annual growth rate of GDP per capita and the explanatory variables are lagged GDP (LLGDPC) lagged investment to GDP ratio (LINVGDP), population growth (LPOPGR), total population (LPOP), lagged growth of government consumption (LGOV), lagged political instability (LCIVIL), terms of trade shocks (DLOGTT), the Frankel and Romer measure of openness (OPENIV), and dummies for Sub Saharan Africa (SAFR),

(because of possible balance sheet effects). Galindo et al. find indeed that δ is negative and significant across a wide range of specifications, allowing for different controls and for the coefficient to differ across industrial and developing countries. It is also robust to different choices of estimator (such as OLS, Random Effects, Fixed effects, GMM).[9] Quantitatively, the results suggest that in countries that do not have foreign currency debt (such as the United States) a 10-percent depreciation is associated with an increase in growth of approximately 0.7 percentage points (even though the effect is not statistically significant).[10] In countries where all the external debt is in foreign currency (such as most Latin American countries), a 10-percent depreciation is associated with a decrease in growth of 1.6 percentage points.

While the cross-country evidence seems to suggest the presence of large balance sheet effects one should recognize that there are serious issues with the experiments described above. First of all, the data on foreign currency debt covers only a relatively short period (the index of original sin is only available for the 1993-2001 period) and is available for a limited sample of countries (approximately 60 countries, or 36 if one focuses only on deposit dollarization). Second, the available cross-country measures of foreign currency debt do not fully capture the possible presence of currency mismatches (Eichengreen, Hausmann, and Panizza, 2002, Goldstein and Turner, 2003). Third, there may be a correlation between depreciation and the presence of foreign currency debt. For instance, according to the "fear of floating" hypothesis countries with a large share of foreign currency debt may attempt to limit exchange rate flexibility (for evidence see Calvo and Reinhart, 2002, and Hausmann, Panizza and Stein,

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Latin America (LATAM) and transition economies (TRANS). The basic specification and the data are from Levy-Yeyati and Sturzennegger (2003).

[9] The Arellano and Bond regressions are estimated by using two lags as instrument and considering all variables as predetermined except for the change in terms of trades that is considered a strictly exogenous.

[10] In this calculation we are using the OLS estimates.

2001).[11] Fourth, depreciations may also have a direct effect on the share of dollar debt (that is defined as $\frac{e_t D_t^*}{D_t + e_t D_t^*}$). Fifth, the estimations may still suffer from omitted variable bias and the share of foreign currency debt may pick up the effect of some other omitted variables, such as changing institutional quality and inflation history.[12] Finally, endogeneity problems are more difficult to address in a satisfactory way in a sample such as this with a short time dimension and a number of cross-sectional units not as large as one would like.

3. Evidence from Firm-Level Data

An alternative approach is to look at firm-level data. This has both advantages and drawbacks. On the one hand, it brings richer and possibly better data to bear on this issue. Moreover, the large cross-sectional dimension permits exploring how the effect of devaluation varies with firm characteristics and allows the use of more sophisticated estimation techniques. Firm-level data certainly permit checking whether balance sheet effects make depreciation less expansionary or more contractionary, but make it very difficult, if not impossible in practice, to assess the overall effect of a depreciation. This is because, in papers that use firm-level data, the existence of balance sheet effects is captured by the interaction term between the currency composition of debt and depreciation. While the sign and significance level of this coefficient indicate the

[11] Fear of floating would lead to situation in which, in presence of dollar debt, we observe fewer but larger depreciations. This is, in fact the case, the median depreciation in countries with *OSIN* smaller than 0.75 is 2 percent and the median depreciation in countries with *OSIN* bigger than 0.75 is 1 percent. At the same time, the 90th percentile of the distribution of depreciations in countries with low original sin is 20 percent, and the corresponding value for countries with high original sin 40 percent.

