Mishmash on Mismatch?
Balance-Sheet Effects and Emerging-Markets Crises*

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Abstract

We critically assess the recent empirical literature on the importance of dollar debt and balance-sheet effects in the emerging-market financial crises of the 1990s. Using a simple model, we discuss which specifications are theoretically appropriate, and provide additional insights as to the proper interpretation of the reduced-form evidence in the literature. We show that the variety of results found in the existing literature are related to the heterogeneity of regression specifications. Using harmonized microdata on corporates across a dozen countries in Latin America and Asia, and we replicate common specifications for the effect of dollar debt on investment and output at the firm level. In this light, we suggest that the literature on corporate-level currency mismatch is hardly a mishmash, but in fact quite concordant.

Keywords: currency mismatch, financial crises, balance-sheet effects.

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1 Introduction

The emerging-market financial crises of the 1990s provoked considerable discussion and theorizing about both their initial causes and the mechanisms that amplified them. Debt denominated in foreign currency became a key villain in the narrative about these episodes. The narrative goes as follows. A firm that issues debt in dollars would see the peso value of its debt increase if the exchange rate depreciates. This rise in debt could devastate the firm's net worth, and, if net worth is a constraint, cause the firm to curtail activity. Given many such firms, the whole economy could contract. This story has the virtue of being easy to understand and remember, and its success as a 'meme' is undeniable. However, for some time there was little evidence, beyond the *prima facie*, that this factor was large enough to have actually caused these crises.

With this as background, a micro-empirical literature has arisen trying to measure the behavior of corporates that were holding dollar debt when the exchange rate depreciated. A study in this literature might potentially address several questions. Did net worth in these firms actually decline? If so, did this have a large impact on investment? Was it large enough to overwhelm the competitiveness effects that are presumed to be present was the currency depreciates? Using microdata has numerous advantages in that it allows controlling for factors besides the exchange rate that hit the economy simultaneously, so as to isolate the role of dollar indebtedness. However, a casual inspection of the resulting studies suggests that the literature is a 'mishmash', with conflicting results and little definitive to be learned. We argue that the opposite is the case. Indeed, once viewed through a coherent framework, the results in this literature are quite consistent.

We begin in Section 2 with a concept that helps us interpret the existing empirical results: matching. In Section 2.1, we use a simple model to motivate why a firm would want to match the currency composition of its debt to the exchange-rate sensitivity its income. Matching to some degree is likely to take place if firms are concerned about the variance of their income or balance sheet—a result that arises from risk averse behavior of managers, bankruptcy costs or capital-market frictions. But faced with a paying a premium on debt in pesos, firms tradeoff the benefit of cheaper debt in dollars with the expected cost of a currency mismatch down the road. We then show in the model which firms would be willing to take on more or less dollar debt. Finally, in Section 2.2, we confirm most (and do not reject any) of the model's predictions in a series of descriptive regressions using firm-level data from six Latin American countries.

In Section 3, we extend the model and derive implications for the investment behavior of dollar-indebted firms. We decompose the response to the exchange-rate depreciation into channels. The first channel is that investment declines because the firm's net worth drops, by virtue of the ballooning peso value of debt. But, because firms choose the currency composition of their debt, there are additional factors that determine how the firm with more dollar debt responds to the exchange rate. Foremost among them that we identify is a 'competitiveness' effect, whereby firms that would experience greater profit opportunities when the exchange rate depreciates are more likely to denominate their debt in foreign currency.

A few results follow immediately from this analysis. First, there is a range of parameters over which the firm's net worth declines, but the firm's investment rises nonetheless, because the net-worth effect on investment is not large enough to eclipse the improved competitiveness of the firm. In other words, currency mismatch does not necessarily imply that a depreciation is contractionary. How these effects net out depends on the size of mismatch, but also on the elasticity of investment with respect to net worth and to profit opportunites. Second, the question of whether the dollar-debt/exchange-rate interaction ($D^* \times \Delta e$) is contractionary depends on the balance of net-worth and other, compensatory effects. This implies that we should estimate the sum of these factors. In contrast, one could imagine a regression that controls completely for competitiveness factors, so as to isolate the (presumably negative) net-worth effect. But this 'conditional' analysis would answer a different question, and have no bearing on whether $D^* \times \Delta e$ is *on net* contractionary.

We then review the numerous empirical studies that use firm-level data to examine the interaction of dollar debt and the exchange rate in Section 4. The main point of our review concerns whether the analysis of $D^* \times \Delta e$ is conditional of unconditional, in the sense of the previous paragraph. Some studies undertake conditional analysis: they estimate $D^* \times \Delta e$ holding fixed competitiveness factors as best they can. Other studies are 'unconditional' because they measure te composite of net-worth and competitiveness factors. Still others mix the two types of analysis. While not all studies that we review make this distinction very sharply, this point explains most of the important variation in the empirical literature. The unconditional results for $D^* \times \Delta e$ are generally positive, often significantly different from zero. (The few cases where negative and significant effects are claimed stem from specification problems that we flag below.) The conditional results for $D^* \times \Delta e$ are often negative, and occasionally significant. This configuration of coefficients is precisely what one would expect if the net-worth effects were present, but not large enough to dominate the improved competitiveness following the exchange-rate realignment. Put another way, on the margin, dollar debt may have attenuated the benefits of the depreciation, but it did not reverse them in these samples.

We then examine $D^* \times \Delta e$ and the behavior of investment in samples of firms from Latin America (Section 5) and East Asia (Section 6) of the 1990s. For comparability, these data are essentially the same as those used in many of the studies in the literature. We use and extend the framework of our earlier study (Bleakley and Cowan, 2002), accounting for criticisms of that study when appropriate. In our 'unconditional' analysis, we confirm that the net-worth effect was not large enough to overwhelm compensatory factors in these data. The estimates on $D^* \times \Delta e$ are almost always positive, sometimes significantly so, and are never negative and significant. This runs contrary to a pure 'balance sheet' view of dollar debt. We show that this result is not sensitive to a variety of controls and estimators.

Section 7 concludes the study, and includes a discussion of some related, open questions. A description of the data is found in Sections 5 and 6 as well as in Appendix A.

2 Matching: Theory and Evidence

2.1 Why Matching?

We present a simple model of firm debt choice in which some degree of currency "matching" between income and liabilities is the optimal choice for a credit-constrained firm.[1] We abstract from many details of the process of debt issuance and investment, but instead focus on a few central features most relevant to the currency composition of debt. The model predicts that dollar debt will be highest in firms whose income is positively correlated with the exchange rate and in firms that are less credit constrained. We start with two main assumptions.

First, we assume that uncovered interest parity (UIP) fails to hold, and in particular that dollar debt is expected to be cheaper than its peso equivalent. This distorts the choice of debt towards dollar denomination for all firms. A possible explanation for the persistent wedge between interest rates is what Eichengreen and Hausmann (1999) refer to colorfully as "original sin": international investors cannot 'forgive' emerging markets for monetary sins even if their governments and central banks have been penitent for some time. An alternative explanation, explored extensively by Caballero and Krishnamurthy, is that contractual and commitment problems prevent international investors from holding certain nontradeable assets, which depresses their value in certain contigencies. But whatever the justification, this particular failure of UIP is by now a standard assumption in the literature on liability dollarization.[2]

Second, we postulate that firms behave to a certain degree as if they are risk averse. We suggest

[1]For other models of currency choice see Chamon (2000), Jeanne (1999a and 1999b), and Cowan (2002), and Luengnaruemitchai (2004).

[2]Despite the prominence of this assumption, there is less empirical work on the matter. Martinez and Werner (2001) argue that in Mexico over the period 1992 to 1994 it is the case that $r^* < r$, although their calculation relies on covered interest parity, and as such may in fact be more informative of bank commissions that expected depreciations. Conesa-Labastida (1997), on the other hand, calculates the implicit differential from Mexican firms debt choices prior to 1995. He finds evidence of a substantial peso discount.

two alternative motivations for this assumption. On the one hand, the owners of the firms might not be able to fully diversify the risk associated with their residual claims on the firm's output. If the owners are also risk averse, then the firm will in effect be risk averse. On the other hand, firms might face a frictional credit market. To complement their internal funds, firms issue debt. However, due to credit constraints, the interest rate they have to pay on this debt is increasing in the amount borrowed. This upward-sloping supply of credit implies that total debt payments are a convex function of loans, and firms will have incentives to hedge against exchange rate fluctuations to reduce the variance of their wealth.[3] Strategies for reducing the firm's exchange-rate risk take two forms: (i) formal hedging with currency forwards and other derivatives, or (ii) 'matching' the currency composition of debt to the exchange-rate sensitivity of income, so that firms whose income is most correlated to the exchange rate will take on a higher fraction of dollar debt. We focus mostly on (ii), although there is some evidence on (i) as well that we discuss below. For simplicity, we model the firm's risk aversion via mean-variance preferences over net worth.

Consider an entrepreneur with access to a project that takes k units of the domestic good today ($t = 0$) and yields $f(k)$ units of output (including the depreciated capital stock) tomorrow ($t = 1$). Of the total output produced by the project, a fraction α is tradeable. Total output tomorrow in pesos is therefore given by

$$y(e_1) = f(k)\left(\alpha e_1 + (1-\alpha)\right) \ , \ 0 \leq \alpha \leq 1 \tag{1}$$

where e is tomorrow's exchange rate, the price of tradeables in units of nontradeables. The exchange rate today is normalized to unity, and suppose further that $E_0[e_1] = 1$. Entrepreneurs start their lives with initial wealth $w_0 > 0$ and live for two periods.

In period zero, the entrepreneur invests in the project, financing the investment in part by issuing debt. The debt contracts can be denominated in either nontradeables (i.e. pesos) or tradeables (i.e. dollars). The capital stock is therefore $k_1 = L + w_0$, where L is total liabilities at $t = 0$ prices. The market interest rate on tradeable debt is r^* and on nontradeable debt is r. For some reason, dollar debt is relatively cheap: $r^* \leq r$.

In the next period, production takes place, the exchange-rate shock is realized and entrepreneurs

[3] In motivating the demand from hedging by an upward sloping supply of external credit, our framework is similar to Froot, Scharfstein and Stein (1996). For a discussion and evidence on the relation between capital-market frictions and optimal debt composition see Cowan (2002), who presents a model that is built up from assumptions about the external-finance premium.

pay back their debt obligations. Tomorrow's wealth w_1 is

$$w_1 = [\alpha e_1 + (1-\alpha)]\, f(k) - [\beta e_1 (1+r^*) + (1-\beta)(1+r)]\, L \tag{2}$$

where β is the fraction of $t = 0$ debt that was denominated in dollars. The expected value of wealth, considered before the period-one exchange-rate is known, is

$$E(w_1) = f(k) - [\beta(1+r^*) + (1-\beta)(1+r)L]\,.$$

The expected value is maximized by issuing debt in dollars ($\beta = 1$), and setting $f'(k) = (1+r^*)$. However, the firm is also concerned with the variance of w_1:

$$\text{var}(w_1) = E\left(w_1 - E(w_1)\right)^2 = [\alpha f(k) - \beta(1+r^*)L]^2\, \sigma_e^2$$

where $\sigma_e > 0$ is the standard deviation of the exchange rate. The variance of wealth in $t = 1$ is zero if β is equal to

$$\beta_{\text{match}} \equiv \alpha \frac{f(k)}{(1+r^*)L}$$

which is greater than α. Note, therefore, that perfect matching will generate a debt portfolio that is more dollarized than the effective currency composition of assets, as long as the firm is less than fully leveraged.