[12] It should be pointed out, however, that Eichengreen, Hausmann and Panizza (2002) show that there is no strong correlation between Original Sin and institutional quality or inflation history and that the results are robust to interacting depreciation with an industrial country dummy, therefore the effect of original sin is not explained by the different behavior of developed and developing countries.

possible presence of a balance sheet effect, they do not capture the total effect of currency depreciations. In principle, one could capture the total effect, conditional to an initial currency composition of debt, by augmenting the specification with the depreciation rate itself (non-interacted) and then, by adding the coefficient of the non-interacted term to the coefficient of the interacted term times the currency composition of debt. If desired, and conditional to data availability, one could interact depreciation with other variables such as export orientation or the importance of imported inputs, and calculate the total effect of depreciation, conditional to this wider range of firm characteristics. In reality, things are not this simple because the non-interacted depreciation variable would end up capturing all the macro shocks that occur in the economy (financial crisis, credit crunches, fiscal policy posture, etc.). This is particularly problematic because panels for which firm-level data are available tend to have a rather short time dimension, leading to a situation in which it is very difficult, if not impossible, to disentangle the effect of the depreciation variable from other macro shocks. As a result, it is basically impossible to get a meaningful and reliable estimate of the total effect of depreciation on investment from country-level studies on micro data. Note that in the panel data exercises described in the previous section both the cross-sectional and time-series variation in the exchange rate are used in order to pin down its effect on growth. As a result, the problem derived from having a short panel is, perhaps, less severe.

There are a limited number of papers that focus on emerging market countries and use firm-level data to explore the issue of debt dollarization. Typically they analyze two related questions: (i) Do firms try to hedge by borrowing in foreign currency when they produce tradable goods and in domestic currency when they produce non-tradables? and (ii) Do firms with foreign currency debt suffer negative balance sheet effects from devaluations?

Bleakley and Cowan (2002) attempt to answer both questions by using a sample of up to 480 firms from five Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico) over the 1991-1999 period (for a total of 2,824 observations). They find that firms tend to match the currency composition of their liabilities with their ex-ante sensitivity of revenues to the real exchange rate. In other words, firms that produce tradable goods tend to hold more dollar debt than firms that produce non-tradables. As a consequence of matching, Bleakley and Cowan find no evidence in support of a negative balance sheet effect. On the contrary, they find that currency depreciations tend to benefit more firms with a larger share of foreign currency debt (they attribute this result to the presence of omitted variable bias).

The Bleakley and Cowan contribution is an important one. Yet, there are some problems with it. First of all, their panel is highly unbalanced. Fifty percent of the observations come from Brazil, a country where liability dollarization is fairly limited and where the government may have provided implicit hedges to firms that do hold dollar debt. Another 10 percent of observations come from Argentina, a country that during the period under observation experienced extremely small movements of the real exchange rate. Furthermore, the baseline econometric methodology adopted by Bleakley and Cowan (2002) forces the coefficients to be identical across countries. This is a strong assumption because one may argue that the interaction between depreciation and foreign currency debt may have different effects in countries with different economic structures and institutional arrangements. Finally, the econometric specification does not allow for firm-specific time-invariant components of the error term and relies on OLS estimation methods.

Another paper that studies how the interaction between debt and depreciation affects firm performance in a cross-section of emerging market countries is Forbes (2002). While she does

not focus on the currency composition of debt, she finds that in the aftermath of large depreciation events, firms with higher debt ratios have lower net income growth. However, she finds no robust relationship between debt levels and the performance of sales, market capitalization, and total assets, after a depreciation. Firms with greater foreign sales exposure have significantly better performance, independently of how the latter is measured.

In a study of the Asian crisis, Harvey and Roper (1999) find that balance sheet effects played a significant role in propagating the crisis. They argue that Asian corporations were highly leveraged in foreign currency at a time of declining profitability and were betting on currency stability. In turn, the crisis was greatly exacerbated by these bets.

Aguiar (2002) and Martinez and Werner (2002) focus on the Mexican experience. All these papers find that Mexican firms tend to partially hedge the currency composition of their liabilities. However, Aguiar provides *prima facie* evidence for the fact that firms are not fully hedged by showing that the currency depreciation during the Tequila crisis led to a reduction of net worth with a consequent drop in investment. Martinez and Werner find weak evidence of hedging before the Tequila crisis, but they suggest that the flexible exchange rate system adopted by Mexico in the aftermath of the crisis increased the incentives for hedging and hence reduced mismatches in firms' balance sheets.[13]

The fact that there is a relatively small number of papers on the balance sheet effects of currency depreciation in developing countries is not due to lack of interest in this subject that, on the contrary, has been at the center of the recent debate in international finance. It rather is due to the difficulty of finding data on the currency composition of firms' liabilities. Very often these data exist but are not readily available in electronic format, and their collection requires either

buying expensive databases, having access to confidential information maintained by supervisory institutions, or collecting hardcopy balance sheet and manually inputting the data. Recently a series of papers have relied on mostly new detailed data on currency composition of firms' liability in six large Latin American economies (Argentina, Brazil, Chile, Colombia, Mexico and Peru) to assess the determinants of the currency composition of debt and the presence and importance of a balance sheet effect.[14] In the remaining part of this section, we describe the main results obtained in these studies.

While, for the sake of homogeneity, five of the country studies follow the basic approach of Bleakley and Cowan (2002), they improve on the existing literature on at least three counts. The first concerns the data, the second the econometric methodology, and the third the attention to country-specific details.

The sample of firms covered in these studies is significantly larger than that of previous papers. The nature of the data set in each country (number and type of firms) is summarized in Tables 2 and 3. In total, the sample includes 8,500 firms (approximately 10 times larger than the one used by Bleakley and Cowan). The country with the largest number of firms is Colombia (up to 7,500 firms) and the one with the smallest number of firms is Mexico (approximately 150 firms). While most studies focus on listed firms, the papers on Argentina and Colombia include a variety of non-listed firms. One third of the firms included in the Argentinean sample are privatized firms (mostly utilities), some of which are not publicly traded. The Colombia sample includes a large number of non-listed firms (the sample include all non-financial firms with assets above USD2 million) representing all productive sectors.

[13] This evidence is supportive of models that emphasize the moral hazard role of fixed exchange rate regimes; see, for instance, Burnside, Eichenbaum, and Rebelo (1999).

Table 4 presents summary statistics for the share of foreign currency debt over total debt. It shows that there are large cross-country differences in liability dollarization. The share of foreign currency debt goes from 6 and 11 percent in the case of Colombia[15] and Brazil to well above 50 percent in the cases of Argentina and Peru. These large differences in liability dollarization partly reflect the different nature of the samples, but they also suggest that there might be important differences in the economic and institutional structures among the countries under observation. These differences are likely to affect the incentives to hedge. In the case of Argentina, for instance, Galiani, Levy-Yeyati and Schargrodosky (2003) suggest that the large share of dollar debt provided an implicit guarantee against sudden depreciation or, in case a depreciation would happen, the high level of liability dollarization would generate strong political pressure for protecting foreign currency borrowers (this is, in fact, what happened with the asymmetric "pesification" in 2002).

The determinants of debt composition are studied by estimating equations that relate the share of foreign currency debt with firm specific characteristics and macroeconomic events of the type:[16]

$$\frac{D^*_{i,t}}{D_{i,t}} = a + bT_{i,t} + cX_{i,t} + \mu_i + \tau_t + \varepsilon_{i,t} \qquad (2)$$

[14] These papers were part of a project sponsored by the Research Department of the Inter-American Development Bank and will be appearing in a special issue of the Emerging Markets Review.

[15] As the Colombian data set includes a very large number of small firms that do not hold foreign currency debt, we also report average dollar debt for firms that do hold some foreign currency debt.

[16] Some papers deal with the fact that the dependent variable is a ratio by taking a log transformation and then estimate the model with a Tobit regression.

where $\frac{D^*_{i,t}}{D_{i,t}}$ is the share of foreign currency debt, T is variable that measures the importance of exports relative to total sales, and X a matrix of firm specific characteristics. μ is a firm-specific component and τ a time-specific component of the error term. If firms match their liabilities with the structure of their revenues we would expect b to be positive. Table 5 summarizes the results of the six studies concerning the determinants of currency composition of debt. The papers all find a positive relationship between tradability and debt composition, but this is not statistically significant in the cases of Argentina and Brazil. Most studies also find that foreign currency debt share is positively correlated with firms' size and leverage, although the coefficients are not statistically significant in the cases of Brazil and Peru.

In the case of Chile, Benavenente, Johnson and Morandé (2003) do not estimate these types of equations but use an industrial survey to check whether export-oriented firms are more likely to report exchange rate losses (a variable that is associated with the presence of foreign currency debt). They find that export orientation is positively correlated with both the probability of reporting exchange rate losses and the magnitude of the losses, and they use this finding as evidence of the fact that firms tend to partially match their liabilities with the exchange rate elasticity of their revenues.

Galiani, Levy-Yeyati and Schargrodosky (2003) use their findings as evidence in support of one of the main criticisms levied against the Argentinean currency board. In particular, the fact that dollarization in Argentina was pervasive and common to all productive sectors lends support to the idea that the currency board was seen as providing an implicit guarantee and hence, by reducing the incentive to hedge, increased the potential disruptive effect of a sudden devaluation.