The firm with mean-variance preferences will choose the capital stock (k) and the currency composition of liabilities (β) to maximize the weighted combination of expected value and expected variance:

$$\max_{k,\beta}\ [(1-\theta)\text{E}(w_1) - \theta\text{var}(w_1)] \tag{3}$$

where θ is the weight on variance in the firm's preferences. The optimal debt composition is thus implicitly defined by two first-order conditions: one FOC w.r.t. β and another w.r.t. k. The FOCs are rather messy quadratics in the choice variables. Rather than work through the solutions analytically here, we simulate the model using reasonable sets of parameters.

The simulated choice of β and k is presented in Figure 1. Parameter values are listed in the note for that Figure. The spot marked with an 'x' represents the firm that chooses β_{match} and $k^{**} = f^{-1}(1+r^*)$ would be here. Note that this is only a benchmark. We do not predict that any firm would actually be here: the firm that chooses k^{**} would be maximizing expected value only, and therefore should not care about matching. What does characterize the choice β and k, then? On the one hand, the maximization problem above yields an FOC for β that defines the optimal choice of β given a fixed value for k. This is the dashed line. There are two things to note: (a) it is shifted to the right of β_{match}, and (b) the firms choice of β is relatively insensitive to the choice of capital. On the other hand, the FOC w.r.t k defines, for given β, the optimal k: the solid line. It is everywhere below k^{**}, consistent with the firm being risk averse.

We explore the firm's capital and currency-composition choice further in Figure 2, where we consider ranges of the parameter values. Specifically, in this exercise, we vary a single parameter across a wide range, but fix the others to their baseline values. All the while, we compute the optimal β and k for each parameter set. For this analysis, β is constrained to be between zero and one (inclusive). We compute the capital stock as a fraction as that which maximizes expected wealth (k/k^{**}), the fraction of debt in dollars (β), and the firms 'currency mismatch' ($\beta - \alpha f(k)/L$). Each parameter is analyzed in a separate Panel of Figure 2:

A. The optimal choice of β is decreasing in θ, the weight of variance in the mean-variance objective funcation. Indeed, as $\theta \to 1$, $\beta \to \beta_{\text{match}}$, which minimizes the variance of w_1. We motivated $\theta > 0$ above as a proxy for the sensitivity of its price of external funds to net worth. If $\theta = 0$, then this is like that entrepreneur being risk neutral. If, as we assumed above, $r^* < r$ then the optimal β is 1, a corner solution. The entrepreneur maximizes expected wealth in period 1, and he does so by choosing the cheapest source of credit regardless of the effects of his debt choice on the variance of period-1 wealth. Bottom line: we expect both dollar debt and mismatches to be higher (*cet. par.*) in firms that are less credit constrained. The capital stock, k, will be modestly higher as well.

B. The fraction of dollar debt will be higher in firms whose income covaries most with the exchange rate: firms with a higher α. This result is central to interpreting the empirical work below.

C. β rises as the firm's $t = 0$ internal funds rise, but investment and mismatch do not.

D. All three variables are relatively insensitive to the total-factor productivity of the firm. (Note that the firm would get larger if $A \uparrow$, but the gap between actual and expected-wealth-maximizing investment does not.)

E. The dollarization of liabilities and currenecy mismatch are both decreasing in σ_e, the standard deviation of the exchange rate. This is perfectly sensible: mismatch generates less variance of wealth.

F. Dollar debt as a fraction of total debt is increasing in the interest rate differential, $r - r*$. Mismatches increase as well, but both are capped by the constraint that $\beta \leq 1$. Note the special case of when this spread is zero (and therefore UIP holds). If $\theta > 0$ and $r = r^*$, then β is set to $\beta_{\text{match}} = \alpha \frac{f(k)}{(1+r^*)L}$, and period-one wealth will be independent of the exchange rate, In this case, insurance is complete, because it is costless to perfectly match. Also, the capital stock, relative to the risk-neutral optimum, is at a maximum when the spread is zero.

2.2 Correlates of Liability Dollarization at the Firm Level

The predictions of the model are borne out in a database of firms from six Latin American countries in the 1990s. (The data are further described in Section 5 and Appendix A below.) We estimate the following descriptive (i.e., not causal) regression:

$$D^*_{it} = A_{it}\Gamma + \Theta_{it}B + \delta_c + \varepsilon_{it} \tag{4}$$

for firm i in year t. The A_{it} are indicators of the exchange-rate sensitivity of profits (analogous to the α parameter in the model). The Θ_{it} are proxies for the firm's ability to access external credit, which correspond to the parameter θ in the model (the firm's aversion to variance in net worth, perhaps stemming from the sensitivity of the cost of external finance to firm net worth). D^*_{it} is the firm's debt denominated in foreign currency, normalized by the total assets of the firm. Dollar debt divided by firm size is both the theoretically indicated measure and the empirically relevant one, because it measures the firm's exposure to the exchange rate on the liability side.

Table 1 contains estimates of equation 4.[4] A regression with country-specific constants is found in Column 1. Average dollar liabilities to assets is as high as 30+% in Argentina and Peru and as low as a mere 3% in Colombia. In Columns 2 and 3, we introduce proxies of α and θ. To proxy for the exchange-rate sensitivity of profits, we include the ratio of export to total sales and a dummy for being in a (one-digit) tradeable sector. Both of these measures predict more debt in dollars, although the tradeable-sector dummy is not significant. To proxy for the firm's access to capital, we include firm size (the natural log of assets) and the fractions of its liabilities that are long term. Larger firms typically have easier time accessing credit markets, and we see that large firms are more likely to issue debt in dollars. Firms with a higher fraction long-term debt probably have more reliable access to credit, both by selection and by virtue of not being exposed to the rollover risk of short-term financing, and these firms also have more dollar debt. We also add dummies in Column 3 for whether the firm had issued an ADR/GDR or was foreign owned (meaning having a foreign parent company). These firms are more insulated from domestic credit volatility, and also

[4] We examine correlates of the fraction of liabilities that are in dollars in Appendix C, which contains estimates of the same set of regressions as Tables 1.

issue more debt in dollars.

By construction of these new regressors, the country dummies are now evaluated at points where the model predicts less dollar debt, so comparing country effects in Columns 1 and 3 gives a sense of the quantitative importance of these variables. For a firm of average size, but with no exports, in a nontradeable sector, with all its liabilities at the short end, without an ADR/GDR, and domestically owned, its dollar leverage is predicted to be about 8 percentage points below the country average (except for a Colombian firm, where it would be 4%pt below the country average). For a firm with those same characteristics, but at the 5th percentile in the size distribution, its dollar liabilities would be an additional 3.4%pt lower.

Regression results done separately by country are also consistent with the matching model, as seen in Columns 4–9 of Table 1. Exports, firm size, and longer-maturity debt all predict significantly higher dollar debt. As before, tradeable is a less good indicator of dollarization, except for Mexico where the results are significantly positive. Also of note is the high R^2 throughout. The regression model explains around 70% of the variance in Argentina and Peru, and 50-60% in Brazil, Chile, and Mexico. Matching variables play a central role understanding the currency composition of debt in this sample. The only exception to these patterns is Colombia, where there is not much dollarization of liabilities anyway.

3 Modeling the Investment Response

We consider in this section the theoretical impact on contemporaneous investment behavior of lagged decisions about the currency composition of debt. Following a movement in the exchange rate, four mechanisms will affect a firm's choice of investment:

1. the peso value of dollar debt will change, altering the value of total debt;

2. internal funds available for investment will be affected due to changes in current profits;

3. changes in expected future profits will alter the firm's current collateral; and

4. shifts in relative prices will change the marginal product of capital.

The first two mechanisms will have immediate effects on the firm's balance sheet, and if the firm is credit constrained, will affect investment due to higher costs of external capital. The third mechanism changes what a firm can credibly pledge to creditors, and thus may change the cost of capital as well. The fourth channel will affect demand for capital by altering current and future marginal products of capital.

The net result of these four effects is ambiguous. Specifically, we demonstrate below that it is not always the case that firms holding higher levels of dollar debt will experience larger reductions in investment during a depreciation. This result depends crucially on how dollar debt is distributed among firms. If firms match income streams with currency composition of liabilities, then those firms with higher levels of dollarization will also be those firms whose profits respond most favorably to a depreciation. Using the typology we introduce later in this section: if firms match, the higher "competitiveness effect" of a change in the real exchange rate may well offset the larger "net-worth effect" brought about by dollar debt. Below we justify this typology, and propose an empirical framework for assessing which effect dominates in our sample.

Also note that θ is changing as well, which adds a third term: selection into firms with better credit access. This will tend to attenuate the net-worth effect as we look at firms with more dollar debt.

3.1 Setup

The world now has three periods: 0, 1, and 2. Periods zero and one are similar to those in the model of debt composition above. In period zero, the firm debt (L), and the fraction of said debt issued in dollars (β), as measured at the period-zero exchange rate of $e_0 = 1$, and finally the capital stock to be passed on to period one (k_1). (The main point of departure in the analysis to follow is that we use the debt-composition results from the mean-variance model above rather than backwards inducing them here.) In period one, the exchange rate (e_1) is realized, the firm produces according to $f(k)$, and resulting firm wealth is given by equation (2) above. It then decides how much to invest for the capital stock in period two (k_2). In period 2, the firm produces $f(k_2)$, and the model ends. For simplicity, we suppose that there is no exchange-rate risk going from periods 1 to 2, so $e_2 = \mu(e_1)$, where μ is a deterministic function that represents the exchange rate's gradual reversion to its mean of unity. This latter characteristic of the exchange rate allows us to focus on the choice of debt and investment in period one, but suppress analysis of the currency composition of L_2. Wealth (in domestic currency) in period 2 is therefore given by

$$w_2 = [\alpha e_2 + (1 - \alpha)] f(k_2) - R(w_1)L_2. \tag{5}$$

The new feature of equation 5 is $R(w_1)$. We assume that firms cannot borrow at the risk-free rate but must pay a firm-specific risk premium that is decreasing and convex in period 1 net worth,

w_1.[5] Finally, note that f and R are gross production and interest functions.

The only choice variable is $t = 2$ capital. Firms face a time-to-build constraint, so that in period 1 they determine k_2 so as to maximize w_2, as described in equation (5). The optimal level of capital can then be expressed as a function of the current exchange rate and the firm's net worth, itself a function of the exchange rate,

$$k_2^* = \check{k}(e_1, R(w_1(e_1))), \tag{6}$$

or simply as a function of the $t = 1$ exchange rate:

$$k_2^* = \tilde{k}^*(e_1). \tag{7}$$

3.2 Competitiveness and Net-Worth Channels

In this framework, what are the effects of a change in the current exchange rate on investment? Taking the derivative of $\tilde{k}^*$ and $\check{k}^*$ with respect to the exchange rate, we obtain

$$\frac{d\tilde{\check{k}}}{de_1} = \frac{\partial \check{k}}{\partial e_1} + \frac{\partial \check{k}}{\partial R} R'(w_1) \frac{\partial w_1}{\partial e_1}, \tag{8}$$

which allows us to decompose the response of investment to changes in e into two channels: (i) a *competitiveness channel*, in which an exchange rate shock affects the optimal capital stock while holding constant net worth and (ii) a *net worth channel*, in which changes in the peso value of debt and current earnings affect k_2 by changing the cost of external funds. Taking full differentials of the first-order condition with respect to k_2 and e_1, we can express the *competitiveness channel* as

$$\frac{\partial \check{k}_2}{\partial e_1} = \alpha \mu'(e_1) \left[- \frac{f'(k_2)}{(\alpha \mu(e_1) + (1 - \alpha)) f''(k_2)} \right] \tag{9}$$

$$= \alpha \mu'(e_1) \phi_2 \tag{10}$$

where $\phi_2 > 0$. In turn, we can write the *net worth channel* as

$$\frac{\partial \check{k}}{\partial R} R'(w_1) \frac{\partial w_1}{\partial e_1} = \gamma_1 \left[\alpha f(k_1) - \beta L_1 \right] \tag{11}$$

where $\gamma_1 \equiv \frac{\partial \check{k}}{\partial R} R'$, the response of investment to net worth. By assumption, $\gamma_1 \geq 0$.

Several results follow from these equations. First, if we make the reasonable assumption that

[5] There are two additional simplifying assumptions behind this definition of net worth: (i) we assume that future profits are not pledgeable and (ii) we ignore the effect of current period investment on the interest rate. This has the effect that $R(w_1)$ is fixed from the perspective of $t = 1$ decisions about investment. If we relax these two assumptions, we obtain very similar, but messier, results to those presented in this section.

exchange rate movements are persistent ($\mu'(e_t) \geq 0$), then a depreciation will lead to higher investment via the competitiveness channel iff $\alpha > 0$. Second, if $\beta = \alpha f(k_1)/L_1$, the firm's net worth is not affected by the exchange rate, and therefore the effect on investment via the net-worth channel is zero. Next, $\beta < \alpha f(k_1)/L_1$, investment rises because of both higher neoclassical demand for capital and an improved balance-sheet position. On the other hand, if $\beta \gg \alpha f(k_1)/L_1$, a depreciation will reduce investment because falling current profits and a larger peso debt increase the cost of external funds, and this net-worth effect dominates the rising marginal product of capital. Nevertheless, there is a non-degenerate range of β in which the net-worth effect is negative, but in which the competitiveness channel dominates, and therefore the total effect is positive. Specifically, the competitiveness effects dominates net-worth if $\alpha\mu'\phi_2 \geq \gamma_1 (\alpha f(k_1) - \beta L_1)$, which implies that

$$\beta \geq \alpha \frac{f(k_1)}{L_1} - \frac{\alpha\mu'\phi_2}{\gamma_1}.$$

By inspection, we see that this lower bound on β is below that required for perfect matching, $\tilde{\beta} = \alpha f(k_1)/L_1$. In words, a positive currency mismatch is not a sufficient condition for depreciations to be contractionary. Overall, an increase in the exchange rate will have an ambiguous effect on investment in firms holding dollar debt, depending on the degree of currency matching of debt to revenues, *inter alia*.

3.3 Variation across Debt Composition

Having characterized the response of k_2 to e_t, we now address the key question of this section. We are interested in the differential effects of a depreciation on investment across firms with different β. Suppose that there is a continuum of firms indexed by $\beta \in [0, 1]$, which corresponds to the fraction of firm debt denominated in dollars inherited from previous financing decisions. The differential response across β can be represented as

$$\frac{\partial}{\partial\beta}\left[\frac{\partial\tilde{k}_2}{\partial e_1}\right] = \frac{\partial}{\partial\beta}\left[\alpha\mu'(e_1)\phi_2\right] + \frac{\partial}{\partial\beta}\left[\gamma_1\left(\alpha f(k_1) - \beta L_1\right)\right]. \tag{12}$$

As we saw above, β is systematically related to firm characteristics, a fact that we use here by analyzing the inverse relationships. For example, holding all else fixed, β can be treated as some $g(\alpha)$. Because we want to analyze the changes in α across the distribution of β, we consider below $\frac{\partial g^{-1}(\beta)}{\partial\beta}$, which we denote $\frac{\partial\alpha}{\partial\beta}$.

Starting with the competitiveness effect (the first term above), we find that

$$\frac{\partial}{\partial \beta}\left[\alpha \mu'(e_1)\phi_2\right] = \mu'(e_1)\left[\frac{\partial \alpha}{\partial \beta}\phi_2 + \alpha \frac{\partial \phi_2}{\partial \beta}\right] \tag{13}$$

The first term reflects the systematic differences in α—the relative tradeability of the firm's output—across firms with different β. We saw in section 2.1 that this relationship should be weakly positive: $\frac{\partial \alpha}{\partial \beta} \geq 0$. The second term represents how firms with different β might be at differentially curved points in the production function, and therefore have differential responses to the exchange-rate shock, holding fixed α. As we saw above, the choice of capital (and therefore the relative curvature of the production function) was fairly insensitive to the optimal choice of β, so the second term is likely to be of second order (and it certainly so when evaluated at low α). We focus mostly on the first term below in understanding the competitiveness effect.

The relationship in the cross-section between β and the net-worth effect comes out to

$$\frac{\partial}{\partial \beta}\left[\left(\alpha f - \beta L_1\right)\gamma_1\right] = -\gamma_1 L_1 + \gamma_1 \frac{\partial \alpha}{\partial \beta} f + \gamma_1 \left[\alpha \frac{\partial w_0}{\partial \beta} - \frac{\partial L_1}{\partial \beta}\left(\alpha f' - \beta\right)\right] + \left(\alpha f - \beta L_1\right)\frac{\partial \gamma_1}{\partial \beta} \tag{14}$$

The first term of equation (14) is $-\gamma_1 L_1$. This is the most basic incarnation of the balance-sheet effect: firms with more debt in dollars see the peso value of their debt increase more with a depreciation. The remaining terms, on the other hand, attenuate the negative effect of ballooning debt. The second term accounts for the relationship between α and β. If firms match to some degree, $\frac{\partial \alpha}{\partial \beta} > 0$, and firms with more dollar debt will receive favorable earnings shocks from a depreciation, and thereby have higher net worth. The (positive) dependency of β on firm's *ex ante* financial position is reflected in the third group of terms. The final term measures how firms with more dollarized debt will have *ceteris paribus* different sensitivities of interest rates (and thereby, investment) to net worth. We proxied this in section 2.1 as risk aversion over firm net worth, and saw that a higher θ lead to a lower β. This suggests that $\frac{\partial \gamma_1}{\partial \beta} < 0$. If firms have some currency mismatch, then $\alpha f - \beta L_1 < 0$, and the final term in equation (14) is positive, attenuating the first effect via increasing debt. Note that none of the terms of equation (14), except the first one, is a causal effect. These latter terms are instead due to selection: firms that issue compose more of their debt in dollars are better equipped to manage the concomitant risk.

Once again, the net result of these effects is ambiguous. Following a depreciation, firms with higher levels of dollar debt will see their debt rise, but will also be those firms whose earnings and profit opportunities rise. Increased current earnings may offset the inflated peso value of dollar debt, so that the balance-sheet channel may turn out positive or negative. As for competitiveness factors, higher future marginal products of capital will increase the demand for capital. Moreover, the mechanical effect of debt revaluation will be attenuated by differences in the financial positions and sensitivities of the firms that issue dollar debt. The combined effect of all these changes is uncertain and therefore an empirical question. With this case in mind, we turn our attention to measuring these effects.

3.4 Empirical Specification

The central empirical question of the present study is how the changing exchange rate interacts with dollar-denominated liabilities on the firm's balance sheet to alter the firm's investment behavior. Therefore, the key explanatory variable in our analysis is the interaction of lagged dollar debt, $D^*_{i,t-1}$, with the change in the exchange rate, Δe_t:

$$D^*_{i,t-1} \times \Delta e_t$$

This term will measure the differential change in investment associated with holding dollar debt during a depreciation.[6] This expression is equivalent to $\frac{\partial}{\partial \beta}\left[\frac{\partial K_2}{\partial e_t}\right]$ in the model above. Recall that the prediction for the sign of this derivative is ambiguous and results from the combination of variations across β of two distinct channels: a competitiveness effect, related to capital demand; and a net-worth effect, related to capital supply. By including this interaction of lagged dollar debt and the change in the exchange rate, we are therefore trying to recover the sample average of this effect. The estimated sign of this coefficient should indicate which effect dominates: increasing competitiveness or decreasing net worth.

In addition to interaction effects, we also include both main effects: lagged foreign-currency-denominated debt and the change in the real exchange rate. Including the main effect of dollar debt absorbs any pre-existing differences among firms with different levels of dollar-indebtedness. Such differences might have prevailed in the absence of movements in the real exchange rate, e.g., if

[6] One way to derive this interaction is to write down the law of motion for total debt, expressed in terms of inflation-adjusted pesos. The interaction effect is the only second-order term that enters this specification. An alternative way to motivate this interaction by considering firm i's optimal choice of period-2 capital, $K^*_{i,2}$, as implicitly defined above. Since the firm's predetermined net worth, $W_{i,t}$, can be expressed as $W(e_t, D^*_{i,t-1})$, we can rewrite $K^*_{i,2}$ as $K^*(e_t, D^*_{i,t-1})$. Taking a second-order Taylor approximation around the lagged exchange rate, e_{t-1}, and some level of dollar leverage, X, we see that deviations from $K^*(e_{t-1}, X)$ can be expressed as

$$\Delta K = \frac{\partial K}{\partial e}\Delta e + \frac{\partial K}{\partial D^*}\Delta D^* + \frac{1}{2}\left(\frac{\partial^2 K}{\partial e^2}(\Delta e)^2 + \frac{\partial^2 K}{\partial D^{*2}}(\Delta D^*)^2 + \frac{\partial^2 K}{\partial e \partial D^*}(\Delta e \times \Delta D^*)\right). \quad (15)$$

where $\Delta K = K^*(e_t, D^*_{i,t-1}) - K^*(e_{t-1}, X), \Delta e = e_t - e_{t-1}$ and $\Delta D^* = D^*_{i,t-1} - X$. The final term in this equation is the one of interest. Both derivations are found presented by Bleakley and Cowan (2002).

expanding firms were more likely to issue dollar debt than stagnant ones. (This is analogous to an ever-treated dummy in a difference-in-difference specification.) The main effect for the change in the exchange rate captures the variation in relative prices that may impact all firms in the economy without regard to the currency composition of their debt. (In practice, to avoid functional-form assumptions, we replace the exchange-rate variable with dummies for country×year.)