The presence of balance sheet effects is studied by estimating how firms' performance is affected by real exchange rate fluctuations in the presence of liability dollarization. All studies use the investment rate as a measure of firm performance and analyze the significance of an interaction between real exchange rate fluctuations and the ratio of foreign currency debt to total debt, controlling for total debt, export orientation (if available), other firm specific characteristics and macroeconomic shocks. Formally, they estimate the following equation:

$$I_{i,t} = \alpha + \beta\left(D^*_{t-1,i} * \Delta e_t\right) + \gamma D^*_{t-1,i} + \chi X_{i,t} + \mu_i + \tau_t + \varepsilon_{i,t} \qquad (3)$$

where I is the investment rate or another measure of firm performance (sales or earnings), D^* is a measure of foreign currency debt, Δe real depreciation, X a matrix of firm characteristics, μ a firm-specific fixed effect and τ a time-specific fixed effect. The main coefficient of interest is β, the coefficient of the interaction term. If β is negative, depreciation will have a negative balance sheet effect, leading firms with more dollar debt to invest less with respect to firms with less dollar debt.[17]

While the basic specifications are close to the ones used by Bleakley and Cowan (2002), there are at least three differences relative to theirs. First, all papers include firm fixed effects that allow controlling for time-invariant firm specific characteristics and hence reduce the omitted variable bias. Second, while Bleakley and Cowan estimate a model that includes a set of macroeconomic variables (like non-interacted real depreciation, GDP growth, etc.), the papers surveyed here keep track of all the macroeconomic effects by augmenting the equation with time dummies. Finally, all papers recognize and address the fact that many of the regressors are

correlated with the error term and present results using the appropriate GMM methods for dynamic panels.

Four out of six studies find a negative balance sheet effect on investment. Table 6 summarizes the main findings. The balance sheet effect is statistically significant in the cases of Mexico and (using proxies for the risk of devaluation based on interest rate differentials) Argentina. For Colombia and Peru the evidence is more mixed, and the significance varies across specifications. In the case of Brazil the coefficient is mostly negative but insignificant in the more general specifications. For Chile the relevant coefficient interaction is highly unstable being positive in some specifications and negative in others. These overall results differ from those of Bleakley and Cowan (2002) who, in a similar sample of countries, find evidence of positive and statistically significant balance sheet effects.

As Brazilian firms represent more than 50 percent of the sample of Bleakley and Cowan (2002), Bonomo, Martins and Pinto (2003) investigate what drives the difference in results. They argue that the difference is not driven by the fact that Bonomo et al. (2003) have observations for a longer period (1991 to 1999 versus 1990 to 2002).[18] In fact, when they restrict the sample to the 1991-1999 period they still find a negative but not statistically significant balance sheet effect (the authors conjecture that the lack of significance may be due to the role played by the government in providing hedges at the time of the crisis). When Bonomo et al. (2003) replace year dummies with macroeconomic variables (in particular non-interacted real depreciation) they are able to reproduce the positive (although not statistically significant) balance sheet effect obtained by Bleakley and Cowan (2002). This suggests that the presence of a positive balance

[17] Some papers also analyze the impact of depreciation on earning or sales.
[18] The additional information may be relevant because at the end of 1998 Brazil devalued its exchange rate and moved from a fixed to a flexible exchange rate regime.

sheet effect obtained in the previous literature might be partly driven by the omission of relevant variables.

Along with Brazil, Chile and Colombia are countries with a relatively low degree of financial dollarization.[19] In Chile, Benavenente, Johnson and Morandé (2003) find no evidence of a balance sheet effect. In Colombia, however, there is some evidence of balance sheet effects. While Echeverry, Fergusson, Steiner and Aguilar (2003) do not find consistently robust evidence of balance sheet effects when using the investment ratio as the relevant outcome measure, they find that depreciations have a negative effect on the profitability of firms with higher foreign currency debt. They also find some evidence that exporting firms tend to have larger increases in their profits during depreciations, whereas the impact of having a higher share of imported inputs, even if negative, is not robustly significant.

Mexico, Peru and Argentina are countries with much higher degrees of liability dollarization. In the case of Mexico dollar debt has fluctuated between 25 percent and 43 percent of total short-term debt. For this country, Pratab, Lobato and Somuano (2003) find evidence of a negative and significant balance sheet effect on investment in most of their specifications. There is also evidence that a depreciation has more severe negative effects on earnings for more dollarized firms. Given dollarization, the effect of depreciation is more positive for firms with a greater share of exports.