The basic specification (for firm i in country j at year t) that results is

$$Y_{ijt} = \gamma(D^*_{i,j,t-1} \times \Delta e_{jt}) + \delta D^*_{i,j,t-1} + X_{i,j,t-1}B + X_{i,j,t-1} \times \Delta e_{jt}\Gamma + \delta_{jt} + \varepsilon_{ijt} \tag{16}$$

where Y_{ijt} is the firm-level outcome, typically investment, and the δ_{jt}'s are country×year dummies. This empirical framework allows us to estimate the result of holding dollar debt during an exchange rate realignment: $\hat{\gamma} = \widehat{\frac{\partial^2 Y}{\partial e \partial D^*}}$. It bears mentioning that this is not measuring a *causal* effect, but instead the result of a combination of one causal factor—the effect due to increases in the peso value of debt—and other changes in financial and capital-demand factors that happen to be correlated with the currency composition of the firm's debt. The X variables and their interactions with the real exchange rate allow for alternative hypotheses about the effect of $D^* \times \Delta e$. One control that seems key is total debt, $D^T_{i,j,t-1}$ and $D^T_{i,j,t-1} \times \Delta e_t$, because we are interested in the currency composition of debt, rather than debt itself.

4 Review of Microempirical Studies

We review the several studies that relate investment to the interaction of dollar debt and the exchange rate using firm-level data. As shown above, if firms are matching, it is important to distinguish whether the results are unconditional or conditional on competitiveness factors, and we separate the discussion of results by this typology.

Several studies address whether firms holding more dollar liabilities invest relatively less following a depreciation without conditioning on competitiveness factors as part of their main results. We ourselves produced an early paper in this vein (Bleakley and Cowan; 2002, 2008). Using data largely scraped from Bloomberg, we examined investment behavior of firms in six Latin American countries. We estimated the $D^* \times \Delta e$ coefficient to be generally positive, and never negative and significant. We also found that including proxies of competitiveness pushed the $D^* \times \Delta e$ coefficient to being more negative, as expected. Bonomo, Martins and Pinto (2003) look at a sample of publicly listed firms in Brazil over the period 1990-2002 and Benavente, Johnson and Morande (2003) study the investment response of a similar sample of firms in Chile over the 1994-2001 period.

Neither of these obtain a robust, negative and significant coefficient on the interaction between dollar debt and the exchange rate. Carranza et al (2003) examine a sample of Peruvian firms, but the omission of the main effects of the key interaction terms makes the results of this study very difficult to interpret. In those specifications in which the main effects are included, they fail to find a negative and significant coefficient on $D^* \times \Delta e$. Echeverry, Fergusson, Steiner and Aguilar (2003) address this question using a much larger sample of firms from Colombia. Drawing on data for close to 8000 listed and non-listed firms over the period 1994-2001 they also fail to find a negative and significant negative coefficient on the $D^* \times \Delta e$ interaction. Pratap, Lobato and Somuano (2003), on the other hand, do find a negative and significant coefficient on the interaction between dollar debt and devaluations in publicly listed Mexican firms. However, as shown by Bleakley and Cowan (2008), this result seems to be driven by an omitted variable. In no specification do they control for the interaction between total debt and the real exchange rate, and omitting this variable results in a sizeable downward bias on the estimated coefficient of $D^* \times \Delta e$. Because the tequila crisis in Mexico was a shock to both the exchange rate and a credit crunch, this omission seems problematic. This is similar to the study by Senses (2003), who estimates a negative and significant coefficient on $D^* \times \Delta e$ in Turkey circa 1994 (although not circa 2001). But that paper also does not control for the interaction of total debt×crisis.[7] Luengnaruemitchai (2004) looks at the response of investment to a depreciation in non-financial firms in Asia. He finds that firms holding dollar debt invest at least as much as their counterparts following a depreciation.

In contrast, a number of other studies attempted to isolate the net-worth effect of $D^* \times \Delta e$ by conditioning on competitiveness factors. To answer this question requires detailed information on the income and cost structure of firms, as well as the currency denomination of their assets. With this detailed information it is possible to separate the negative balance sheet effects of a depreciation from its positive competitiveness effects on current earnings and the demand for capital. Because of the data requirements, there are few empirical papers that address this question, two of them for Mexico, two for Chile, and one for Turkey. Aguiar (2002) and Pratap et al (2003) look at the investment behavior of publicly listed Mexican firms. Aguiar (2002) concentrates on the years around the tequila crisis, while Pratap et al (2003) analyze firm data from 1989 to 1999. Both control for differential competitiveness effects by including firm level data on exports interacted with

[7] One might think that there is an inconsistency in our logic if we prefer to condition on the interaction of macro shocks with total debt, but not condition on changing competitiveness factors. There is, however, no inconsistency in that we are investigating the currency composition of *debt*, meaning that a firm that issues an additional unit of debt might do so in dollars or pesos, so the relevant comparison firm is one that is similarly leveraged *ex ante*. If in the end we found that the reason the dollar indebted firms did badly after a crises is because they were had issued more debt regardless of currency, this would suggest a different model of crises, and point us away from all the policies directed at de-dollarization of liabilities.

the relevant macroeconomic variables. Both find that following a depreciation, firms with larger currency mismatches invest relatively less. Fuentes (2003) finds evidence of matching in Chilean firms, and, using similar competitiveness controls, obtains an estimate implying negative effects of $D^* \times \Delta e$. Cowan, Hansen, and Herrera (2005) also use controls for the currency composition of assets (including net derivative positions) of Chilean corporations between 1994 and 2001. Their results confirm the uncoditional-versus-conditional hypothesis. Without adding additional competitiveness controls, firms holding dollar debt do not invest relatively less than peso indebted firms following a depreciation. On the other hand, once the currency composition of assets and income is accounted for, they find a significant, negative balance sheet effect of dollar denominated debt.

Again, the distinction between conditional and unconditional analyses of dollar debt and depreciations is key here. If 'the game' were simply to find a negative coefficient on $D^* \times \Delta e$, then conditioning on the compensatory, competitiveness factors would seem the best route to winning. But if the goal is to understand whether net-worth effects outweighed competitiveness factors, then conditional regressions are not informative on this point. Firms with high levels of dollar debt are also firms whose current earnings (and marginal product of capital) go up following a depreciation. These positive competitiveness effects appear to offset the negative balance sheet effects of dollar debt, in the studies that do not condition on such competitiveness factors.

5 Results for Latin America

In this section, we replicate our methodology on a database of Latin American firms. These data were assembled in a project funded by the Inter-American Development Bank (IADB, 2002; Galindo, Panizza, and Schiantarelli, 2003). Notably, the data contain information on debt denominated in foreign currency, which is the focus of our analysis. The database also has standard accounting variables, such as liabilities, short-term liabilities, assets, sales, operating income, etc.

The main outcome is investment. The first type of investment we consider is fixed-capital investment, which is measured as capital expenditures. (We do not use the change in net fixed assets as a measure of investment, as accounting standards allow for revaluations of assets, making it impossible to separate investment from changes in the accounting valuation of capital goods.) Second, we consider inventory investment, which is the yearly change in the stock of inventories. Both are important components of the business cycle, but reflect different horizons. Building up inventories is a short-term investment, and is likely to be sensitive to the availability of working capital. Investment in fixed capital is about the long-term expansion of the productive capacity of the firm, and depends on a more broadly weighted cost of capital.

We merge in macro data from the International Financial Statistics. The main macro variable is the natural-log change in the real exchange rate, which is defined as the exchange rate with the US dollar, deflated by the CPIs of the respective countries. We consider the five countries that experienced nominal depreciations in this sample window (the most of the 1990s): Brazil, Chile, Colombia, Mexico, and Peru. Additional variables are introduced below as needed. Further details of the micro- and macro-data are found in Appendix A, and the number of observations in each country×year cell is shown in Appendix B.

5.1 Investment Results

Estimates of equation 16 are found in Table 2. The coefficient of interest—the reduced-form effect on investment of holding dollar debt during a depreciation—is uniformly positive across specifications and dependent variables, and is often significantly different from zero. Columns (1)–(5) contain the results for fixed-capital investment, whereas in Columns (6)–(10), we present estimates for inventory investment. We report the effect on current-year investment in Panel A, whereas Panel B contains results where investment for the following year is the dependent variable. All of the micro-level variables are lagged one year, so "current year" is contemporaneous with the macro variable. For Panel B, the dependent variable is from period $t + 1$ and the lagged dependent variable is therefore from period t.

For each set of dependent variables, we report a variety of specifications. The regressions summarized in columns (1) and (4) include only the principal first-order effect and the interaction term: dollar debt times the change in the exchange rate ($D^* \times \Delta e$). (In all specifications, macroeconomic effects that are common across firms are absorbed by country×year dummies.) In subsequent columns, we add total debt and its interaction with the real exchange as a simple control for macro shocks coincident with the depreciation and that differentially affect highly indebted firms, regardless of the currency composition of their debt. (Examples of such confounding macro shocks might be a simultaneous rise in the country risk premium or a collapse of the banking sector.) We also add the interaction of peso debt with the change in the domestic price level, to control for possible indexation of peso debt.[8] Finally, we include a lagged dependent variable in the specification in Columns (5) and (10). In no case do we obtain a negative, and certainly not negative and significant coefficient estimate for $D^* \times \Delta e$. Moreover, for all specifications, we can reject that the four coefficients sum to zero at conventional confidence intervals. (We conduct this test by re-running

[8] Based on the law of motion of debt, we add $\sum_j (1-\alpha)_j \, D_{i,t-1} \Delta cpi_{j,t}$ to the specification, in which $D_{i,t-1}$ is lagged peso debt (as before) and $cpi_{j,t}$ is the log of the local price level. Using country-specific α allows the specification to accommodate different countries' use of indexed debt.

the model with Seemingly Unrelated Regressions.)

This result is robust to a slew of alternative hypotheses, as shown in Table 3. The first row repeats the baseline estimates shown in Columns (5) and (10) of Table 2. Because we argued that larger firms tended to issue more debt in dollars, we control for direct effects of this by including firm size and its interaction with the log change real exchange rate in the next row. In the following two rows, we allow for the debt variables to have differential impacts according to changes in aggregate domestic credit (the net capital account or the change in aggregate bank credit). Next, to account for possible maturity mismatch, we incorporate the firm's short-term debt into the model and interact it with either the the change in the real exchange rate or the aggregate-credit variables. Finally, in the last four rows we allow for differences in the responsiveness to the exchange by measures of firm performance (lagged earnings or investment) or ownership (having an ADR or a foreign parent company). In none of these specifications is the estimate for $D^* \times \Delta e$ negative and significant. On the other hand, in all cases, the sum of these effects is statistically significant and positive. In other results not reported here, we found similar effects of $(D^* \times \Delta e)$ whether the exchange-rate change was an appreciation versus a depreciation or whether it was expected versus unexpected. (The latter measure was constructed using peso interest rates to measure the expected change in the exchange rate. See Bleakley and Cowan (2008) for more on this methodology.) We also examined specifications that allowed for the effect of $D^* \times \Delta e$ to differ across firms with more total debt. These results suggested that the effect was less positive for more indebted firms (consistent with the net-worth effect being larger), but, at the same time, the sum of point estimates would only be negative for firms with substantially negative accounting equity (that is, for those firms with liabilities more than double assets).

We obtain similar results when using a variety of plausible estimation strategies. These results are found in Table 4. First, in rows 1–4, we obtain similar results using a variety of strategies for estimating the standard errors, including Gauss-Markov and White estimates as well as those adjusted for clustering by firm or by country×year. We also relax the assumption of linearity of the main effects of debt and dollar debt in row 5 by including them in the regression as 10th-order polynomials instead, which changes the results little.

Our earlier study (Bleakley and Cowan, 2002) received considerable criticism for our limited treatment of firm fixed effects and/or lagged dependent variables, but the results here are not materially affected by the inclusion or omission of these variables. First, estimates obtained without including a lagged dependent variable are similar to the baseline above, whether estimated using OLS (as in row 6) or with firm fixed effects (as in row 7). As above, the sum of these effects across investment variables is positive and statistically significant. On the other hand, it is well known that including both fixed effects and a lagged dependent variable in a regression yield biased estimates. We pursue several strategies to avoid this problem. First, a simple and transparent solution is to instrument (IV) for the lagged dependent variable using its twice-lagged value, as shown in Hsiao (1989, page 75). Estimates of $D^* \times \Delta e$ that follow from this approach are seen in rows 9 and 10; row 9 reports estimates controlling for firm fixed effects, while the row 10 values are estimated without fixed effects. Both sets of estimates are broadly consistent with the earlier results.

Several critics of our earlier study stated categorically that IV/GMM estimators such as Arellano-Bond or Blundell-Bond, both of which can also deal with the problem of fixed effect and lagged dependent variables (LDVs), should be used exclusively. But doing so introduces a slew of problems, probably greater than the one they were meant to address in this case. First, note that the GMM panel estimators typically use higher-order lags as IVs for the lagged firm variables, which are usually the main regressors of interest. It is not clear, however, why lags of the $D^* \times \Delta e$ interaction term would be good instruments for the most recent term. Indeed, it is not in the IADB sample, as we see in the following simple regression:

$$D^*_{i,t-1} \times \Delta e_t \;=\; \underset{(.025)}{-.003}\; (D^*_{i,t-2} \times \Delta e_{t-1}) + \underset{(.003)}{-.014}\; D^*_{i,t-2} + \delta_{ct} + \varepsilon_{ict}$$

where δ_{ct} are country×year effects. The lag of $D^* \times \Delta e$ has a t statistic of -0.1; it is hardly a good predictor of itself. Why? Because what is relevant is the firm's exposure to the exchange rate now, rather than the lagged exchange rate. This highlight the broader problem that it is less than transparent what the identification in these GMM estimators actually comes from. Another problem is that these procedures generate many IVs, and, for the IADB data, our implementations of the estimators are overidentified by several hundreds of degrees. It is well known that instrumental-variables methods exhibit small-sample biases when overidentified, and at least some of the proposed estimators have this property. Finally, yet another problem with IV methods is that sometimes they produce estimates that imply explosive dynamics in the system. For example, in Table 4, Panel 9, we estimate an LDV coefficient for inventory to be 1.64. This is plainly nonsensical: inventory investment might occasionally grow at 64% per annum, but not as a rule.

We suggest an alternative strategy for dealing with the problem of estimation with fixed effects and lagged dependent variables. A simple solution is to check for the sensitivity of these estimates in the broadest possible way: that is, does our conclusion hold for any value of the LDV parameter (β_{LDV})? It is worth noting that the LDV parameter is not intrinsically interesting here, but rather a confound in the estimation of $D^* \times \Delta e$. Our strategy to overcome this confound is to (1) fix β_{LDV} at a particular value and estimate the constrained model, (2) iterate over the feasible range of β_{LDV}, (3) examine how results for $D^* \times \Delta e$ depend on β_{LDV}. The feasible range of the LDV parameter is defined by stability of the system, that is $|\beta_{\text{LDV}}| \leq 1$. Our prior beliefs suggest further restrictions on this range: it is likely that $\beta_{\text{LDV}} > 0$ (investment is persistent, as in a partial-adjustment model), but that $\beta_{\text{LDV}} \ll 1$ (capital stocks should have stable roots, so investment must be even less persistent). The results of this exercise are found in Figure 3, which reports coefficients on $D^* \times \Delta e$ for various assumptions the lagged dependent variable. The dashed line displays the coefficients for inventory investment, while the solid line represents estimates for fixed-capital investment. (Within investment categories, we sum current- and following-year effects together.) The 'worst case' scenario would be seen is fixed-capital investment were perfectly oscillatory ($\beta_{\text{LDV}} = -1$) and inventory investment were perfectly persistent ($\beta_{\text{LDV}} = 1$), in which case the total effect of $D^* \times \Delta e$ on investment would be around -0.1 (though not significantly different from zero). But these LDV parameters are both implausible. If we focus on more plausible values for β_{LDV}, we obtain parameter estimates for $D^* \times \Delta e$ around -0.05 for fixed capital and +0.15 for inventory, the sum of which is positive and significantly different from zero at some points in that neighborhood. These estimates are quite similar to those above. Note again that β_{LDV} was not estimated in this exercise, so there was no need to use GMM to address any bias in $\hat{\beta}_{\text{LDV}}$, in spite of the presence of firm fixed effects in the model.

In any event, with all this focus on IV methods, one might miss the central logic of the exercise. First, the change in the exchange rate is not endogenous to any particular firm, so there is no need to instrument for the macro shock. Second, we do not need to estimate the causal effect of dollar debt to measure the differential response to dollar-indebted firms to the exchange rate. Indeed, as we stated before, the goal of this whole exercise is *not* to measure a causal effect of $D^* \times \Delta e$, but to instead to measure the composite of net-worth and compensatory factors that result from selection *ex ante* of firms into different currency compositions of debt. Think of this as a difference-in-difference exercise. In a normal year (e.g. when $\Delta e = 0$), the coefficient on dollar debt measures whatever behavior might be correlated with D^* issuance. The interaction term measures how this behavior changes during the depreciation, relative to normal times.

The main challenge to this estimation strategy is if the firms were to somehow recompose their debt prior to the depreciation in a way that shuffles up whatever correlations there were normally present between D^* and other factors. We suggest a check for this possibility: use the second lag of dollar debt to construct instruments for the variables containing $D^*_{i,t-1}$ in the equation. Specifically, $D^*_{i,t-2}$ serves directly as an IV for the main effect ($D^*_{i,t-1}$), and it interacted with the contemporanous change in the exchange rate (i.e., $D^*_{i,t-2} \times \Delta e_t$) to instrument for $D^* \times \Delta e$. The results from this, found in Panel 11 of Table 4, are similar to the baseline. This approach does not suffer from the criticisms of IV methods above. First, the system is just identified. Second, the coefficient on $D^*_{i,t-2} \times \Delta e_t$ in the first-stage regression for $D^*_{i,t-1} \times \Delta e_t$ has a coefficient around 0.7, which does not imply explosive behavior, and, third, the instrument, with a t-stat of around 50, is not a weak one by any classification. The new estimates of $D^* \times \Delta e$ that results from this strategy are similar to the baseline.

5.2 Firm Income and Debt

We confirm here that the motivating hypothesis that dollar-indebted firms receive differential shifts in both competitiveness and net worth. These results are found in Table 5. We run regressions similar to those above, but place sales, income, and liabilities on the left-hand side instead of investment. Again, the coefficients on $D^* \times \Delta e$ are the ones of interest. In the wake of a depreciation, dollar-indebted firms see substantial increases in sales (columns 1 and 2) and operating income (columns 3 and and 4). This is evidence of matching of the sort predicted by the model above. Firms that issue dollar debt also stand to receive favorable shocks to profitability when the exchange rate depreciates. Put another way, the strong and positive responses to the exchange rate among dollar-indebted firms points to those firms having a natural hedge against the currency risk on their balance sheet.[9] In Column 5, we include period-t investment variables, and we find that these account for approximately 60% of the period-$t+1$ response of operational income associated with $D^* \times \Delta e$. The remaining columns report results for liabilities. In the year of the depreciation, total liabilities rise in dollar-indebted firms, relative to their peso-indebted counterparts. This precisely what one we expect: dollar liabilities increase in real-peso terms. The coefficient on $D^* \times \Delta e$ is close to one, which is what one would obtain from a mechanical revaluation of debt. The coefficient for liabilities in the following year is lower than that of the contemporaneous year and less precisely determined. This suggests that the impact on the balance sheet attenuates over time.

5.3 Country-Specific Results

We examine the five countries that experienced nominal depreciations during the IADB sample frame, and find little evidence of a deleterious effect of $D^* \times \Delta e$ on investment. A criticism directed at our earlier work was that pooling samples from several countries occulted possibly

[9]These firms might also use financial hedges, the return from which would appear as non-operational income following the depreciation. The data do not contain nonoperating income, but the effect on earnings is similar to that on operational income, which suggests that natural more important than financial hedging in this sample.

heterogeneous experiences across episodes. We consider countries separately in Table 6, which presents regression coefficients on $D^* \times \Delta e$. On the one hand, we find that two of these regression coefficients that are significantly different from zero: Brazil for fixed-capital investment and Mexico for inventory investment, both from the year contemporaneous with the depreciation. On the other hand, none of these coefficients are both negative and significant. Indeed, the coefficients across investment variables sum to a negative number in one sample only: Colombia, a country that was not especially dollarized. Overall, evidence of strongly negative effects of $D^* \times \Delta e$ do not emerge when decomposing our results by country.

6 Results for East Asia

[TO COME; Results are similar to Luengnaruemitchai (2004).]