With nearly 60 percent of firms' debt in foreign currency, the Carranza, Cayo and Galdon-Sanchez (2003) study on Peru provides insights on the impact of exchange rate fluctuations in one of the most dollarized countries in Latin America. The paper provides suggestive evidence on the presence of negative balance sheet effects for Peruvian firms,

although the significance varies across specifications. These results can be linked to the finding that firms match the currency composition of liabilities with the composition of their revenues.

Compared to the other six studies, Argentina is a particular case because, during the period under observation, it maintained an exchange rate regime in which the peso was fixed by law to the US dollar. So, while in most of the studies surveyed here a large share of the volatility of the real exchange rate was explained either by fluctuations in the nominal exchange rate or by the collapse of a peg, in their study of Argentina, Galiani, Levy-Yeyati and Schargrodosky, (2003) focus on what Fisher labeled "debt deflation." They recognize that a super-fixed regime does not eliminate the possibility of negative balance sheet effects due to adjustments of the real exchange rate and point out that, with a fixed exchange rate, the real exchange rate adjusts to a shock via a process of deflation that, by reducing the relative price of non-tradables, reduces the net worth of the non-tradable sector. As the nominal exchange rate is fixed, this reduction of net worth does not depend on the currency composition of firm liabilities.

With these considerations in mind, Galiani et al. (2003) adopt an approach that is different from the one discussed above. The paper finds evidence in support of the idea that the relative price changes affect earnings in the expected direction, which implies that the earnings of non-export oriented firms suffered over the period. Since earnings enter significantly into the investment equations, also investment by these firms was also adversely affected. The authors further find evidence that greater dollarization affects earnings positively, presumably due to lower financing costs during the convertibility period.

Finally, Galiani et al. explore whether devaluation expectations negatively affect investment in firms with large dollar debt shares. They find that the interaction between dollar

[19] This could be due to the fact that financial intermediaries have limited ability to collect foreign currency deposits

debt and the perceived risk of a devaluation (using proxies based on interest rate differentials) is indeed negative and statistically significant, providing empirical support for a negative balance sheet effect of expected devaluation.

4. Conclusions

Until recently, the discussion on the optimal exchange rate regime was rooted in the standard analysis of Fleming (1962), Mundell (1961, 1963), and Poole (1970). According to the latter, countries that face primarily real shocks should adopt a flexible exchange rate regime and countries that are subject to nominal shocks should move towards a fixed exchange rate regime.

Calvo and Mishkin (2003) suggest that, in the case of emerging market countries, the above literature can yield misleading implications. They point out that there are several institutional features that make emerging market countries different from the industrial countries for which these models were originally developed. In particular, emerging market countries tend to suffer from weak fiscal, financial and monetary institutions, are characterized by currency substitution and liability dollarization, and are subject to sudden stops in capital flows.

Liability dollarization is a particularly important phenomenon, and it is likely to be at the root of some of the other institutional features that make emerging market countries different. Calvo, Izquierdo and Mejia (2003) show that liability dollarization is associated with sudden stops in capital flows. Eichengreen, Hausmann and Panizza (2003a 2003b) show that dollarization of external debt (original sin) is a persistent phenomenon that cannot be easily explained with standard theories that focus on credibility or institutional quality. They also show

(however, foreign currency debt is often contracted with foreign creditors).

that inability to borrow abroad in own currency is associated with the volatility of GDP growth and with low credit ratings (hence increasing the cost of financing the debt and exacerbating fiscal problems). Galindo, Panizza and Schiantarelli (2003) present some evidence for the fact that liability dollarization may lead to contractionary depreciation.

In this paper, we survey some new evidence that focuses on how domestic dollarization can have balance sheet effects and make devaluation contractionary. Knowledge on this topic is still limited, and the main conclusion that we draw from our reading of the literature is that more progress needs to be made and more research is needed before economists can make confident statements about the overall effects of depreciations. While the papers surveyed here do not provide a definitive answer to the main questions at hand, they contain pieces of interesting evidence and data from which such an answer can eventually be obtained.