7 Conclusions and Discussion

This paper offers a critical review of the recent micro-empirical literature on dollar debt and its role in causing crises via balance-sheet effects in the corporate sector. While the theoretical antecedents of this literature suggest that this is a logical possibility, understanding whether the net-worth effect dominates the traditional competitiveness effect is ultimately an empirical matter. While a casual review of the relevant empirical literature suggests a 'mishmash on mismatch', we argue that the opposite is the case. We show that the question of dollar debt causing a depreciation to be contractionary is related to whether the detrimental net-worth effects overwhelm traditionally assumed benefits of increased competitiveness. Many of the studies that report negative effects of $D^* \times \Delta e$ do not actually answer this question because they condition on competitiveness factors in the regression. The few others that report negative and significant effects do so via important errors in the specification. The remaining studies that measure the composite (i.e. unconditional) coefficient do not find evidence of negative and significant coefficients on $D^* \times \Delta e$, and moreover tend to find positive and occasionally significant effects. We replicate these estimates in samples from Latin America and East Asia, and find similar results: estimates of $D^* \times \Delta e$ on investment are typically positive, often significantly so. These results, taken as a whole, suggest the net-worth effect of $D^* \times \Delta e$ was not large enough to dominate the improvement in competitiveness, and that the dollar indebtedness of corporates would not be enough to make a depreciation contractionary.

Where does then this leave the balance-sheet view of these crises? One possibility is that the relevant effects of dollar debt lie elsewhere in the economy, perhaps in the government or among banks, although the only evidence we know of on this point is by Mora (2003), who finds that dollar-indebted banks in Mexico did not perform differentially worse in the Tequila crisis. On the other hand, a related hypothesis suggests that these crisis are instead a sort of 'bank run', with the maturity mismatch of firms creating the potential for a crisis. The only micro evidence that we are aware of on this point is by Bleakley (2003) and Bleakley and Cowan (2004), who find that, following a crisis, the corporates with more exposure at the short term (meaning more short-term debt than liquid assets) have investment and operational outcomes that are statistically indistinguishable from their long-term-exposed counterparts. Finally, Bleakley and Cowan (2007) find that indebtedness prior to a sudden stop is a very strong predictor of reduced investment after the crisis, but they cannot conclude whether these leverage effects are Fisherian ('overhang') or Schumpterian ('hangover') in nature. This suggests that future work should therefore investigate the causes and consequences of excess debt, regardless of its currency or maturity structure.

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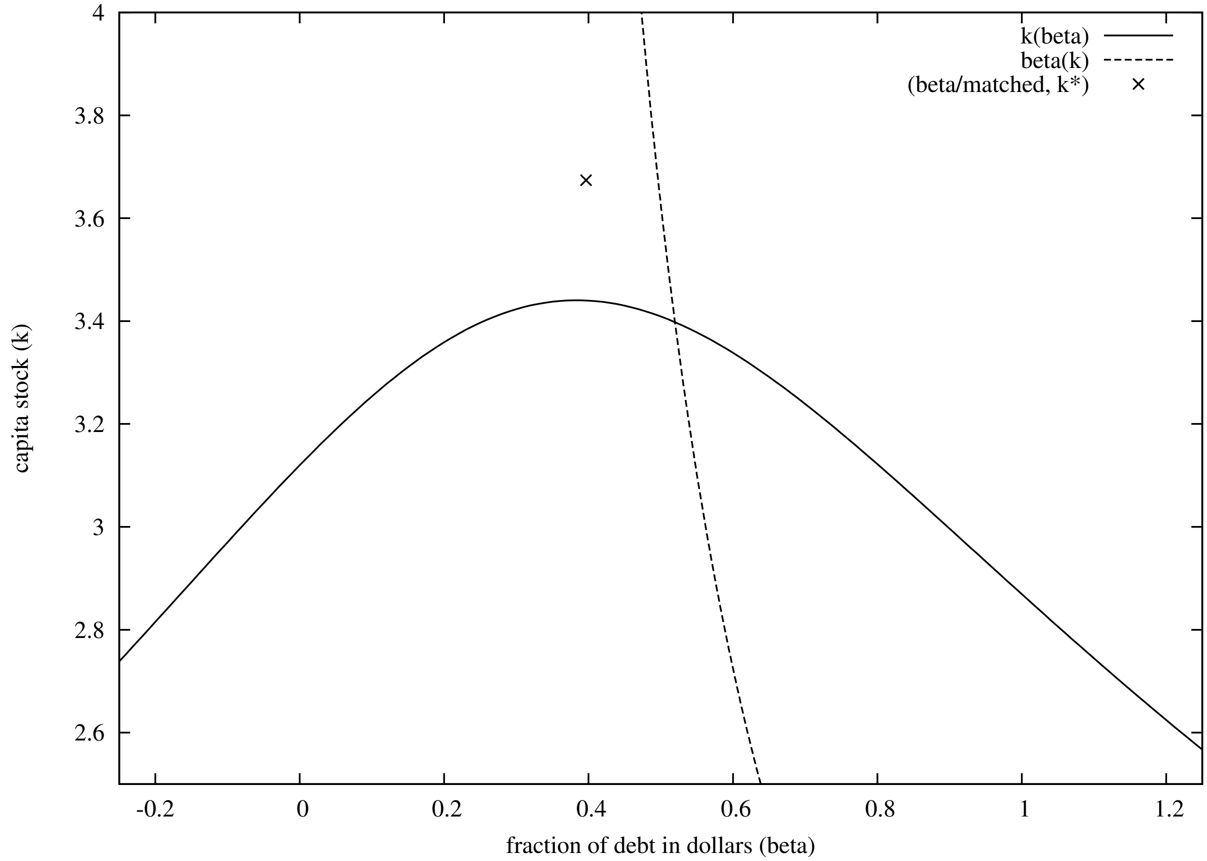
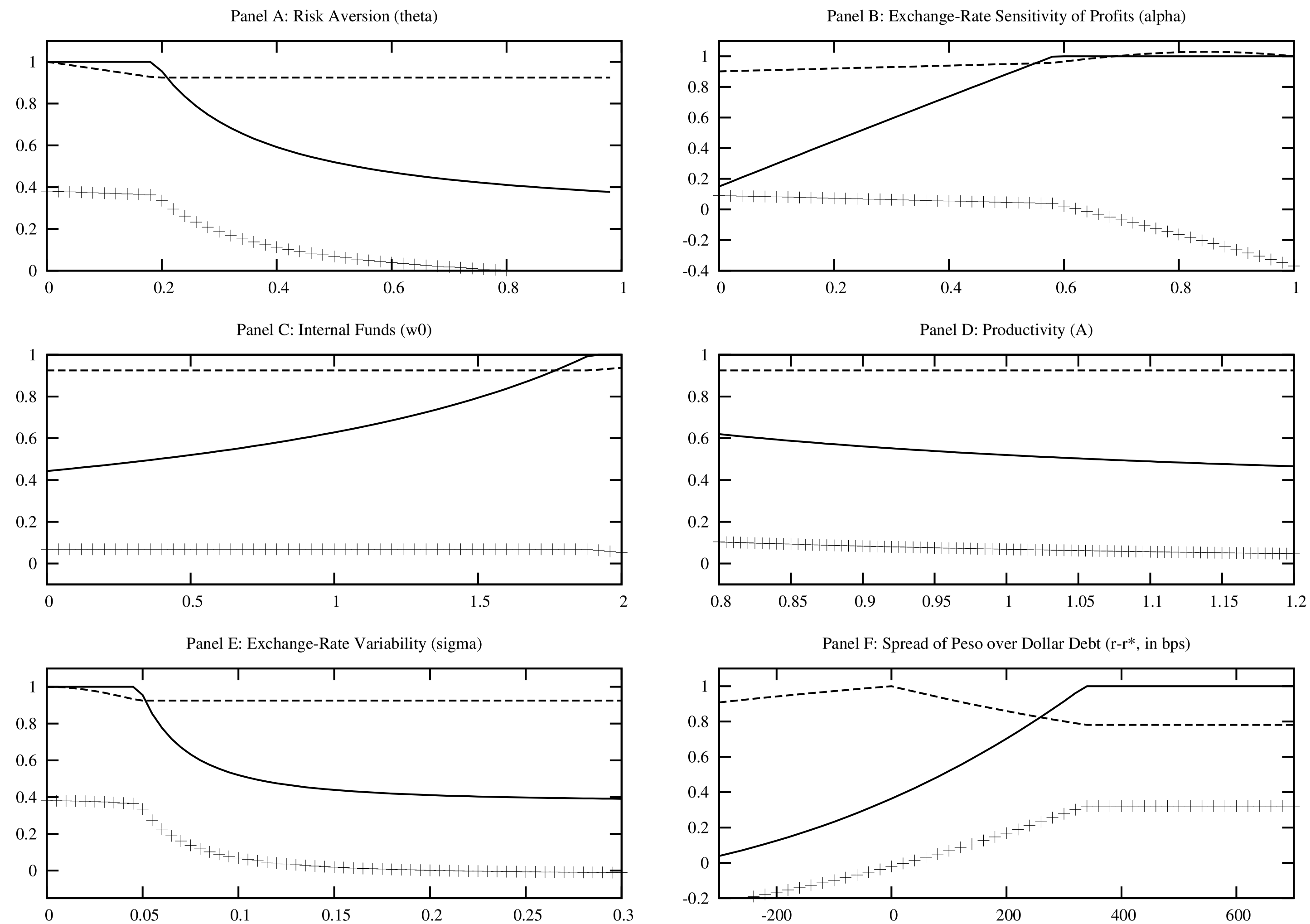
Figure 1: Optimal choices of Capital and Currency Composition of Debt



This figure presents simulation results for the maximization problem in section 2.1, equation (3). The solid line graphs the optimal choice of k given values of β, as defined by the FOC w.r.t. k. Conversely, the dashed line graphs the optimal choice of β given values of k, as defined by the FOC w.r.t. β. The point 'x' marks a firm that is perfectly matched ($\beta = \beta_{\text{match}}$) and maximizes expected wealth in period one ($k^{**} = f^{-1}(1 + r^*)$). The (gross) production function is $f(k) = A * k^a + k(1 - \delta)$ and the model parameters are as follows:

Variable	Value	Description
θ	0.5	Weight on variance in the objective function
σ_e	0.1	Standard deviation of the exchange rate in period 1
α	0.25	Fraction of output that is tradeable
r	0.10	Interest rate on peso/nontradeable debt
r^*	0.09	Interest rate on dollar/tradeable debt
w_0	0.5	Initial firm wealth
δ	0.05	Depreciation rate of capital
A	1	TFP term in the production function
a	1/3	Exponent in the production function

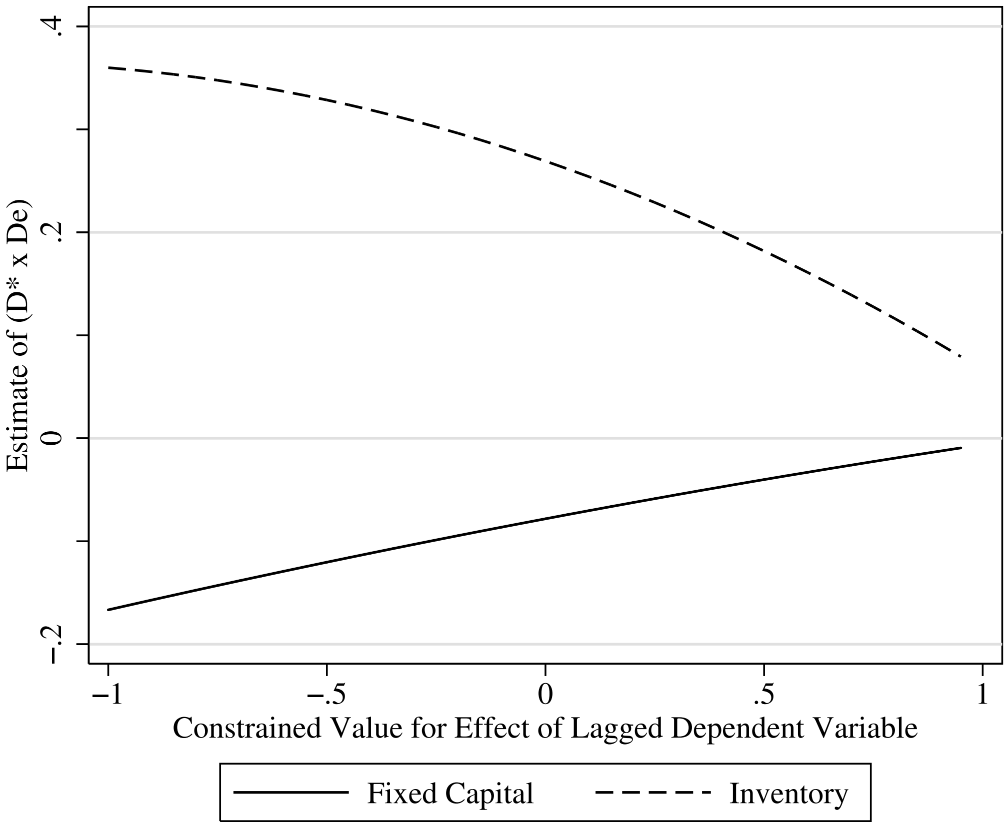
Figure 2: Investment, Currency Composition of Debt, and Mismatch for Various Parameter Values



Key: Currency Composition of Debt (β) —— ; Capital Stock (k_1) as fraction of Optimum - - - - ; Currency Mismatch ($\beta - \alpha f(k_1)/L_1$) ++++

Notes: simulation results for model in section 2.1. Parameter values are as denoted in Figure 1, except for the parameter that is varied for the simulation on the x axis of each panel.

Figure 3: Estimates of Dollar Debt × Real Exchange Rate for Various Coefficients on the Lagged Dependent Variable



Notes: This figure reports estimates of $D^* \times \Delta e$ (the y axis) for various constrained values for the coefficient on the lagged dependent variable (the x axis). The dependent variables are types of investment, as indicated by line type. The coefficients on $D^* \times \Delta e$ are summed over years t and $t+1$. The regression specifications include firm fixed effects, but are otherwise as in Columns (5) and (10) of Table 2. For detailed sources and descriptions, see Appendix A.

Table 1: Descriptive Regressions for Dollar Leverage (Latin America)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sensitivity of Profits to the Real Exchange Rate									
Exports to Sales Ratio		0.191	0.188	0.288	0.119	0.175	0.042	0.389	0.067
		(0.025)***	(0.025)***	(0.077)***	(0.032)***	(0.038)***	(0.029)	(0.058)***	(0.058)
Dummy for Tradeable Sector		0.011	0.012	-0.004	0.048	-0.004	-0.001	0.024	0.033
		(0.009)	(0.009)	(0.031)	(0.015)***	(0.016)	(0.010)	(0.021)	(0.044)
Access to External Funds									
Log Assets (demeaned by country x year)		0.015	0.011	0.018	0.026	0.024	0.009	0.016	-0.023
		(0.003)***	(0.003)***	(0.010)*	(0.005)***	(0.004)***	(0.003)***	(0.007)**	(0.012)*
Fraction of Liabilities Long Term		0.114	0.114	0.253	0.055	0.053	0.020	0.116	0.264
		(0.014)***	(0.014)***	(0.055)***	(0.027)**	(0.019)***	(0.013)	(0.034)***	(0.064)***
Has ADR or GDR			0.038						
			(0.013)***						
Dummy if is Foreign Owned			0.019						
			(0.009)**						
Country Dummies									
Argentina	0.316	0.258	0.246	0.215					
	(0.007)***	(0.016)***	(0.016)***	(0.029)***					
Brazil	0.105	0.034	0.019		0.045				
	(0.003)***	(0.010)***	(0.011)*		(0.016)***				
Chile	0.086	0.015	0.008			0.048			
	(0.004)***	(0.009)	(0.010)			(0.011)***			
Colombia	0.031	-0.034	-0.039				0.020		
	(0.002)***	(0.009)***	(0.009)***				(0.007)***		
Mexico	0.200	0.127	0.115					0.090	
	(0.005)***	(0.013)***	(0.013)***					(0.017)***	
Peru	0.332	0.256	0.248						0.215
	(0.010)***	(0.019)***	(0.019)***						(0.047)***
Regression Statistics									
N	7876	6343	6342	797	1142	1269	953	1581	601
R^2	0.540	0.610	0.610	0.740	0.570	0.460	0.220	0.580	0.690

This table reports the OLS estimates of equation 4 in the text. Standard errors adjusted for clustering by firm are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variable ("dollar leverage") is foreign-currency debt over total assets. Firm-level data are from the IADB database described in the text. For detailed sources and descriptions, see Appendix A.

Table 2: Effect of Dollar Debt and Exchange Rate Movements on Investment

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent Variables:									
	Capital Expenditures					Inventory Investment				
	Panel A: Dependent Variables from the Current Year									
Interactions										
Dollar Debt x	0.165	0.162	0.162	0.189 *	0.230 **	0.135 ***	0.134 ***	0.139 ***	0.179 ***	0.231 ***
(Δ Log Real Exchange Rate)	(0.114)	(0.114)	(0.115)	(0.114)	(0.109)	(0.043)	(0.043)	(0.043)	(0.055)	(0.059)
Total Debt x				-0.049	-0.047				-0.059	-0.097 **
(Δ Log Real Exchange Rate)				(0.036)	(0.035)				(0.042)	(0.046)
Controls:										
Dollar Debt	-0.030 *	-0.021	-0.028	-0.028	-0.027	-0.014 ***	-0.012 **	-0.018 **	-0.016 **	-0.006
	(0.017)	(0.018)	(0.019)	(0.019)	(0.019)	(0.005)	(0.006)	(0.007)	(0.008)	(0.008)
Total Debt		-0.014 *	-0.008	-0.009	-0.002		-0.003 *	0.002	-0.001	-0.010
		(0.008)	(0.008)	(0.007)	(0.007)		(0.002)	(0.005)	(0.006)	(0.006)
Lagged Dependent Variable					0.162 ***					0.060 *
					(0.041)					(0.034)
Peso Debt x (D Log CPI)			Yes	Yes	Yes			Yes	Yes	Yes
	Panel B: Dependent Variables from the Following Year									
Interactions										
Dollar Debt x	0.039	0.034	0.055	0.079	0.064	0.107 ***	0.107 ***	0.105 ***	0.063	0.057
(Δ Log Real Exchange Rate)	(0.099)	(0.099)	(0.100)	(0.116)	(0.113)	(0.039)	(0.039)	(0.040)	(0.045)	(0.045)
Total Debt x				-0.035	-0.024				0.059 *	0.061 **
(Δ Log Real Exchange Rate)				(0.076)	(0.070)				(0.031)	(0.031)
Controls:										
Dollar Debt	-0.029	-0.021	-0.026	-0.028	-0.019	-0.011 **	-0.011 **	-0.016 **	-0.018 **	-0.017 **
	(0.019)	(0.020)	(0.021)	(0.022)	(0.022)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
Total Debt		-0.012	-0.010	-0.007	0.001		0.000	0.005	0.007	0.007
		(0.009)	(0.010)	(0.013)	(0.012)		(0.002)	(0.005)	(0.005)	(0.005)
Lagged Dependent Variable					0.225 ***					0.031
					(0.045)					(0.029)
Peso Debt x (D Log CPI)			Yes	Yes	Yes			Yes	Yes	Yes

Each column reports the results of an OLS regression. The dependent variables are as indicated above each column. Estimates of the effect of the independent variables are listed in each row. Also included in each regression are indicator variables for each country-year cell. Huber-White standard errors are given in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The number of observations varies because of data availability. Firm-level independent variables are once-lagged values. All accounting variables are scaled by the lag of total firm assets. Macroeconomic variables (real exchange rate and CPI) are from the current period. The real exchange rate is defined as as nominal exchange rate over domestic CPI. The accounting data are from the IADB database, as described in the text. Macro data are drawn from the International Financial Statistics of the IMF. For detailed sources and descriptions, see Appendix A.

Table 3: Robustness Of Main Results

	(1)	(2)	(3)	(4)
	Dependent Variables:			
	Capital Expenditures		Inventory Investment	
Period for dependent variable:	(t)	(t+1)	(t)	(t+1)
Specification:				
1. Baseline	0.230 **	0.064	0.231 ***	0.057
	(0.109)	(0.113)	(0.059)	(0.045)
2. Add firm size and interact with real exchange rate	0.177	0.034	0.220 ***	0.053
	(0.122)	(0.122)	(0.060)	(0.050)
3. Add interactions with Net Capital Account	0.248 **	0.015	0.239 ***	0.092 **
	(0.112)	(0.117)	(0.061)	(0.046)
4. Add interactions with D log Domestic Bank Credit	0.230 **	0.070	0.232 ***	0.056
	(0.109)	(0.114)	(0.059)	(0.045)
5. Add short-term debt and interact with real exchange rate	0.246 **	0.059	0.244 ***	0.051
	(0.118)	(0.114)	(0.060)	(0.045)
6. Add short-term debt and interact with aggregate credit variables	0.274 **	0.006	0.253 ***	0.089 *
	(0.122)	(0.117)	(0.062)	(0.047)
7. Add lagged earnings (EBITDA) and interact with real exchange rate	0.168	0.025	0.241 ***	0.046
	(0.115)	(0.116)	(0.059)	(0.045)
8. Interact lagged dependent variable with real exchange rate	0.208 *	-0.039	0.240 ***	0.070
	(0.114)	(0.109)	(0.058)	(0.048)
9. Add dummy for ADR and interact with real exchange rate	0.220 *	0.037	0.245 ***	0.051
	(0.117)	(0.117)	(0.060)	(0.046)
10. Add dummy for foreign owned and interact with real exchange rate	0.190 *	-0.027	0.214 ***	0.072
	(0.113)	(0.111)	(0.060)	(0.052)

Each cell presents the results from a different regression, and each panel uses a different specification. The dependent variables are as indicated above each column. Estimates of the effect of dollar debt × changes in the real exchange rate $D^* \times \Delta e$ are reported in each panel. Independent variables in each regression are as in Table 2, Column 5, however reporting of the rest of the estimates is supressed. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The number of observations varies because of data availability. Firm-level independent variables are once-lagged values. All accounting variables are scaled by the lag of total firm assets. The macroeconomic variables are from the current period. The real exchange rate is defined as as nominal exchange rate over domestic CPI. Net capital inflows are the net financial account. Bank credit refers to private sector loans by the domestic banking system. The accounting data are from the IADB database, as described in the text. Macro data are drawn from the International Financial Statistics of the IMF. For detailed sources and descriptions, see Appendix A.