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Table 1: Correlation between Growth and Real Depreciation

	All Countries		
	All Countries	Countries with OSIN<0.75	Countries with OSIN>=0.75
	GROWTH	GROWTH	GROWTH
DRER	-0.12	0.01	-0.15
	(7.78)***	(0.33)	(7.76)***
N. Obs.	472	112	360
	Industrial Countries		
	All Industrial	Countries with OSIN<0.75	Countries with OSIN>=0.75
	GROWTH	GROWTH	GROWTH
DRER	-0.03	-0.01	-0.06
	(1.86)*	(0.30)	(1.96)*
N. Obs.	155	97	58
	Developing Countries		
	All Developing	Countries with OSIN<0.75	Countries with OSIN>=0.75
	GROWTH	GROWTH	GROWTH
DRER	-0.15	0.17	-0.16
	(7.36)***	(1.97)*	(7.56)***
N. Obs.	317	15	302

Table 2: Cross-country Table 3: Number of Firms

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	**TOTAL**
Argentina					122	146	164	176	193	202	202	201	186		**1592**
Brazil		204	201	228	252	249	261	241	245	251	206	208	191	158	**2895**
Chile						189	189	189	189	189	189	189	189		**1512**
Colombia							5942	6448	7217	7567	7125	6661	4219		**45179**
Mexico	45	80	94	104	107	105	109	108	92	86	85	77			**1092**
Peru						163	163	163	163	163	163	163	163		**1304**
TOTAL	**45**	**284**	**295**	**332**	**481**	**852**	**6828**	**7325**	**8099**	**8458**	**7970**	**7499**	**4948**	**158**	**53574**

Table 3: Basic Characteristics of the Firms

Country	**Characteristics of Firms**
Argentina	Non-financial companies, publicly traded, publicly listed but not traded and formerly state owned. Main Sectors: Industry, Services, Mining, Utilities
Brazil	Non-financial publicly traded firms
Chile	Non-financial publicly traded firms
Colombia	Non-financial firms that have assets above USD2 million and report to the Superintendencia de Sociedades. Main Sectors: Manufacturing, Commerce, Services, Construction, Agriculture
Mexico	Non-financial mostly publicly traded firms
Peru	Non-financial publicly traded firms Main Sectors: Manufacturing, Services, Mining

Table 4: Debt Composition

Country	**Share of Foreign Currency debt**	**Standard Deviation**
Argentina	56.4%	29.0
Brazil	11.8%	26.4
Chile	21.2%	29.9
Colombia*	5.5%	14.8
Colombia*#	20.4%	22.7
Mexico*	34.6%	28.6
Peru*	62.7%	23.1

*Data for year 2000. In the case of Mexico foreign currency debt peaked at 42% in 1995. In the case of Peru foreign currency debt peaked at 67% in 1998.
Only firms that have foreign currency debt (27 percent of sample)

Table 5: Determinants of Debt Composition

Country	Do firms match currency of debt with their production?	Do size and Leverage matter?
Argentina	**NO** The coefficient of a tradable dummy is positive but not significant	**YES** Large and more leveraged firms have more foreign currency debt
Brazil	**NO** The coefficient of a tradable dummy is positive but not significant	**NO** Size and leverage are not significantly correlated with debt composition
Chile	**YES** The evidence does not come from estimating equation (1) but form the fact that export oriented firms are more likely to report exchange rate losses	**YES** Large and more leveraged firms have more foreign currency debt
Colombia	**YES** Share of exports is significantly correlated with share of foreign currency debt	**YES** Large and more leveraged firms have more foreign currency debt
Mexico	**YES** Share of exports is significantly correlated with share of foreign currency debt	**YES** Large and more leveraged firms have more foreign currency debt
Peru	**YES** Share of exports is significantly correlated with share of foreign currency debt	**NO** Size and leverage are not significantly correlated with debt composition

Table 6: Balance Sheet Effects for Investment

Country	Balance-Sheet Effect
Argentina	NEGATIVE AND SIGNIFICANT (FOR EXPECTED DEVALUATION)
Brazil	NEGATIVE AND SIGNIFICANT

	If time dummies are substituted with macro variables the effect becomes positive but not significant
Chile	LARGE SWITCHES OF SIGN ACROSS SPECIFICATIONS
Colombia	NEGATIVE , MIXED SIGNIFICANCE (GREATER FOR EARNINGS)
Mexico	NEGATIVE AND MOSTLY SIGNIFICANT (ALSO FOR EARNINGS)
Peru	NEGATIVE , MIXED SIGNIFICANCE