Table 4: Alternative Estimators

	(1)	(2)	(3)	(4)
	Dependent Variables:			
	Capital Expenditures		Inventory Investment	
Period for dependent variable:	(t)	(t+1)	(t)	(t+1)
Independent Variables:				
1. OLS, baseline, Gauss-Markov standard errors	0.230 **	0.064	0.231 ***	0.057
	(0.096)	(0.123)	(0.044)	(0.040)
2. OLS, baseline, Huber-White "robust" standard errors	0.230 **	0.064	0.231 ***	0.057
	(0.109)	(0.113)	(0.059)	(0.045)
3. OLS, baseline, errors clustered on country x year	0.230 **	0.064	0.231 ***	0.057
	(0.104)	(0.064)	(0.061)	(0.038)
4. OLS, errors clustered by firm	0.230 **	0.064	0.231 ***	0.057
	(0.112)	(0.116)	(0.063)	(0.046)
5. OLS, using 10th-order polynomials in the debt controls	0.164	0.095	0.245 ***	0.059
	(0.111)	(0.118)	(0.061)	(0.046)
6. OLS, no LDV, Huber-White standard errors.	0.189 *	0.079	0.179 ***	0.063
	(0.114)	(0.116)	(0.055)	(0.045)
7. Firm fixed effects, no LDV, Huber-White standard errors	0.099	-0.066	0.200 ***	0.066
	(0.123)	(0.116)	(0.060)	(0.048)
8. Firm fixed effects, no LDV, AR(1) error	0.171 *	-0.089	0.195 ***	0.064
	(0.099)	(0.140)	(0.045)	(0.044)
9. Firm fixed effects, IV for lag of dependent variable	0.145	-0.030	0.367	0.050
with twice-lagged dependent variable	(0.176)	(0.149)	(0.273)	(0.067)
10. IV estimator using twice lagged dependent variable	0.244 **	0.021	0.229 **	-0.070
as instrument for lagged dependent variable	(0.114)	(0.130)	(0.102)	(0.091)
11. IV estimator using twice lagged dollar debt to	0.150 **	-0.134	0.238 **	0.028
to construct instruments for D* variables	(0.136)	(0.130)	(0.087)	(0.079)

Each panel presents the results from a different estimator. The dependent variables are as indicated above each column. Estimates of the effect of dollar debt x changes in the real exchange rate are reported in each panel. Independent variables in each regression are as in Table 2, Column 5, however reporting of the rest of the estimates is supressed. The exceptions are panels G-I that exclude the lagged dependent variable, as in Table2, Column 4. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The number of observations varies because of data availability. Firm-level independent variables are once-lagged values. All accounting variables are scaled by the lag of total firm assets. The macroeconomic variables (real exchange and CPI) are from the current period. The accounting data are from the IADB database, as described in the text. Macro data are drawn from the International Financial Statistics of the IMF. For detailed sources and descriptions, see Appendix A.

Table 5: Changes in Income and Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Sales		Operating Income			Liabilities	
Period for dependent variable:	(t)	(t+1)	(t)	(t+1)	(t+1)	(t)	(t+1)
Interaction Effect							
Dollar Debt x	1.060	3.565	0.979	0.798	0.339	0.747	0.496
(D Log Real Exchange Rate)	(0.364) ***	(0.502) ***	(0.470) **	(0.192) ***	(0.230)	(0.182) ***	(0.340)
Main Effects							
Total Debt	0.226	0.456	-0.011	0.003	0.002	0.860	0.960
	(0.051) ***	(0.063) ***	(0.011)	(0.018)	(0.031)	(0.041) ***	(0.045) ***
Dollar Debt	-0.278	-0.455	-0.092	-0.157	-0.136	0.058	0.045
	(0.057) ***	(0.078) ***	(0.034) ***	(0.034) ***	(0.043) ***	(0.035)	(0.057)
Controls							
Total Debt x	-0.262	-1.792	-0.161	-0.218	0.163	0.047	0.794
(D Log Real Exchange Rate)	(0.321)	(0.312) ***	(0.085) *	(0.081) ***	(0.182)	(0.212)	(0.303) ***
Fixed-Capital Investment					0.123		
(period t)					(0.027) ***		
Inventory Investment					0.756		
(period t)					(0.092) ***		
Regression Statistics							
N	7407	6071	7630	6132	3373	7646	4896
R^2	0.090	0.100	0.090	0.140	0.200	0.610	0.470

This table contains OLS estimates of equation 16 in the text, as in Column (4) of Table 2. The dependent variables are as indicated above. Standard errors adjusted for clustering by (country×year) are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variables are as indicated above. Firm-level independent variables are once-lagged values, except as indicated. All accounting variables are scaled by the lag of total firm assets. "Sales" are the firm's sales revenue. "Operating Income" is the income from its main operation. "Liabilities" refer to the total, end-of-year liabilities on the firm's balance sheet. Macroeconomic variables are from the current period. Outcome variables labelled (t) are from the year contemporaneous with the macroeconomic variable, while outcomes labelled ($t+1$) corresponds to the succeeding year. The real exchange rate is defined as the nominal exchange rate divided by the domestic CPI. The accounting data are from the IADB sample described in the text. Macro data are drawn from various sources, principally International Financial Statistics. For detailed sources and descriptions, see Appendix A.

Table 6: Country Decompositions

	(1)	(2)	(3)	(4)
	Dependent Variables:			
	Capital Expenditures		Inventory Investment	
Period for dependent variable:	(t)	(t+1)	(t)	(t+1)
Panel A: Brazil	0.413 **	0.171	N/O	N/O
	(0.200)	(0.345)		
Panel B: Chile	1.008	0.602	-0.006	-0.123
	(0.895)	(1.527)	(0.169)	(0.132)
Panel C: Colombia	0.201	-0.319	0.041	0.030
	(0.255)	(0.372)	(0.215)	(0.140)
Panel D: Mexico	0.212	0.083	0.253 ***	0.045
	(0.148)	(0.142)	(0.068)	(0.050)
Panel E: Peru	-0.119	0.034	0.086	-0.002
	(0.226)	(0.397)	(0.061)	(0.080)

Each panel presents the results for an individual country. The dependent variables are as indicated above each column. Estimates of the regression coefficient on dollar debt × changes in the real exchange rate are reported in each panel. Independent variables in each regression are as in Table 2, Column 5, however reporting of the rest of the estimates is supressed. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The number of observations varies because of data availability. Firm-level independent variables are once-lagged values. All accounting variables are scaled by the lag of total firm assets. The macroeconomic variables (real exchange and CPI) are from the current period. The accounting data are from the IADB database, as described in the text. Macro data are drawn from the International Financial Statistics of the IMF. For detailed sources and descriptions, see Appendix A.

Appendix A Data Sources and Methods

[DETAILS TO COME]

The Latin American firm-level data are described in December 2003 volume of *Emerging Markets Review*. See Galindo *et al* (2003) for an overview.

The firm-level data from Asia are those used in Bleakley and Cowan (2004). The main accounting information is taken from Worldscope (Thomson Financial, 2003), while the information on dollar debt is from Orgill and Lee (1997).

Appendix B: Sample Sizes for Baseline Regression, by Country and Year

	Fixed-Capital Investment					Inventory Investment				
	Brazil	Chile	Colombia	Mexico	Peru	Brazil	Chile	Colombia	Mexico	Peru
Year:										
1991				167						
1992				180					151	
1993				167					149	
1994				171					152	
1995				151					143	
1996	123	179	129	148	95				132	
1997	128	203	136	142	95		202	135	122	103
1998	124	202	98	143	83		200	97	131	110
1999	144	200	99	130	72		202	98	123	101
2000	144	200	80	106	84		201	79	103	108
2001	151	189	80				190	80		
2002	153	187	75				189	75		
2003	92		78					78		

Notes: Reports the number of usuable observations, by country and year, for the current-year regressions in Table 2, Panel A, Columns 5 and 10.

Appendix C: Descriptive Regressions for Currency Composition of Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sensitivity of Profits to the Real Exchange Rate									
Exports to Sales Ratio		0.356	0.353	0.366	0.205	0.464	0.050	0.643	0.221
		(0.029) ***	(0.029) ***	(0.065) ***	(0.045) ***	(0.074) ***	(0.055)	(0.047) ***	(0.060) ***
Dummy for Tradeable Sector		0.048	0.047	-0.020	0.071	0.063	0.021	0.104	-0.064
		(0.013) ***	(0.013) ***	(0.034)	(0.023) ***	(0.035) *	(0.020)	(0.025) ***	(0.047)
Sensitivity to Domestic Credit									
Log Assets (demeaned by country x year)		0.035	0.034	0.037	0.046	0.058	0.020	0.050	-0.020
		(0.004) ***	(0.004) ***	(0.012) ***	(0.007) ***	(0.007) ***	(0.006) ***	(0.007) ***	(0.011) *
Fraction of Liabilities Long Term		0.166	0.170	0.431	0.066	0.080	0.065	0.178	0.219
		(0.022) ***	(0.022) ***	(0.059) ***	(0.041)	(0.042) *	(0.046)	(0.047) ***	(0.066) ***
Has ADR or GDR		0.073	0.066						
		(0.018) ***	(0.018) ***						
Dummy if is Foreign Owned			0.028						
			(0.013) **						
Country Dummies									
Argentina	0.575	0.468	0.456	0.430					
	(0.009) ***	(0.020) ***	(0.021) ***	(0.035) ***					
Brazil	0.174	0.021	0.011		0.086				
	(0.004) ***	(0.016)	(0.016)		(0.025) ***				
Chile	0.228	0.100	0.093			0.125			
	(0.008) ***	(0.016) ***	(0.017) ***			(0.023) ***			
Colombia	0.076	-0.046	-0.052				0.034		
	(0.005) ***	(0.015) ***	(0.015) ***				(0.019) *		
Mexico	0.402	0.254	0.247					0.186	
	(0.008) ***	(0.018) ***	(0.018) ***					(0.025) ***	
Peru	0.634	0.483	0.475						0.581
	(0.011) ***	(0.023) ***	(0.023) ***						(0.049) ***
Regression Statistics									
N	7876	6343	6342	797	1142	1269	953	1581	601
R^2	0.650	0.750	0.750	0.870	0.620	0.600	0.280	0.780	0.870

This table reports the OLS estimates of equation 4 in the text. Standard errors adjusted for clustering by firm are reported in parentheses. A single asterisk denotes statistical significance at the 90% level of confidence; double, 95%; triple, 99%. The dependent variable (”dollar debt fraction”) is the fraction of debt denominated in foreign currency. Firm level data is from the IADB database described in the text. For detailed sources and descriptions, see Appendix A.